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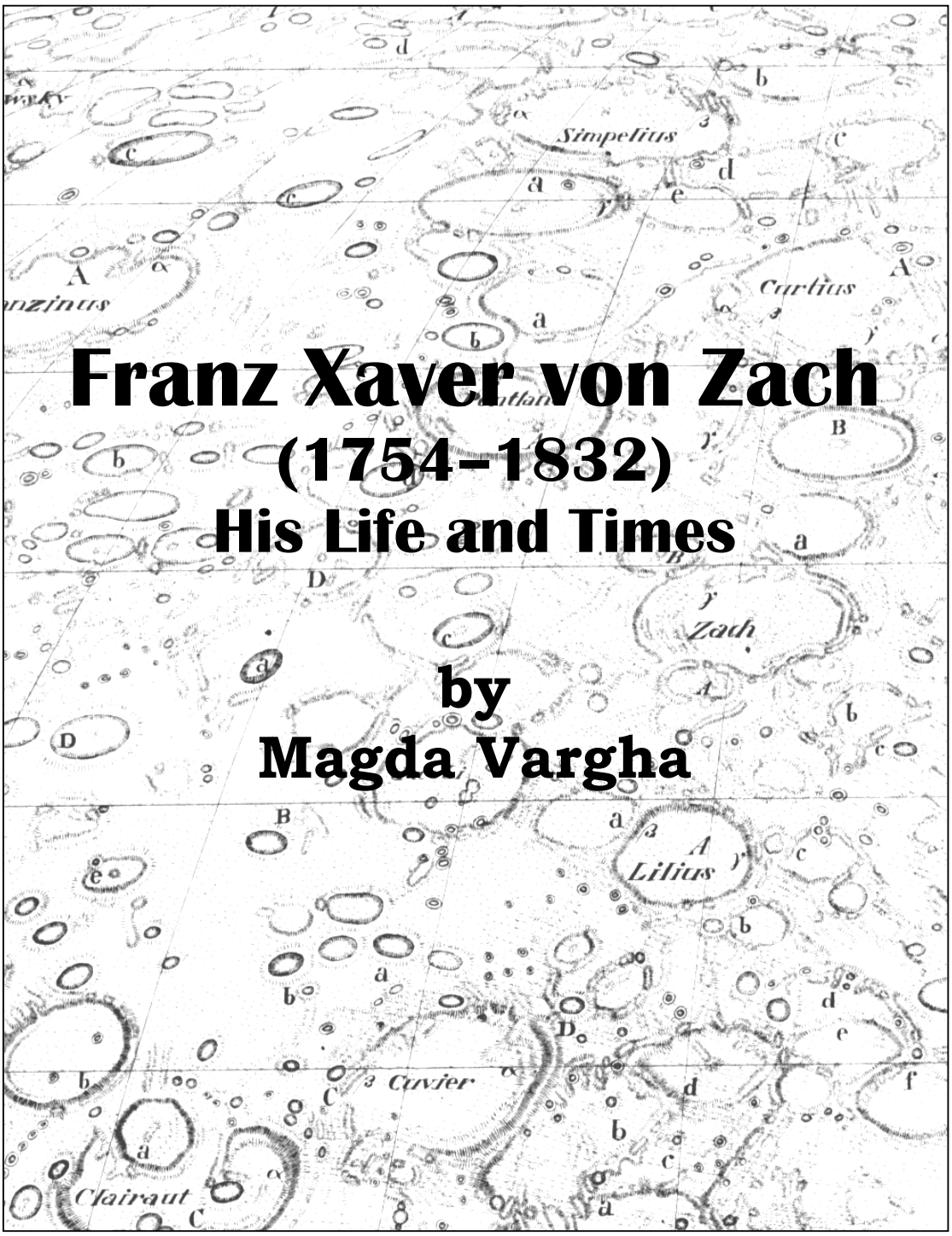

Franz Xaver von Zach
(1754–1832)
His Life and Times

by
Magda Vargha

Budapest
2005

To my friend *Peter Müller*

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Translated by
József Csaba

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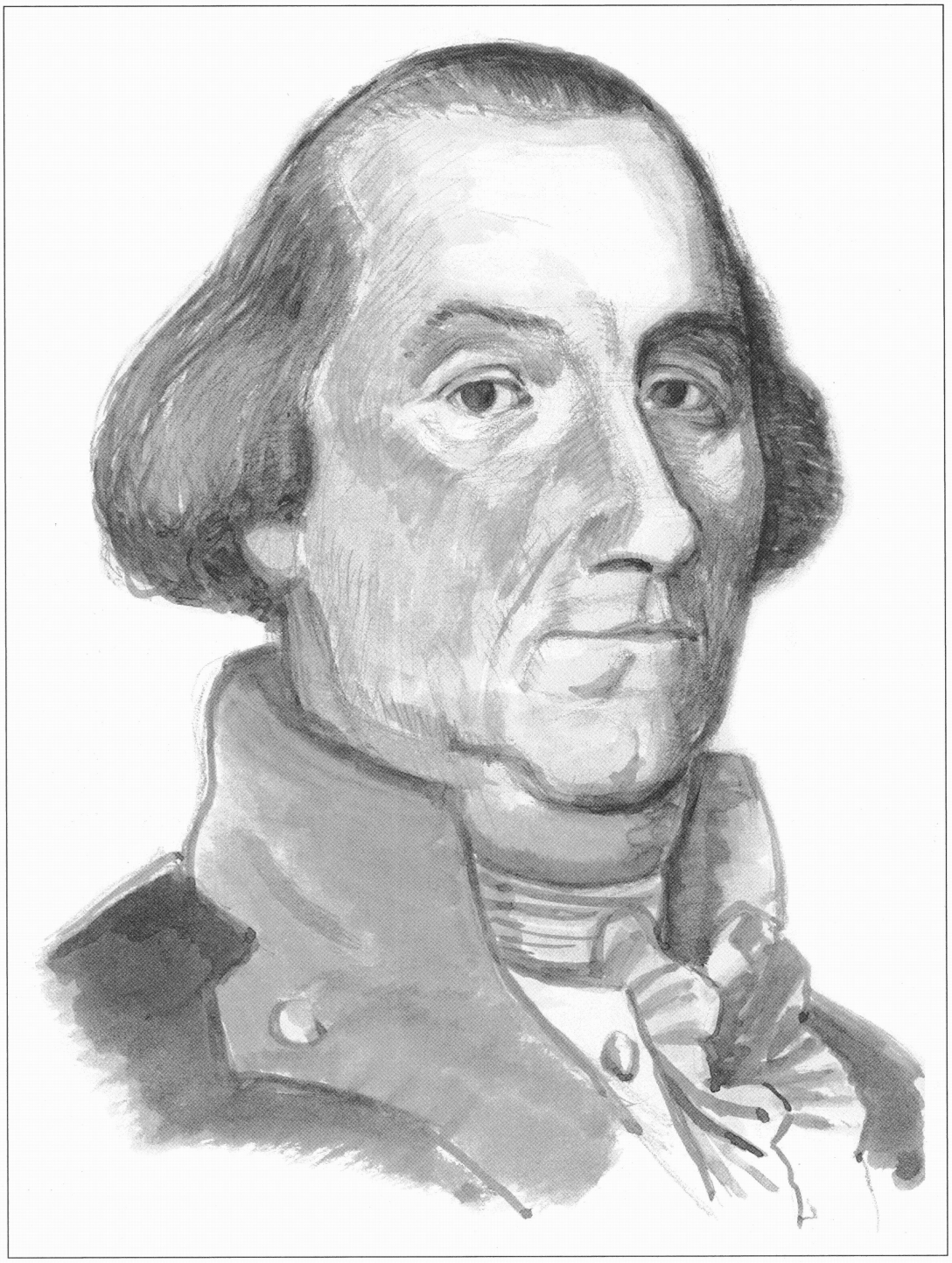


Sie sehen, Liebster Freund, der igaz Madgyar steckt noch immer im Blute bey mir

(Drawing by Viktor Kiss)

Foreword

In Bonn, Germany, there is an astronomer called Peter Brosche, whose research spanning several decades has ensured that it has become almost a fashion among astronomers to study Zach's life and works. Besides numerous treatises, Brosche has also produced a detailed monograph on Zach. In 1798, this Seeberg astronomer organised the first international astronomical conference. To commemorate the 200th anniversary of this event, as well as the person who made it all possible, the Astronomische Gesellschaft organised a scientific conference in Gotha, 1998.

We Hungarians should be proud of the fact that there once was a Hungarian astronomer, whom Laplace recognised as his student, and Lalande as his close friend; whom, further, had the fortune and privilege of following the trajectory of the newly-discovered Uranus with Sir William Herschel in England. And I have to admit that it was with no little pride that I learnt of how the genius (yet, to some extent arrogant) Gauss had to besiege Zach with his letters for years until he got the chance to work as an apprentice beside him on the summit of Seeberg.

Baron Franz Xaver von Zach, the son of a military doctor, was not only at home in the company of contemporary prominent scientists; his love, later his secret wife, Duchess Charlotte Amalie of Saxon-Meiningen also put him in close contact with members of the European royal families. It was from Charlotte Amalie, this woman of great culture and character, that Grand-Duke Albert, much-beloved husband of Queen Victoria of England, descended. Unfortunately, the circumstances of war forced Zach into a perpetual state of travel. He had lived in Pest, Veszprém, Vienna, Lemberg, Paris, London, Gotha, Marseille, Genoa, Naples, to mention only the most important stations of his life. A sharp-eyed portrayal of these places has been preserved for posterity, by the hands of a virtuosic writer.

Events of which we only know from history books can be read as daily news in his letters. New advancements in science come to life spiced with rich humour. His letters are pervaded with the ideals of the Enlightenment, and every line throbs with life, full of emotion and grand humour. His years of service in the Austrian Army also come through in his writings. Franz Xaver von Zach was a hot-blooded man, who could love greatly, and who readily made sacrifices for others. But he loathed hypocrisy and charlatanry, always giving voice to this in the journals he edited.

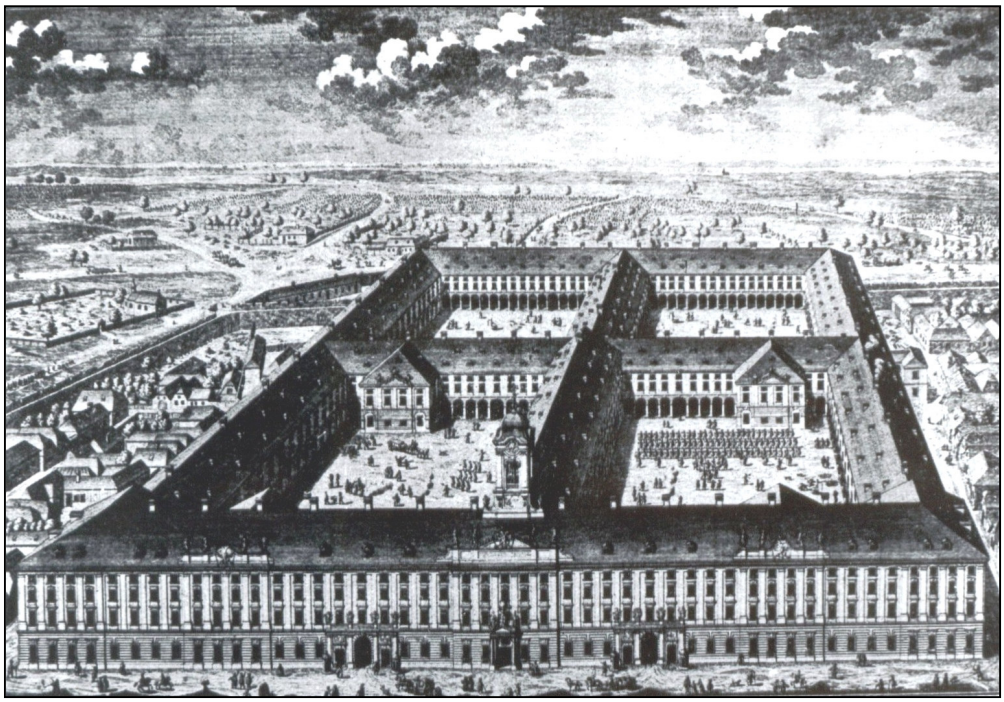
His personality stands very close to the modern idea of an 'ideal scientist'; it is perhaps thanks to this that one study on him succeeds the other. Zach was born to create and to organise; he was someone who made great use of his own energy, and who encouraged others to do useful things themselves. In short : he was a manager, through and through. It is a pity that despite his self-confidence and creative energy, he could not escape his own emotional and physical trials either.

Therefore, it seems a miracle that three years before his death, having been tormented by all kinds of emotional and physical pain – and without being set free from his illness – he regained his old self-strength, standing up on his two feet. Amongst all the political uncertainty, revolutionary wars, he was able to preserve, up to the very end, his

intellectual freshness and human dignity. ”There are few persons of the age who are likely to be more regretted by the numerous friends to who, his talent, vivacity, sociability, and agreeable manners has endeared him.” wrote a contemporary English astronomer in his obituary. His name is not well-known in present-day Hungary, and perhaps it was the same during Zach’s life. But what, we wonder, did his Hungarian nationality mean to Zach himself? He, who was forced to live in several countries, in reality felt an alien, an outsider, wherever he went. Once, in his despair, he wrote : “I am nothing but an ox from the Hungarian puszta [steppe]”. Zach often insisted on his Hungarian identity in his letters to Lajos Schedius. In one of his German letters, he referred to himself as a “True Madjar”, but expressions such as “my homeland”, “my dear country”, “my dear compatriot” also abound his letters sent home. Even in letters addressed to non-Hungarians, he often makes mention of his Hungarian nationality.

It is little wonder then, that it grieved him when despite all the recognition he received abroad, that from his own native country only reached him in the very last minute. Sadly, it is even possible that it came too late, for it may be that the much-awaited news : membership of the Hungarian Academy of Sciences, only reached Paris after his death. In June 2004, we celebrated the 250th anniversary of Franz Xaver von Zach’s birth. This would be a good opportunity for Zach to be discovered in his native land, as well as abroad. It was with this in mind that I had written my book.

Magda Vargha



The Invalid's Hospital in Pest.

PART 1
ROOTS

The Net

Spread out, my frozen net
its the bright firmament–
its icy knots with stars
resplendent.

Attila József
(Translated by John Bátki)

For those who know only the Budapest of the present day, it is almost impossible to imagine what the city of Pest might have looked like on the 13th June 1754, the day Franz Xaver von Zach first saw the light of day in the Invalid's Hospital, the most grandiose and beautiful building in the city {1}. His father, Joseph Zach, was the Medical Superintendent of the City of Pest, and his authority extended to the Invalid's Hospital, which served the needs of the city's military garrison. The newborn baby's godfather was Johannes Fekete, the son of György Fekete, Seneschal of Hungary and one of the most respected members of the nobility. {2} In later years he became a correspondent of Voltaire and acquired a certain renown as a military leader, poet and politician. At the time in question the thirteen year old Johannes Fekete was on his way to Wienerneustadt, to enrol in the Military Academy, as this was the expected thing to do for the young sons of the Austro-Hungarian aristocracy. The Academy was commanded by the Count Franz Eszterházy. A few decades later (1783-1792) Anton Zach, elder brother of Franz Xaver von Zach was placed in charge of this prestigious establishment. {3}

Joseph Zach MD came to Pest from the city of Olmütz. {4} It is very likely that he arrived first in Esztergom in 1740, not as a sponsored immigrant, but as a solitary wanderer. From here he moved on to Pest in 1745. We do not know where and how he met his wife, Klara Sonntag, nor do we know where they became married. Anton, their first son, was born in Pest in 1748. His godfather was the richest landowner of the country, the Duke Anton Grassalkovich. Baroness Anna Laffert was the godmother of both boys. {5}

The German-speaking Joseph Zach, besides serving faithfully the medical needs of the still predominantly German speaking community, and caring for the invalid soldiers languishing in the hospital, earned additional respect as a member of the Royal Governing Board by looking after the members of the highest ranking members of the royal establishment (this fact is confirmed by the illustrious godparents of his sons). Perusing the contemporary Register of Births, it is very rare event to find an aristocratic name among the registered godfathers.

Until 1740 there were no aristocrats living in Pest, except the members of the Royal Governing Board, which moved to Pest only in 1723. In 1741 the country landlords complained that the local government of Pest did not allow them to buy residential property in the town. The Seneschal of the country, Count György Fekete paid 10 000 Rhenisch Forints for his house in Pest. {6} In these times the population of Pest was not more than 11 000 people, but in spite of the low population the town could already boast

of a printing press since 1756. According to the Land-register, in 1765 the number of houses was 1146, out of which 453 were built of stone. {7} In 1770 the population reached 13 000 residents. Regular shipping-traffic started between Pest and Vienna in 1752. Since 1769 Pest was semi-permanently connected with Buda by means of a floating bridge. The rebuilding of the Royal Palace started in 1760 and the Queen promised to spend more time in Hungary, rewarding the nation with her presence for the share of military burdens they were willing to carry in the recent wars of the Empire.

Joseph Zach performed his medical task in an exemplary manner. In 1751 the Empress Maria Theresa herself visited the Invalid's Hospital, and expressed her complete satisfaction with the way the establishment was run. It is well known that her reign was beset with numerous wars, consequently the care of the crippled war veterans was a very serious problem indeed. {8}

The Invalid's Hospital (in our days the home of the Lord Mayor's Office) was the largest and most beautiful building of contemporary Pest. It had capacity for caring for four thousand sick or injured soldiers. The building was commissioned by Karl III. and was designed by the architect Anton Martinelli, under whose direction its construction was started in 1727. The inner court of the building was used as a market place, where merchants and artisans had a chance to exhibit and sell their wares. {9}

The establishment could also boast of a pharmacy, which also operated under the supervision of Dr. Zach. Some surviving prescriptions show that the Seneschal of Hungary, who was suffering from TB, obtained his medicines at this pharmacy, on the basis of prescriptions probably filled by Joseph Zach himself. As the Medical Superintendent of the military hospital, Zach also had some nation-wide responsibilities, such as regularly reporting on the medical status of Imperial Army units stationed in the country. {10}

In 1765 the Empress elevated Zach and his family to the ranks of Hungarian nobility. The official instrument of ennoblement, in which his wife, Klara Sonntag, and his children, Anton, Franz Xaver, Karl and Anna, Jozepha and Juditha, are also mentioned by name, emphasises the exemplary performance of Zach's official duties. {11}

In his writings Franz Xaver von Zach often refers to his native country and to Pest, his place of birth. I have not yet succeeded in locating any of his letters written to his father or mother. With his elder brother Anton, who had an outstanding career in the Imperial Army, Zach maintained an intimate correspondence until his (Anton's) death in 1726. The Emperor Franz made them Baronets together in 1801. {12} They shared many interests, such as the accurate fixing of geographical locations and the making of accurate maps. Both of them were well versed in higher mathematics. For a few years Anton taught Mathematics at the Military Academy. He was already a general when some of his work on cosmological subjects was published in his brother's Journal. Karl, their younger brother, was a lieutenant in the Imperial Army, when he died a soldier's death on the Italian front. Johann Franz Zach paid homage to his young brother's memory in his letter written to A. David in Prague, in 1792. {13}

Of the fate of his sisters we know nothing. He never mentioned any of them. On the other hand he frequently mentioned some attractive cousins and nieces who occasionally visited him during his stay abroad. It is very likely that these included some of his sisters' descendants. {14}

Of his mother, Klara Sonntag, we know even less. Her name is preserved only in the pages of the letter of ennoblement and the children's birth certificates. The Sonntag's of the Northern Hungary[1] were reckoned as one of the most influential Protestant families of Hungary, whose every member can be identified in written contemporary records. {15}

[1] Today: Slovakia

The wife of Joseph Zach is not mentioned in their list. There lived in Esztergom and Buda some other Sonntags, German speaking 'Burghers' of Roman Catholic religion. We know that Joseph Zach maintained a close working relationship with a military Chief Surgeon by name of Anton Sonntag, with whom he often co-operated in the reporting on the medical conditions prevailing in the Imperial Army. {16} Of this Anton Sonntag, who might conceivably have been Joseph Zach's brother-in-law, I managed to find only one single written trace : he is mentioned in the Register of Births and Deaths on the 6th March 1770, as the father of a new-born son named Franciscus Xavier Sonntag. {17}

Joseph Zach became a resident of Pest officially on the 24th Sept. 1791, when he acquired his own house in the city. {18} On his retirement in 1785 he left his home in the hospital. He died in Pest on the 16th July 1792. {19}

Franz Xaver von Zach never mentioned his school-years. His biographers thought that the roots of his life-long antagonism towards the Jesuit Order could be attributed to his experiences at school. There is much truth in this, but not in the way it has been thought. He did not dislike them because he was taught by them, but because he was educated, as attested by the schools' year books, in the school of the Piarist Order in Veszprém, from 1764 till 1770. {20} In 1773 he studied at the School of Natural Philosophy of the same order in Pest. {21} For historical reasons the Piarist fathers were attracted to the Jansenist teachings, consequently they felt a certain degree of antagonism towards the Jesuit Order. Very few of the Piarist teachers were educated at the University of Nagyszombat. They tended to complete their postgraduate education abroad, or, later, at the School of the Piarist Order in Pest, where the academic standards, particularly in the field of natural sciences, satisfied the standards set by the universities. Naturally, there were exceptions. For example Károly Koppi, an excellent scholar, openly admitting to 'Masonic' principles, defended his graduation thesis in Nagyszombat. This 'rivalry' came to an end in 1780, when the University moved to Pest, where the Jesuit and Piarist instructors carried out their duties side by side, while respecting each other's views and positions.

The pupils of the Piarist Order in Veszprém were recruited, almost without exception, from the scions of the Hungarian nobility. {22} For the reason why the originally German speaking, but later assimilated, Doctor had chosen this school, where the language of instruction in many of the subjects and of social contact between the students was Hungarian, for his son, I have found only one plausible theory to offer : Joseph Zach, in the course of practising his profession, established close relations with some prominent representatives of the nobility. When he himself was elevated to their ranks, he may have felt the need to establish his proper place among them. His eldest son, Anton, who later became an Imperial general, used Hungarian to talk to the soldiers recruited in his adopted country. During his stay in the Wiener Neustadt Military Academy he met many compatriots, serving as instructors or students, who had shown great patriotic pride in their origins even as members of this Imperial Establishment.

The Role of the Piarist Fathers in the Intellectual Development of Franz Xaver von Zach

The Piarists were emphatic about nourishing the nationalist spirit in their schools. No Piarist father could be appointed a Father Superior unless he could speak Hungarian fluently. In their schools the greatest importance was attributed to the teaching of the French language (in addition to the obligatory Latin). In their libraries the works of the leading figures of the Enlightenment (Montaigne, Kant, Rousseau, Wolff, Fénelon, Corsini, Galileo) were all represented with their principal works. Many members of the order were members of various Masonic lodges. They were gentlemen, scholars and men

versed in the ways of the world. The Prussian Emperor Friedrich the Great took such a liking to Father Antal Bajtay, that he wanted to enrol him among his courtiers. The Piarist philosopher Johann Cörver has also made an appearance in the Prussian Emperor's Court. In the Order's libraries the ratio of books on Natural Science was higher than in other educational establishments, one could find the works of Newton and Leibnitz even in the poorest monasteries. They realised the importance of direct experience and observation, and this spirit of empiricism permeated their whole outlook on scientific education. {23}

Norbert Conradi (1718-1785) was probably the master with the greatest influence on Zach's development. He was teaching in Veszprém when Zach was there, and in 1773, when Zach moved to Pest, he was already there, teaching Philosophy. He brought the ideas incorporated in the *New Philosophy* (also called *Recentor's Philosophy*) from Rome and Florence. The most important element of this was the freedom of thought and opinion, and the unprejudiced search for truth within the intellectual framework set by the church. Their motto was : "By being a good Philosopher you will also be a good Piarist". Another master of Zach, Bernard Benyák, stated : "A philosopher is characterised by his intellect, self-discipline, respect for the law and sense of duty. These are also the attributes of a Piarist teacher." {24} In the spirit of Enlightenment the Piarists were also promoting the development of a deeper Hungarian national consciousness.

Veszprém was the venue of Zach's first encounter with Astronomy. Somehow he got his hands on Lalande's multi-volume opus titled *Astronomie*, from which he learned for the first time of the scientific information obtainable from the observation of the passage of the planet Venus in front of the Sun. He was also in Veszprém to observe the first appearance of the bright comet of 1769. In their teaching of Astronomy the Piarist fathers always made a determined effort to base their teaching on the latest discoveries made in their special field. {25}

At the end of the XVIIIth century the enlightened spirit of the Piarist fathers had a significant impact on the nationalist movements of the Hungarian nobility. It was fashionable among the ranks of the said nobility to engage Piarist fathers in their homes to educate their children. For example, in the year 1774, Károly Koppi, who later became a professor at the University of Pest and was one of the order's most outstanding scholars, was living in the palace of Count János Fekete in Vienna, guiding the education of the young Count Ferenc. {26} By this time Franz Xaver von Zach was also staying in Vienna as a student at the Academy of Military Engineering. It may be a matter for conjecture, whether he had a chance to visit the palace of his godfather, with whom he shared so many of his ideas.

Vienna and Lemberg[2]

The 'K.K. Ingenieur Academie zu Wien' was an excellent school, producing military engineers for the Austrian Imperial Army. There was another similar establishment at Wiener Neustadt, but it was open only to members of the aristocracy, such as János Fekete, who also enrolled in this establishment after finishing his studies at the 'Theresianum'.

Anton Zach became a student at the 'Engineering Academy' in 1764. After graduation, in 1770, he became first an officer, and later the commandant of the 'K.K. Ingenieur-Korps'. {27}

In 1763 the Empress Maria Theresa commissioned the mathematician Joseph Liesganig SJ, a professor of Vienna University, to carry out some accurate determinations

[2] Today : Lwow (in Poland)

of geographical latitudes and longitudes within the Austrian Empire. Liesganig carried out some of the necessary astronomical observations in the Jesuit Observatory in Vienna.

Franz Xaver von Zach finished his studies in Veszprém in 1770. In 1773 we found him a student at the Piarist Academy in Pest. {28} It is very probable that he spent the missing years as a student at the Academy of Military Engineering in Vienna. It is probable that it was then, that he made the acquaintance of Joseph Liesganig, from whom he learned the basic theory and practice of geographical surveying.

In 1772 Poland was carved up by Russia, Prussia and Austria. Galicia was part of Austria's share. Maria Theresa was rather half-hearted abut the division. For a while she procrastinated about signing the treaty. When she finally did so, she gave detailed instructions to András Hadik, the Commander in Chief of the Army of Occupation, to spare no effort in preventing his subordinates from treating the population with undue harshness. In 1774 Liesganig was again entrusted with the preparation of a geodesic survey of the annexed territories as the groundwork for the accurate mapping of the territory. In 1776 Franz Zach arrived in Lemberg, to work at the side of Liesganig. At the same time he was appointed to teach Mechanics as professor at the reorganised university. The university had an observatory, and it was there that Zach started on his lifelong work of astronomical observations.

In 1774 the Lieut. Anton Zach became ADC to Gen. Gábor Splényi. Count János Fekete also served in Lemberg between 1774 and 1776, commanding a unit in Gen. Splényi's command.

The capital city of Galicia had a rather turbulent history. The district was part of Poland until 1772. From 1767 onwards the city was regularly subjected to raids of the Russian Army, as part of Russia's attempt to extend her political influence to the territory. {29} In 1772 the Austrian Army, commanded by Count András Hadik, annexed Galicia. Lemberg was an interesting, lively and important commercial centre. It was inhabited by Poles, Jews, Armenians and Ukrainians. The Jesuits appeared in the city at the end of the XVIth century. {30} It was their Academy of Philosophy that may be regarded as the direct predecessor of the University, which was founded by Maria Theresa, and later combined in its teaching the strict classical scholarship, taken over from the Jesuit tradition and the achievements of the newly emerging cultural trends from Germany. Due to the multiplicity of nationalities and religions the city had a lively intellectual life. There was a multitude of well-stocked bookstores, where it was often possible to find copies of books unobtainable in the other parts of the Empire. These were the shops frequently visited by Franz Xaver von Zach, the budding soldier, land-surveyor and astronomer during his Lemberg years. Later, he commemorated the local observatory in the November 1801 number of the MC in the following terms :

> "This observatory, well known to me, in which I had made some observations twenty-five years ago, consisted of an octagonal tower erected over the archway, which could be reached from the Jesuit College through a narrow stairway. Inside there was this spacious room, windows on every wall, covered by a roof, the view from which covered every direction." {31}

When Liesganig moved from Vienna to Lemberg to take over the 'Land-Survey Bureau', he was also entrusted with the running of the local observatory. He brought his instruments from the Jesuit College in Vienna. The detailed list of these instruments and their description was also published in the number of the *MC* already quoted. {32}

Astronomical observations have been made in Lemberg even before the arrival of Liesganig. The observations of the Jesuit astronomers Fr. Lisogorsky, Fr. Hossouski and Fr. Jasembowski were published in Ephemerides of Hell in Vienna. For a time Lisogorsky was also studying with Hell in Vienna. After the arrival of Liesganig the

Polish astronomers left Lemberg. In his previously mentioned article Zach paid handsome homage to these scientists. {33}

After the death of Maria Theresa in 1780, Joseph II took in his hands the reins of the Empire. He abolished the Dept. of Mechanics at Lemberg University, so Franz Zach had lost his livelihood and had to leave Lemberg. Of his subsequent travels we know very few. He was staying for a short period in Northern Italy. {34} The first reliable information on the subject dates from the March of 1783. According to this, he interrupted his journey from Italy in Lyons, where he co-operated with Fr. LeFèbvre in the observation of a lunar eclipse. In May 1783 he was already in Paris. {35}

It is a fact worthy of comment, that in the Lemberg Observatory Ignaz Martinovics inherited Zach's position. According to contemporary records he managed to live with Liesganig on good terms. In Lemberg Martinovics was a member of the Masonic Lodge named 'Phönix zur Runden Tafel', and in his capacity of paid imperial informer, he sent regular reports to Vienna. It is known, that the brothers Zach, together with János Fekete, were also Masons, and that in the 1770's they had also lived in Lemberg. So it is not impossible, that they might have belonged to the same Lodge, and been the subject of Martinovics' reports.

Franz Xaver von Zach, Liesganig and the Jesuits

Although there will be many tales told on the following pages of Liesganig and of Lemberg remembered, I shall try to explain right away the circumstances which led to Zach's acquisition of a lifelong enemy in the person of Liesganig.

Zach was a man of strong feelings and a quick temper, but was not one to nurse a grudge. Neither was he vengeful. He liked people and needed to have his feelings reciprocated. But what kind of a man was Joseph Liesganig? Did he have other antagonists? I do not know. One thing is certain : During his whole life Zach was plagued by Liesganig's letters of denunciations, and he could not, even as a member of the Hungarian nobility, enjoy even a moment of safety within the borders of the Austrian Empire.

Joseph Liesganig was born in Graz, in the year of 1719. In 1742 he became a professor of mathematics at the University of Graz. In 1751 he was teaching in Kassa[3]. From 1752 to 1754 he taught mathematics at the Theresianum. During this time he also published a book on mathematics under the title : *Tabula Memoriales Praecipue Aritmeticae*. The book contained, in addition to material for use in secondary schools, mathematical description of war machinery. During his sojourn in Vienna he carried out some observations at the Jesuit Observatory led by Joseph Franz. He received an Imperial Commission from Maria Theresa to determine the geographical latitude of population centres found in the Empire. This resulted in another book under the title : *Dimensio graduum ...* . In 1774 he was entrusted with doing a geographic survey as the groundwork of the mapping of Galicia. Liesganig died in Lemberg, in the year 1799. {36}

The 1750[s] were a time of fulfilment for the Jesuit observatories in Europe. Observatories were built, in close succession, in Graz, Vienna, Nagyszombat, Mannheim. They were directed by scientists of international renown, such as Maximilian Hell, Franz Weiss, Christian Mayer, to mention only the best. {37} Zach had never said a bad word about any of them, but often referred to them with praise, respect and approval. His favourite motto was Hell's saying : "Geographia sine Astronomia nulla est." In one of his letters to Ludwig Schedius he wrote in 1799 :

[3] Today: Kosiçe (in Slovakia)

> "There are only three towns in our country, Buda, Nagyszombat and Eger, whose location was fixed with the required accuracy, so we must use them as base-points. Their positions were determined by expert Astronomers, Hell, Weiss, Taucher, Bruna, Triesnecker and Madarassy. These names are the guarantee of the accuracy."

The first five scientists were of the Jesuit Order, the sixth was a lay-preacher.

Why did Zach feel so negatively towards Liesganig right from the beginning of their acquaintance? Because he did not need a long time to realise that Liesganig's work was deficient in the virtue of accuracy.

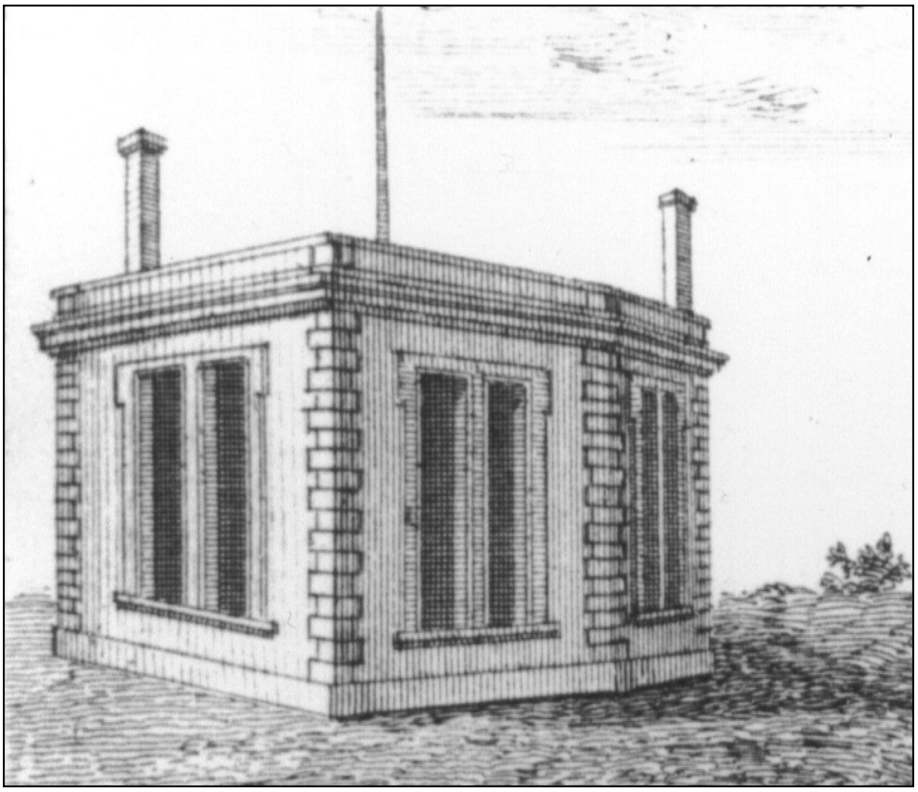
> "Basically, Liesganig's knowledge was totally inadequate to perform his work. I recognised this fact even as a youngster of twenty-two, and have drawn his attention to it." {38}

The young Zach, educated by the Piarists and taught to appreciate accurate mathematics at the Military Academy, despised his pretentious master who hid the questionable quality of his work under the affectation of scientific renown. It was only natural that Liesganig returned hatred for Zach's contempt. He hated Zach for showing him up for what he was. To be shown the truth about himself could be too much even for a man much better than Liesganig was shown to be. Their fight lasted to the very end. From now on Zach was never free from the anticipation of threatening and abusive letters, which followed him to Gotha, Geneva and Paris. It was one consequence of this feud, that Zach could never return to his own country. {39}

Coat of arms of the Zach family.

In 1815, after a period of forty-two years of ban, the Jesuit Order was officially permitted to operate again. This edict had a significant effect on Zach's life. During his exile in Genoa, in 1826, he had to put up with being attacked in his sick-bed by official bailiffs, who wanted to evict him flaunting some official papers in his face. Zach attributed this insult to the increasing power of the Jesuits. {40} In Paris, immediately before his death, the old scientist was almost pathologically afraid of them. He wrote in his letter that he was too afraid to walk in the street on account of the Jesuits keeping him under constant observation. Alas, it is a well attested fact of history that the rivalry between Jesuits and Jansenists often manifested itself in hardly fought street battles. Zach counted many scientists with Jansenist leanings among his friends, so his fears were not entirely unfounded.

Zach confined his struggle with Liesganig to the level of scientific debate. In 1801, with the help of his friend, Alderman Ertel, he managed to put his hands on the manuscripts left in Liesganig's estate. Using these, he could demonstrate the inaccuracy of Liesganig's measurements, and the unreliability of numerical conclusions derived therefrom. Zach also published his criticism of Liesganig's work in his own Journal. {41}



The Royal Greenwich Observatory.

The City of London.

PART 2
THE JOURNEYMAN'S YEARS OF FRANZ XAVER VON ZACH

Ars Poetica

I'v done with the milky of story book
time's slow seeping will never stop.
I quaff great draughts of realty
neat work with foaming sky top

Attila József
(Translated by Michael Beevor)

Six Months in France

As it was already mentioned, on the 18th March 1783 Zach was observing a lunar eclipse in Lyons. Fr. LeFèbvre, the Astronomer Royal took him to his own observatory, and even let Zach use his own astronomical instruments. The 17th and 19th they spent measuring solar elevations. Gnomon, pendulum clock, quadrant and an achromatic telescope on a tripod were used for these measurements. {42}

Later, from May until November 1783, Zach was working in the Paris Observatory, in the company of Lalande, Laplace and others. He also made the acquaintance of other well known scientists, among others Jean-Baptiste-Gaspard Bochard de Saron, the then President of the Academie royale des sciences. He wrote to Bode about their meeting:

> "At the General Meeting of the Academy the present state of literature was discussed and experiments in Physical Chemistry were performed. I was privileged to have an opportunity to take part in some of these sessions. So, my grief was all the greater, when I was informed that he became one of the victims of the 'bloodthirsty hound' Robespierre." {43}

It was also during his Paris sojourn that he was introduced to Count Mercy d'Argenthau, Knight of the Golden Cross, who was also a devoted amateur astronomer and a munificent patron of the sciences. He used to live in the Luxembourg Palace, where he also had a small observatory installed. Wallot, the German astronomer, (born in Oppenheim and later also a victim of Robespierre) {44} was also working there, In his new house, built in Paris in 1783, Count Mercy has also had an observatory, which he was proud to show off to Zach. This house was open to all, who were worthy to enter it. During the Revolution Count Mercy escaped to London, where he died in 1794. He left his astronomical instrument to Mercier in Paris. {45}

In Paris, Zach refreshed his knowledge of theoretical astronomy and its practical applications. After close study he accepted Laplace's theory of comets, in preference to Boscovich's theory, of which he was an adherent until this time. In his orbital calculation of the comet of 1779 he used Laplace's method. {46}

Time in England

In November 1783 Zach was already settled in the Dover Street home of Count Moritz Brühl, in London. {47} The Count was the Ambassador of Saxony, and he moved in the

highest social circles. He was married to the widow of Lord Egremont, but he belonged to the upper circles in his own right. In olden times his father was a Plenipotentiary Regent in Poland. The circle of Brühl closest friends included Joseph Banks, the President of the Royal Society, Jesse Ramsden, maker of the most famous astronomical instruments, and Mudge and Emery, famous clock-makers. All of them immediately accepted Zach as their friend. Sir William Herschel, the Astronomer of the King, who earned this great distinction by the discovery of the planet Uranus, was also a member of this exclusive circle. {48}

Brühl was a frequent visitor to Paris, and it was there that his attention was drawn to Zach, described as a well informed man of sound education and – in spite of his youth – of deep knowledge of science.

Officially Zach was on the payroll as a tutor to Brühl's son George. Although not as well trained as Zach, Brühl was an ardent astronomer of considerable talent who also constructed scientific instruments as a hobby. Consequently he was happy to take the young man to his house and make him a companion in his scientific endeavours. Their way of looking at the world was also very similar. Count Brühl was a Freemason, and Zach was one also.

In the Dover Street house Zach lived in a very congenial environment. He had no difficulty with tutoring, as in all his life he had a great fondness for the company of young people. In letters written in his old age he often complained about the sadness he felt about not having children of his own. {49} In his last, disease-ridden years, the burden of his suffering was eased by the company of his many young and helpful friends.

Weather permitting, Brühl and his young companion would spend their evenings making astronomical observations. In inclement weather – not infrequent in contemporary London – they carried on with their social life. Joseph Banks' home in Soho Square was one of the houses they have frequently visited. Zach was still in Paris, when he first contacted Banks by a letter, in which he discussed some astronomical instruments. {50}

Sir Joseph Banks, director of the Botanical Gardens at Kew, was also versed in the methods of astronomical observation. He was a member of Capt. Cook's expedition to Tahiti, whose purpose was to observe the passage of Venus in front of the Sun on the 3rd June 1769 with astronomical instruments. As it is attested by the *Astronomisches Jahrbuch*, Banks remained an amateur astronomer of good standing even in the later years of his life. {51}

In the 1787 volume of the Astronomisches Jahrbuch Zach published an extract from a letter of Joseph Banks written to him, in which the President of the Royal Society expounds his theory, that the new planet discovered by Herschel is identical with the heavenly body observed on the 23rd December 1690 by Flamsteed, who entered it in his catalogue as star No. 34 in Taurus. {52}

After his arrival in England Zach visited the Royal Observatory at Greenwich, where he looked up these old observations of Flamsteed and recalculated the planet's position for the date of the taking of the original readings. He handed over his calculation to Count Brühl, who, in turn, forwarded them to Maskelyne, the Astronomer Royal. {53}

Franz Xaver von Zach was very popular in London Society. This was due, in addition to his attractive personality, to his enlightened ideas which he had inherited from the Piarist fathers, his classical education, his linguistic prowess, and his profound knowledge of mathematics. He collected the observed results of the English astronomers Hornsby, Brühl, Herschel, Aubert and Pigott. After mathematical evaluation he translated them into German and sent them to Bode for publication in his Jahrbuch. He gave the same help to his French friends. Some yearly volumes of the Jahrbuch look as if they were a result of co-operation between Zach and Bode.

Hungarian Scientists and Politicians in London

Even after living the life of an expatriate for more than a decade, in the company of Brühl Zach was able to meet some exceptional Hungarians, such as Baron Nicholas Vay, who spent six months working in Ramsden's workshop, and Baron József Podmaniczky, who came to London to study Economics and Statistics. They were both members of the Royal Society. Podmaniczky was elected in 1780, Vay in 1787. In 1804 Zach himself joined them in this distinction. They both enjoyed the intimate friendship of Sir Joseph Banks. {54} Vay came to London in 1790 ostensibly seeking a cure for an ocular ailment, but in reality he travelled on state business. A group of Hungarian noblemen wanted to replace the Emperor Joseph II on the Hungarian throne with the Duke of York. The negotiations with Prime Minister Pitt were facilitated by Sir Joseph Banks, and were interrupted only by the unexpected death of the Emperor. {55}

Excursions in England

Brühl and Zach travelled extensively all over England, collecting observational data at various locations. They often visited Oxford together, where the young Zach formed a life-long friendship with Hornsby, the builder and first Director of the local observatory. Later, when he built his own establishment, he admitted to using the Oxford Observatory as his model.

The first place Zach and Brühl visited was the estate of Baron Porchester's of Highclere in the county of Hampshire. Their first act was the determination of the longitude and latitude of the place, using a reflecting Hadley quadrant, made by Dollond. Count Brühl was not only an industrious practitioner of the sciences, but also had an uncanny practical 'knack' of using, modifying and augmenting astronomical instruments. Watch-making in London, specially the development of marine chronometers was very much influenced by his work. Due to his contacts thus established, he had no difficulty of obtaining timepieces that represented the contemporary pinnacle of the watchmaker's art, such as a pocket watch, developed by Mudge and completed by Emery, which was compensated for cold and hot temperatures. The Count used this watch for a year during his observations.

On the 30th of September the Count was observing Algol. Comparing his own observations with those made by Herschel, Aubert and Blagden, he found his own work a cause for self-satisfaction.

In the second half of 1784 Zach and Brühl continued their travels and visited Lord Egremont, who, together with Baron Porchester, was a stepson of Brühl. This visit was very successful and had a great influence on Zach's later career.

The estate was centred on the small town of Petworth. The observations were carried out in the castle itself, which was built in one of the most beautiful and extraordinary parks of England. Here they used an eighteen inch quadrant, equipped with a micrometer with two inch divisions. The meridian, which was determined using the method also used at Highclere, was found to differ from that of Dover St. (London) by 1'48". On 21st October, taking advantage of an exceptional clear night, they succeeded in observing three of the moons of Jupiter, using a two foot reflector. On the 24th, 25th and 26th they followed a sunspot, using a quadrant, right until its disappearance. Later on they both carried out some observations using the Hadley sextant. They also made comparisons between identical measurements of the Sun's elevation, made by Brühl using a Navy issue sextant and Zach using a Bird type quadrant.

On the estate of Lord Egremont Brühl and Zach came across a manuscript of exceptional interest.

The Harriot Papers

Brühl had already informed Zach, that some manuscripts of special value were to be found at Lord Egremont's estate. The most renowned member of the family, the Duke of Northumberland, was a patron and protector of science and scientists. Many distinguished scientists were welcome guests at his table. These included three luminaries : Robert Hues, Walter Warner and Nathaniel Torporley. One man, the famous mathematician Thomas Harriot was of even higher renown. He was also the recipient of £300 annual stipend from the Duke's purse. Thomas Harriot was born in 1560 and died 1621. During his life only one of his works has appeared in print. In his last will and testament the grateful mathematician left all his papers to the Duke, his benefactor. In the autumn of 1784 the papers were still known to be in Petworth Castle.

In his time Harriot was a well thought of mathematician and astronomer, one of the first to conduct systematic astronomical observations in England. He made 199 observations on sunspots, which he also documented by his own drawings. We can not even be sure that it was not his observations that were the first ever made. In 1611 they were observed by Fabricius in Wittenberg. He has also published his work under the title : *De Maculis in Sole*. In a volume published by Galileo in 1613 the editor mentions that his observation, made on the 2nd June 1612, was not the first one, as he has already performed observations of a similar kind several months ago. The date of Harriot's observations was the 8th December 1610. It is extremely likely that Harriot's telescope was obtained from the same source in Holland, as Galileo's. Among the papers left behind there were some dealing with observations of the planet Mars and several solar eclipses. Perhaps the most interesting items among his papers are those describing a series of observations of two comets. One of them deals with the appearance, in 1607, of the comet later named after Halley, the other contains observed data of the so called Kepler's comet, observed again in 1618. {56} Even at this time, Halley's comet was not the only celestial object, whose period was known. Her special significance may be attributed – according to Zach – to the fact, that the observations and calculations performed in connection with her became ensconced as the foundation stone on which the later theoretical studies of comets was based.

Edmund Halley, a distinguished disciple of Newton, his industry matching the strength of his inclinations, applied himself to the task of resolving the chaotic state prevailing in the theoretical studies concerning comets. Applying tireless energy to the tiresome calculations, he has shown that there was no comet in existence which did not behave according to Newton's laws. He determined the paths of the comet, which later was to bear his name, for the years of 1305, 1380, 1456, 1531, 1607 and 1682, and stated that all these observations were of different appearances of the self-same comet. Cassini, in his exposition given in 1699 at the Paris Academy, has already drawn attention to the repeated appearance of this comet and to the similarity of the orbits calculated, but he could not find an explanation for it. It was Halley, who pointed out that for every calculated orbit the Sun was always occupying one of the focal points of the orbital ellipsis. After calculating twenty-four such orbits, Halley was also the first to predict the comet's next return towards the end of 1758 or the beginning of 1759.

In 1531 the comet was kept under observation by Peter Biennewitz (Apianus), for a short while. Unfortunately Halley had only these fragmentary data available for his calculation.

Observations Made during the 1607 Appearance of Halley's Comet

Not much more luck has been had at the 1607 appearance of the comet. Although some observation were made by Kepler in Prague and Severini (Longomontanus) in Malmö

and Copenhagen, unfortunately the majority of these observations were carried out without using astronomical instruments. Although in Copenhagen, between the 16th and the 21st of September, Longomontanus made use of a 'quadrato geometrico', but his observations made later in Malmö were rather superficial. In one of his publication he described these observations as :

> "… before the 25th of September the comet was of such low visibility, that I have preferred to spend my time on observing Jupiter. At $8^{\underline{20}}$ during the 28th September was the time of my first observation. In Copenhagen I have managed to see it nine times, but I could use my astronomical instruments only three times (30th September the 'quadrato geometrico' and 1st October a sextant. On the 22nd, 23rd and 24th the comet was too pale, consequently these observations are of doubtful value.)"

Kepler first saw the comet standing on a bridge in Prague, on his way home from a fireworks display. At $8^{\underline{30}}$ he was sure of having seen a comet. He observed it nine times, using his naked eye. {57}

Harriot's Observations

In his 'write-up' of the Harriot-papers in the *Astronomisches Jahrbuch* Zach gave a short review of the comet's history to point out the importance of Harriot's observational data, which were more numerous and more accurate than those given in the previous publicans. The first observation was made in Oxford, on the 25th September 1607, by somebody named Standish, who is mentioned in Anthony Wood's *Athenae Oxoniensis*. On the 18th September Harriot wrote that Sir Allen has seen the comet two days ago. Among the papers a letter from a certain Torpley was found in which it was stated, that when he made a crossing at Wallis on the 27th September, he has caught sight of the comet in the 'Great Bear'. This comment was followed up by twelve fully processed observations.

Nathaniel Torporley was one of the 'three wise men' of Henry Percy of Northumberland. He studied astronomy in Paris, under Francis Viéte, the famous astronomer. He has spent eight years abroad to perfect his mathematical and astronomical skills. After returning home, he went back to Oxford, where he earned the 'Magister Artium' degree in 1591. He died in 1631, surviving his friend Harriot by eleven years.

Harriot kept the comet under observation from 1st of October to the 1st of November. In his notes he listed the distances measured between the comet and some of the fixed stars. The theoretically calculated orbit of Halley's comet does not agree perfectly with Harriot's observations.

Zach immediately recognised the importance of Harriot's papers. He immersed himself in the material, and was curious to learn more about its author. In 1785 he visited the Bodley's Library at Oxford, but was sadly disappointed, as he could not find any references to Harriot. After a close scrutiny of the papers Zach declared them to be of great importance. He attributed a similar degree of importance to Harriot's later work, the observations made of the comets seen during the year of 1618. {58}

Thomas Harriot's Observations of a Comet Seen in the Year of 1618

Records are in existence of not less than six comets seen in 1618. The one, which was the object of Harriot's observation, was a comet of splendid visage, with a specially elongated tail. According to Riccioli it was the fourth, but according to Pingré it was the third comet making an appearance in that year. The same comet was also observed by Kepler in Prague, Longomontanus in Copenhagen, Schikardus in Württenberg, on the banks of the Neckar, by Snellius in Leyden, Gassendi in Aix en Provance, Ursinus in Frankfurt

am Oder, Sab Habrechtus in Strasbourg, Ambrosius Rhodius in Wittenberg, Phil. Müller in Leipzig, Welper in Worms, the Jesuits in Rome, in the Collegium Romanorum, Jos. Blancanus in Parma and Marsilius in Budweis. These observations were published by Kepler in his *Tractatus Cometis* and by Riccioli in the second volume of his *Almagestum Novum*.

Harriot first saw this comet in Oxford, on the 20th November. In his notes he remarked on the invisibility of this Comet in England on the 11th and 12th of November. Harriot observed the comet between the 15th and the 25th of December. The comet was not seen again after the 28th of December. Kepler saw this comet only through his own eyes, without instruments. He voiced the same complaint about the observations of the others. In the '*Tractatus*' Harriot describes altogether nine observations, the majority of them made through instruments. With every observation he included the calculated values of the geographical latitude and longitude. On the 1st of December he has found the comet in the vicinity of Mercury. Kepler wanted to determine the parallax of the Sun and to calculate the Earth's orbit with the help of this comet. which was bright enough to be visible even during the daylight hours. Harriot's last observation took place on the 11th of December, but he was still making calculations of the comet's orbit, titled *De locis Cometae 1618*, on the 15th of December.

Zach and the 'Astronomisches Jahrbuch'

On the 5th of May 1784, a few months after his arrival in London, Zach sent his first manuscript to Berlin, to be published in the *Astronomisches Jahrbuch*, then under the editorship of Bernoulli but later taken over by Bode. In this Zach introduced a communication, received from Sir Joseph Banks, explaining his theories about the planet Uranus being identical to the heavenly body discovered by Flamsteed on the 23rd December 1690 and catalogued as No. 34 in the constellation of Taurus. {59} Another star is mentioned, one discovered by Tobias Meyer, which was proven in 1757 by Laplace, using his own method, to be also identical to Uranus. In this – his first – published paper, Zach included notices of other English astronomers' works. In November of the same year, Zach has produced an article of a more ambitious nature. He collected all the available data on Uranus, completed the necessary calculations using Laplace's method, translated the text into German and sent it to the '*Jahrbuch*'. The observations were made in 1781 and 1784, by Hornsby in Oxford, Pigott in York, Robinson in Edinburgh, Herschel in Bath and Moritz Brühl in London. Zach augmented these observations made in England by material obtained abroad. Included were in this collection: his own and Fr. LeFèbvre's investigations of the lunar eclipse in March 1783 in Lyon, and the data obtained about the passage of Mercury in 1782 by the German astronomer Wallot (Member of the Academie royale de sciences) and by Saint Jacques de Sylvabell. {60}

In his publication, sent on the 21st May 1785, Zach recounts his observations made with Herschel :

> "Recently, in the company of Count Brühl, Mr. De Luc and Mr. Aubert, we spent a night in Datchet with Mr. Herschel. We saw – among others – the nebula, which is described in the 1787 volume of the *Connaisance Des Temps*. It is stated there that the nebula contains no stars, but when we examined it with Herschel's 20′ telescope, with a magnification 250×, we found a thick agglomeration of stars. {61} Through a 7′ instrument the nebula appeared as a single star. The degree of technical ingenuity shown by Herschel in constructing and operating this mighty instrument is worthy of the highest respect. Herschel agrees with me in thinking that the star listed as No. 34 in Flamsteed's catalogue is very probably the same as the planet Uranus." {62}

It is evident from the quoted paragraph, that Zach, with the help of Brühl, had found his way very quickly to the highest circles of the English scientific establishment, and that he was capable of reaching and maintaining a central position therein. He was always happy to use his talent for organisation and 'relation-building' to promote the welfare and advancement of his friends and acquaintances. This happy disposition remained with him during his whole life.

Sir William Herschel.

Rambling in France and Germany

In the summer of 1785 Zach, in the company of Count Brühl, spent some time travelling in Germany. On the journey, they carried a Hadley type sextant and an Emery chronometer. They used them to determine the latitude and longitude of Brussels, Frankfurt am Main and Dresden. In Dresden they have spent several months. Zach made use of this time to make the acquaintance of Köhler, the editor of the 'Mathematical Saloon' together, they observed the occultations of Jupiter's moons, and various other astronomical phenomena. In October they travelled to Berlin, where Zach finally had himself acquainted with Bode, the editor of the '*Jahrbuch*'. They started on their return journey in November, they had a stopover in Paris, where they made use of their chronometer to measure the Paris-Greenwich distance. Zach has also introduced Brühl to Cagnoli, with whom he was acquainted since 1783. (When, on his way to England, he stopped in Calais for a few observations, the results he sent to Méchain and Cagnoli in Paris, whose observatory was not far from the hotel where he and Count Brühl had their lodging.) {63}

In 1785 Brühl, Cagnoli and Zach had made some observations together in this observatory in Richelieu Street. For his observations Cagnoli had at his disposal a passage instrument, made by Megnié, and a Robin type pendulum. Arnold, the famous instrument-maker also made a contribution to this work with a clock of his own design. They, together, determined the Paris-Greenwich distance on the 11th November 1785. They made such good friends with Arnold, that he accompanied them on their return journey to London. Arnold voiced his appreciation of he quality of the Emery chronometer, which he has found fully as good as his own. {64}

On the 12th November they had a meeting with Count Cassini, the head of the Royal Observatory, and asked him for the results of his determination of the Paris-Greenwich distance. They also borrowed Mechain's results for comparison. {65}

They returned to London, enriched with the memory of a pleasant and successful study-tour.

Zach cherished the memory of his years with Count Brühl as long as he lived. In his writings he often remembered these times, and specially their excursion in 1785.

Alas, soon it came to the parting of the ways. On the recommendation of Brühl Zach was invited to the court of Ernest II, Duke of Saxon-Gotha.

In the following I should like to say a few words about the life of Zach's benefactor.

The Life of Count Hans Moritz Brühl

Hans Moritz Brühl was born in Wiederau, on the 20th December 1736. His uncle, Count Heinrich Brühl, who died in 1763, was the Governor-Regent of the Saxon Elector's in Poland. Count Moritz Brühl was a student in Leipzig from 1750 till 1754. He was an excellent student. One proof of this is the ode, which the German poet Christian Gellert (1715-1769) composed for his 14th birthday.

In 1755 the nineteen year old Brühl moved to Paris, to help with the work of Saxony's embassy. He performed his duties to the complete satisfaction of his compatriots, whom he often provided with help and shelter during these troubled times.

In 1759 he was appointed by the Elector to head the ducal court in Warsaw and to serve as governor of Thüringia. The esteem and trust he earned at court, and at the office of his uncle, the Prime Minister, was the foundation to take over the office of the recently deceased Chancellery Minister, Baron Gutschmidt. In 1778 he was officially confirmed as Counsellor to the Elector.

He married twice, both times in London. His first wife was the widow of Lord Egremont. They were married in 1767. After she died in 1794, he married again in 1796. His second wife, Miss Cherone was also of old English stock. He had two children from his first marriage, George and Harriet, who later became Mrs. Scott.

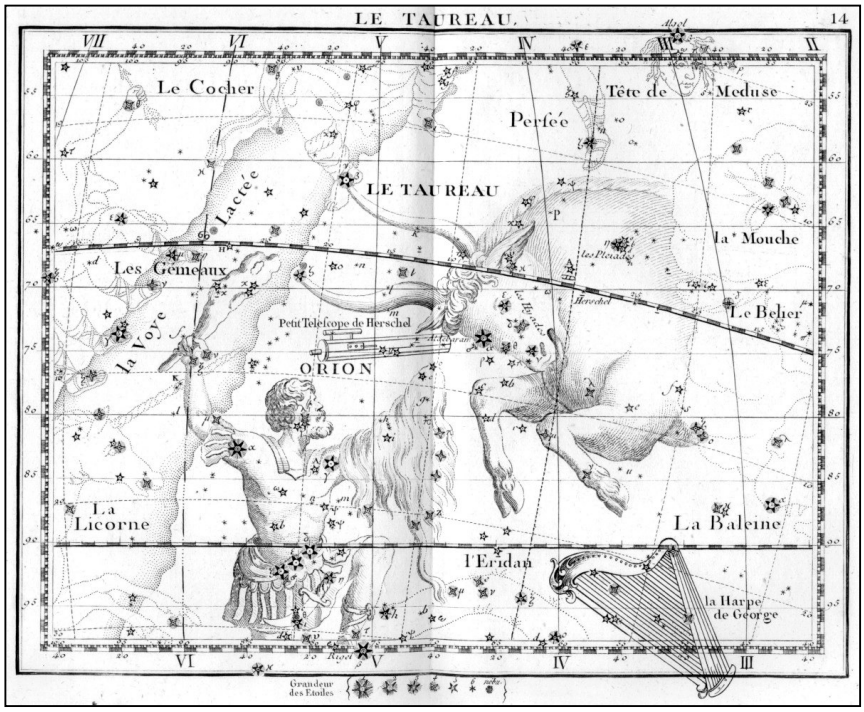
His literary efforts earned him respect at home and abroad. His first opus, 'Recherches sur divers objects de l'Economie politique', was published in Dresden. Between 1784-1786 he also published a few papers about the Customs and Excise Law of England, in the Dresden periodical 'Chanzler-Meisner'ischen Quartals-Schrift'. He was also passionately interested in the sciences of Astronomy and Geology. His interest in determination of the position of geographical location was stimulated not only by scientific interest, but he was also motivated by his appreciation of the subject's importance from the political point of view. He knew how much material loss was sustained by England, the prime maritime power, due to the inaccuracy of contemporary navigational instruments and methods. Brühl raised this question in an official memorandum, but was rebuffed by Maskelyne, the Astronomer Royal, who insisted on sticking to the old ways. Until 1785 even the distance between the two most important observatories, London and Paris, was not accurately defined. Brühl himself was skilled in constructing instruments helpful in position surveys. so he could give useful advice and help to the excellent instrument makers with whom he came in contact. In Zach's opinion neither Thomas Mudge, nor Josiah Emery could have reached the professional heights they did, without the advice of Count Brühl. In 'The Description of the Timekeeper', a book written by Mudge, the author thought it important to include his correspondence with Brühl. {66} The Count's diaries, in which he listed the special instruments he used in his observatories in London and Harefield, are still in existence. In addition to other scientific associations, Brühl was also a 'Fellow of the Royal Society' (FRS). His scientific publications appeared in the *Transactions of the Royal Society*, the *Astronomisches Jahrbuch* and the *Petersburger Commentarien*. His other scientific achievements were immortalised in his letters to his various friends and co-workers.

Count Brühl's second marriage was a failure. In his time of sickness he was left to his own devices. His new wife banned even the children from his first marriage from his presence. In 1803, while still in possession of his faculties, he donated his instruments and the greater part of his books to the University of Leipzig. This action was reported in the February 1803 issue of Zach's *Monatliche Correspondenz*. {67} The Count died after long suffering, in 1809.

❋

It was always with pleasure that Zach remembered the times they spent in each other's company. In June 1786, when he arrived in Gotha as a young astronomer, he only had the small observatory in the castle at his disposal. To help him to make his work more effective, Count Brühl presented Zach with his own Ramsden type passage instrument, whose detailed description is included in Zach's Solar Tables. Later on, when he stayed with the Duke Ernest II. in Hyères, they still used the same instrument. {68} When he wanted to renew his stock of instruments, Piazzi also turned to Count Brühl. The famous passage instrument, with which Piazzi discovered Ceres, was also acquired by the Count. {69}

Count Brühl had many Hungarian friends besides Zach. He was one of the proposers of Baron Nicholas Vay with the Royal Society. {70} He was also active on behalf of Joseph Podmaniczky in the acquisition of the Hadley type sextant, which he purchased for Imre D. Bogdanich. {71}



Taurus Constellation in Flamsteed's Atlas.

It was an act of great unselfishness of Count Brühl that he recommended Zach, his friend, teacher of his children and manager of his estates, into the good graces of Ernest II. In his letter of recommendation not only did he say many good things of Zach, he also related the high opinion his wife had of the young scientist, and of the pleasure with which the family circle, including his children, liked to listen to Zach's ever interesting scientific expositions. In his letter he also described the void to be left by the departure of his friend, with whom he has found so much pleasure in working together. It was only his awareness of the obligations he owed to the Duke, and the knowledge that Zach would find a broader scope for his talents, that made him to forsake the company of his friend in order to safeguard his future. In his letter Brühl referred to Zach as "one of the greatest astronomers of his age". {72}

Franz Xaver von Zach left London in the spring of 1786, in the company of Ernest II. Before describing their journey, I should like to introduce the 'new governor'.

The Life of Ernest II, Duke of Saxon-Gotha {73}

He was born on the 30th January 1745, as the second son of Friedrich III, Duke of Saxon-Gotha. His mother was Dorothea Louise, Duchess of Meiningen, daughter of Friedrich Wilhelm, Duke of Brandenburg.

His mother was an extremely worthy and accomplished woman. Ernest II inherited the best characteristics of each parent. His love of books and sciences (specially the science of Astronomy) came from his mother's side. She was a true woman of the 'Age of Enlightenment'. It was she, who introduced him to the ideas of Voltaire and other philosophers. From his father he inherited his energy, his strength of character and sense of personal honour, and the deeply felt awareness of his duty towards his subjects.

At the age of twenty he fell in love with one of her mother's ladies in waiting. The object of his affections, the warm-hearted, blue eyed Francesca was brought up in the ducal court, as a ward of the Duchess. When the budding of their mutual attraction came to the parents' attention, it inevitably led to the discreet removal of Francesca from the ducal household. The sensitive young man needed a long time afterwards to get over their parting. This was aggravated by his own temperament, which tended towards depression ever since he was born.

He lost his mother in 1767. To alleviate his sense of loss and bereavement he decided to go on an extended European tour. Besides some of the German principalities, he visited the Netherlands, England and France. In England he was received with special affection, as he was closely related to the royal family. It was here that he acquired his first astronomical instruments.

Ernest II was a young man of many talents, well versed in mathematics. His interests included marine design and architecture, and the sea in general. In 1787 he was elected 'Fellow of the Royal Society'.

After England, he visited France, where he made close friends with the Baron Melchior Grimm (1723-1807), the love of Mme Epinay, in whose company he was admitted to the famous salon of Mme Geoffrin. Here he also made the acquaintance of Diderot, D'Alambert and Holbach. He was attracted to these people, and even in his later life he kept returning to their company. Baron Grimm, the renowned writer and critic also paid him a visit in Gotha.

Ernest II, Duke of Saxon-Gotha.

In 1769 Ernest II returned to his own country. On the 21st March he contracted marriage with the eighteen year old, beautiful and very accomplished Charlotte Amalia, Duchess of Meiningen. Unfortunately they were also blood-relations.

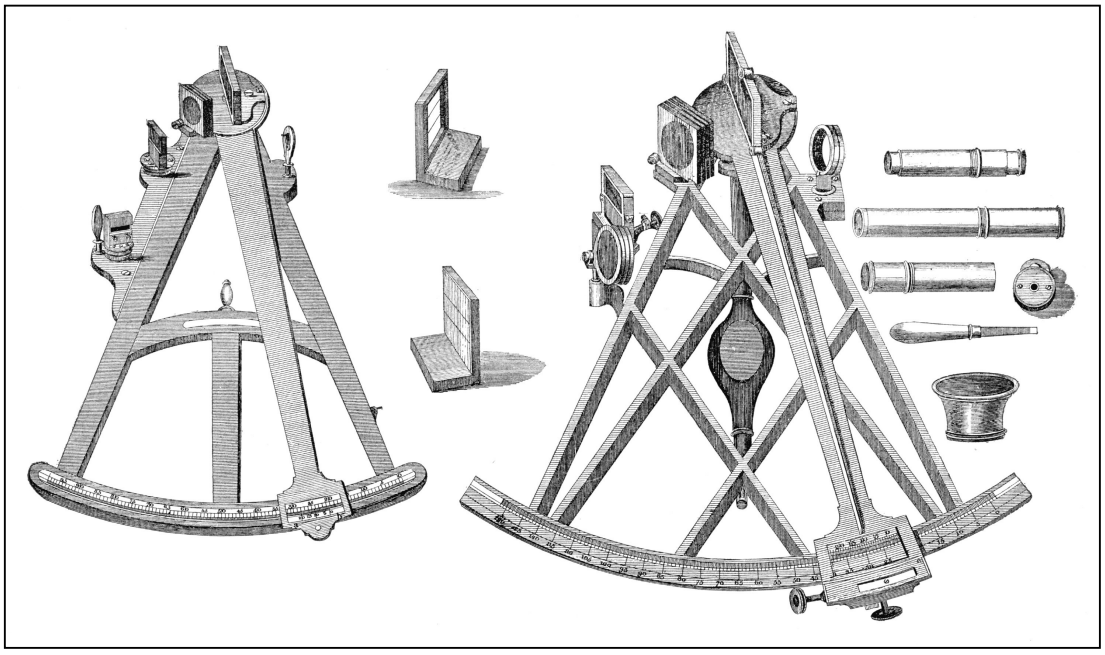
When he ascended to the throne in 1772, he found the coffers empty. When he visited his country, he was distressed by the misery in which his subjects lived. In 1774 he became a Free Mason, joining the lodge 'Gothaische Lodge zum Rozenkrantz'. It was in accordance with the spirit of the Masonic movement, that he made a resolution to improve the lot of his subjects. As a step in this process, he had a hospital built for the benefit of the poor, the old and the disease-ridden.

The love of 'pomp and circumstance', which he inherited from his mother, was to some extent incompatible with the noble ideas of humanism. The ducal palace had a well stocked library, which the duke augmented with many new treasures. He surrounded the ducal palace with an 'English style park'. After his father's death he had an observation dome built on the roof of the ducal palace.

Alas, he was not much blessed in his family life. He lost two little sons in seven years. He had two sons left : August (1772-1822) and Friedrich (1774-1825).

Johann Franz Zach entered the Duke's life in 1786. Although he was a Catholic, he felt at ease in the company of Protestants. The only item of his past life which was of interest to the Duke was : Did he ever enjoy a close relation with the Jesuits? It is very likely that the Duke has met many scientists with Jansenist leanings, hence his interest. We do not know Zach's actual answer to the question, but considering his previous history, it can be guessed with a reasonable degree of certainty what his answer may have been. Anyway, it appears to have been satisfactory. {74}

The fortunes of Zach later became closely linked to the life of the ducal family.



Hadley type sextant.

Castle Friedenstein in Gotha. (Photo by József Márton)

PART 3
IN THE COURT OF ERNEST II, RULER OF SAXON-GOTHA

Don't Be Flighty

Don't be flighty.
Good work is accurate try
to be exact like the star's trek on the sky.
Although of it others will profit.

Attila József
(Translated by Thomas Kabdebo)

1. On the Road to Gotha

On the 30th May 1786 Zach, in the company of Ernest II, left London. Not to be hampered in their astronomical observations, they took along with them a marine timekeeper made by Mudge, a six inch Hadley type sextant and an eight inch achromatic Ramsden telescope, which had a magnification of 20×. An artificial horizon of glass construction completed their equipment. The next day they embarked at Dover, bound for Ostende. On board ship, on the 1st and 2nd of June they enlivened the time with performing some astronomical observations. Zach carried our a few calculations of the distance of the Moon, and determined the elevations of several heavenly bodies. On the 3rd of June they arrived in Bruges, where they determined the latitude of the town and measured the Sun's elevation at noon. On the basis of their measured data they calculated the difference between the Bruges and the Greenwich meridian.

On the way to Gotha Zach determined the position of the meridians of Brussels, Tongeren, Cologne, Bonn, Nassau and Frankfurt am Main, relative to the Greenwich meridian. In Brussels he made the acquaintance of Barnaba Oriani, the Milanese astronomer, an old acquaintance of Ernest II. In Zach's later life Oriani became one of his most loyal friend and correspondent. {75}

The Beginnings in Gotha

They arrived in the Court of Gotha on the 26th June 1786. Here Zach met Professor Adam Weishaupt of Ingolstadt, the founder of the 'Order of the Illuminati', who was invited to the ducal court on his expulsion from his home town by order of the Jesuits.

After his arrival at Gotha, Zach immediately succeeded to cast a spell over his surroundings, not only through his knowledge, but also by his attractive personality. He started work immediately. On the second day after his arrival he determined the latitude of Gotha, using the Mudge type timekeeper he brought along from London. and an Emery type chronometer. {76}

At first the Duke thought of rebuilding, with Zach's help, the little observatory attached to the roof of his palace, but Zach's idea was, right from the beginning, to construct a completely new observatory, using the Oxford observatory, which he came to like so much, as the model. {77}

The Duke, who was not only a sponsor of science, but also aspired to gain competence as a practitioner of astronomy, returned to England on the 5th of July. He

wanted to pick up the best ideas from the local observatories and instrument-makers, and obtain the best equipment with which to equip their new observatory in Gotha. {78}

He has arrived in London on the 17th July 1786 and stayed until the 1st of September, so he could be back in Gotha on the 11th of September. During his absence from home he used the time to practice the solving of astronomical problems. He took along with him an Emery type chronometer to use for the determination of geographical locations. During his stay in London the Duke received another chronometer from Emery. In the Dover Street establishment of Brühl the Duke also carried out regular observations in the company of his host, whose results they sent to Bode in Berlin. The Duke has also received gift of a seven foot telescope from Sir William Herschel. He also brought back to Gotha a pendulum clock from Mudge, and a 'Kiefel Palette', which has already been used by Brühl in his observations for the last three years. In addition to these, the count, who had a rich collection of instruments at his disposal, also presented his friend with a passage instrument. The Duke augmented these London acquisitions by the purchase of four astronomical chronometers. On his way home, he made a stop in Göttingen, where he has bought two telescopes. One of them was ten foot long and was made by Dollond, the other one was two feet of length and was made by Short. {79}

It can be seen from this, that the Duke's London trip was successful, and the instruments he acquired for his observatory were of great help in the later researches.

In the Duke's absence Zach tried to spend his time profitably in his new home. His first effort was directed towards making the existing observatory fit for regular work. So he started to make observations immediately, using the already existing instruments. In a very short time he was faced with a unpleasant but unavoidable fact. He found that Gotha was built in a depression, for which reason the number of days when the atmosphere was clear enough for observation was disappointingly small. He soon formed an opinion, that it would be more profitable to build the new observatory out of town on a hilltop. Unfortunately, the realisation of this idea had to be postponed for the time being, due to an unforeseen event.

An Astronomical Expedition 'a trois'
South of France and Italy in 1786-87

A long time had to pass before the newly acquired instruments could have their debut in Gotha. A few days after the Duke's homecoming, on the 30th of September, the ducal couple left the town in Zach's company. The Duchess, who was, for years plagued by severe rheumatic complaints, wanted to spend the winter in Hyeres, on the French Riviera, as she found that the locally available cure tended to alleviate her discomfort. The Duke, however reluctantly, complied with his lady-wife's wishes, but he was determined not to let this interfere with his astronomical ambition. So, the problem was solved by the Duke's decision to build a small observatory in this pleasant resort, and to carry on their observations without serious interruption. {80} They took along the following instruments:

- ⇒ One Mudge type naval chronometer
- ⇒ One Emery type chronometer
- ⇒ A few English watches showing seconds
- ⇒ One Ramsden type passage instrument
- ⇒ Three Hadley type sextants with artificial horizon
- ⇒ One eighteen inch Sisson type quadrant
- ⇒ One six foot Dollond type telescope
- ⇒ One seven foot Ramsden type achromatic telescope {81}

On Their Way to the French Riviera

From the second day of their trip until the 9th October they remained in the territory of County Hanau. They have immediately started their astronomical activities. Using a five inch sextant Zach determined the Sun's elevation on the 3rd, 8th and the 9th.

They next ten days they spent in Frankfurt, carrying out some solar observations. Frankfurt am Main was the Duchess' birthplace, so, understandably, she was pleased to while away some time there. {82}

On the 5th of November Zach and his Duke organised a little excursion on their own to Mannheim, where they were shown around the local observatory by Fisher the astronomer. Zach would have liked to determine the geographical co-ordinates of Mannheim, but Fisher had not yet had a chance to acquire any useful data, as he just took over the direction of the observatory from König. He was also disappointed by finding the beautiful passage instrument still unpacked, in the same state as it was when Zach and Brühl visited two years ago. To do any work at all in this observatory, they had to erect their eight foot Bird type quadrant and use it to determine the absolute time. This time Zach's luck was in and on the 8th of November he succeeded in observing Jupiter's passage, using the same instrument. On the same day the Duke observed Venus, using the wall-mounted quadrant. {83}

Strassburg was their next stop. Unfortunately it was raining during their whole stay, so there was no chance of any astronomical activities either in the town itself or in the neighbouring Colmar.

The 5th of December found them in Lyon. Here Zach was welcomed by some of his old friends. After their arrival they immediately visited Fr. LeFèbvre and the Observatory of the Academie working under his direction, and the private observatory of Camus. {84}

On the 29th of December, in Marseilles, the weather finally turned clement. So Zach has immediately contacted his old correspondents, Saint Jacques de Sylvabell and Bernard, who were in the habit of sending him their new papers when they wanted to have them published in the *Astronomisches Jahrbuch*, in Berlin. Dividing the work among them, they determined the geographical longitude of Lyons by means of a nautical chronometer and a passage instrument. When they evaluated their measurement, they have found that the corresponding data in the hitherto accepted catalogue of Bradley have been incorrectly given. The king promised Saint Jacques a three foot quadrant, which he was looking forward to for the last few months. {85}

Erecting the Observatory in Hyères

At last on the 10th of January they have reached their destination. After their arrival they determined the exact distance between their town and Marseilles. As they intended to remain here for some length of time, they regarded the erection of the new observatory as their first task. In this the overriding concern for placing their passage instruments on secure foundations was the primary motive. {86}

They found an old Martello tower which could be quickly bought and converted for their intended use. It was the property of a special army unit, presently serving in Toulon. The tower was forty-three Parisian foot high, nineteen foot long and seventeen foot wide. They planned to erect their observatory on the roof of this tower. Unfortunately the interior of the tower was in a very run-down condition, so they had to have a wooden staircase built. The first step was to sort out the roof. The stairway had to be built in a way to make it possible to lock up the observatory securely. The tower proved to be habitable, but could provide only some of the necessary comforts. For this reason at first they took their midday meals in town, and rented a private cottage, built as part of the city's wall and surrounded by an orange grove. The drawback was that the cost of rent was

exorbitant. This provided an additional spur for not delaying with the start of the construction work for any length of time.

On the 13th of January they returned to Marseille, where they made some observations of the planet Uranus. The rebuilding of the tower also started on this day, and made such a good progress, that on the 30th of December it was already possible to perform the first observations. The top of the tower was open, so it could also be used for just sitting there, admiring the view. {87}

They have also made the acquaintance of Thulis, the renowned amateur astronomer. He has spent several years in Cairo as a merchant, and gave up this lucrative activity for the sake of astronomy. He came to see the Duke and Zach in Hyeres, offering his help. He did much to help the construction, and later accompanied them on a marine excursion.

It was a source of some annoyance that they had to miss the lunar eclipse on the 3rd of January, not only on account of the rainy weather, but also because the predicted timing of the event in the Lalande catalogue was found to be unreliable. {88}

From the 10th of January onwards, the Duke, Zach and von Hardenberg, the major-domo of the Gotha court, kept taking observations on top of the Hyeres tower, right until the 1st of April. They published these results in Berlin, in the 1791 volume of the '*Jahrbuch*'. {89}

On the 5th of April the Duke, who found Zach and Thulis good companions, with whom to follow his adventurous bent, started off on a sea voyage, which, just as his other similar excursions, was used to further his astronomical ambitions. {90}

Travels Overland and Overseas between 5th of April and 7th of May, 1787.

Their journey started on board of the *Savoyardische Tartar*. The ship sailed at 9 AM for Nice. At 6 PM a minor storm brew up, so the captain put his passengers and their instruments ashore. Zach has utilised the time to collect data about the sun's altitude from the roof of a 'house of sanitation'. Because of the inclement weather the boat made an enforced landing on the nearby island of St. Margarita, where it was impossible to carry on with their observation due to the high seas and the angry weather. They caught sight of Nice at noon of the 6th but were not able to land until 8 AM. Due to the weakness of the wind they could approach their berth with a highly reduced speed. Between the 9th and the 12th they stayed in Nice, where they were successful in continuing their data collection. The took measurements of the Sun's altitude and determined the geographical latitude of Nice. On the 13th they boarded an English merchant ship, the *Mary of Yarmouth* which had formerly plied the Smyrna run. The Duke and his entourage aimed to visit Genoa and Leghorn. John Bell, the ship's master, was a man keen on broadening his mind, and he was also acquainted with the art of the determination of the moon-earth distance. They landed in Genoa on the 15th. Next day they all participated in the determination of the city's geographical latitude. {91}

They left for Milan on the 17th, arriving in the morning of the 18th. The first place they visited was the Royal Observatory. Here, in co-operation with their fellow astronomers Caesaris, Reggio and Oriani, they made a determination of Milan's geographical longitude, using a marine timepiece, a chronometer, and a pendulum clock. In addition they calculated the difference between the meridians of Milan and Greenwich and also those between Milan and Paris. {92}

They departed for Leghorn on the 22nd of April. On board, in the evening Zach made some measurements of the Moon's distance. On the 23rd they have arrived in Leghorn. Next day Zach determined its latitude. They travelled on to Pisa on the same day. The local times needed by Zach for his observations were supplied by Mr. Slop, a

member of the observatory's staff. Zach also determined that the difference between the positions of Pisa and Milan was 5°. On the 5th of May they re-boarded the French ship '*Tartar*' and sailed for Hyeres. They landed there in the evening hours of the 7th. {93}

Adventures on Dry Land

In Grenoble the Duke measured the solar altitude on the 23rd of May. On the 25th of May they continued their journey to Geneva. {94} The 9th of June was the first chance that Zach had to determine the solar altitude in Sécheron. The Observatory in Geneva and Sécheron lie on the same meridian, but, in spite of this, Mr. Mallet, the director, did not take his measurements in Geneva, but made use of his own instruments and his own comfortable observatory, which he had built on the roof of his own house in Avully, three km. distant from Geneva. Zach liked to pass the time in Avully, in Mallet's company. Whenever he went there, he always took with him his Marine chronometer made by Mudge. They have made several determinations of the difference between the meridians of Avully and Sécheron, which they consistently found to be ±36". {95}

In Avully, on the 15th of June, Zach wanted to observe a solar eclipse, but unfortunately his efforts were prematurely terminated by the onset of bad weather. {96}

The Duke and Zach left Geneva on the 26th of June, planning an especially daring escapade. The intended to climb the icy summits of the Chamonix, with the intention of determining its geographical longitude and latitude. The place where they intended to establish their work-station on the peak of Mount Blanc was hitherto only reached by Dr. Paccard. Sauffure had also made the attempt, but had no more of a success. On seeing the load represented by our friends' astronomical instruments, the onlookers soon formed a consensus about the impossibility of their reaching the peak, let alone their being able to carry out accurate measurements. Paccard was also disinclined to climb to the summit again just for the pleasure of being involved in another failure.

Zach did not want to give up the idea of obtaining the accurate co-ordinates of the peak. He developed a special method, whereby he could take readings from two, lower and more accessible points, and establish the co-ordinates of the summit by calculations, using data obtained from these two locations. This way the purpose of the investigation, to determine the correct co-ordinates of Mount Blanc, was fulfilled.

The time to return home was approaching, so they had to return their instruments from Avully to Geneva. On the 28th of June their little 'caravan' ascended to the two lower peaks under the guidance of Dr. Paccard, and used the time to carry out a few more successful measurements. By the 3rd of July they were in Geneva again. {97}

On the 5th of July they started on their return journey to Gotha. On their way they the made a few stops to carry out 'longitude' determinations at Lausanne, Bern and Tübingen. {98}

Back in Gotha

They have returned from France refreshed in body and spirit, to devote their energies to making their plans for the new observatory. The Duke was convinced by their experiences in Hyeres that the accuracy of the astronomical observations improved if they were taken from a firm foundation, such as provided by an observation tower. From the beginning, Zach's designs and ideas were centred on creating such an observatory on the top of Seeberg. He was lucky that even his first ideas have met with the enthusiastic approval of the Duke. {99}

While the new observatory was being built, the Duke and Zach continued their observations in the East wing of the Friedenstein Castle in Gotha. As their first activity

after their return, they observed a partial eclipse on the 15th June 1787. As usual, Zach published their findings in Berlin, in the '*Jahrbuch*'. {100}

They devoted the years 1787-1789 to the planning and designing the new observatory. They co-operated in establishing its exact geographical co-ordinates. They have also drawn the meridian of the building on the map. The manuscript of the Duke's *Chronometerjournale* are still extant. In this he regularly entered, since 1788, all their observations they had done using a sextant and determinations of location using a chronometer. {101}

On the 10th May 1788 the Duke had to travel to Berlin on official government business. He took this opportunity to determine the geographical longitude of the city.

While the Duke and his astronomer have spent all their time on the design and planning of the new observatory and preparing themselves for the work to be done by constant practice, it is unlikely that they have denied themselves the pleasures of small trips abroad, all the more so, as the health of the Duchess made frequent visits to various medicinal baths a necessity. We know from one of Zach's articles, that in 1789 the three of them visited Karlsbad, where they made the acquaintance of David, the astronomer from Prague, who later became Zach's lifelong correspondent, and who was later also to visit him in Gotha. {102} While in Karlsbad, Zach had also wanted to visit Hungary, but he was frustrated in this intention by officials of the Austrian government. This has probably happened just before his father's death. Joseph Zach could not set eyes on his son the astronomer since 1773.

Observations in Castle Friedenstein in Gotha

Zach was officially appointed to the directorship of the new observatory then still under construction. Until its commissioning the Duke and Zach kept up their work in the small observatory attached to the castle. They had the following instruments at their disposal :

- ⇒ One 18″ quadrant, made by Sisson in London
- ⇒ One small 2′ passage instrument by Ramsden
- ⇒ Three Hadley-type sextants
- ⇒ One achromatic heliometer by Dollond
- ⇒ One achromatic refractor from Ramsden
- ⇒ One reflector (Gregory type) from Short
- ⇒ One 7′ telescope from Herschel
- ⇒ Several astronomical timekeeper {103}

The observations carried out in the castle were reported, as before, in the *Astronomisches Jahrbuch* in Berlin. In his letter dated 2nd May 1790 Zach has reported to Bode the following observations: {104}

On the 28th April 1790 they observed a lunar eclipse in Gotha. At first the weather was good, but during the second half of the measurements the sky became cloudy. On this occasion the Duke and Zach also took a reading of the solar altitude, the Duke using a 5′ sextant and Zach a passage instrument.

Hardenberg, the Duke's Master of Horse, has accompanied them on their trip to Hyeres. Now he also observed the eclipse from his own apartment, which happened to be on the same meridian as the castle. He used a 30″ passage instrument (made by Ramsden) and a chronometer of his own make.

On the 22nd of October they had a wonderful weather for the observation of the complete lunar eclipse. The Duke was busy with a 7′ telescope, which he received from Herschel, while Zach made his observations using a $3^1/_2$′ Dollond type achromatic heliometer.

Through all these years Zach maintained his practice of transmitting his colleagues' results to Bode in Berlin, among others A. David's observations of the lunar eclipse of 28th April 1790. Seyffer also used Zach's good offices to send his notes on the lunar eclipse of 22nd October 1790, which he made in Göttingen, to the Jahrbuch in Berlin. Köhler sent his measurements of the Sun's elevation – made on the 10th August 1790 – to Zach in Gotha. {105}

The Duke developed a liking for the determination of geographical locations to such an extent, that between the 1st June and the 23rd of September he carried out twenty-seven such determinations in the German provinces surrounding Gotha, accompanied and assisted by Lt. Vent. {106}

On this occasion Zach stayed behind in Gotha and devoted all his available time to the planning of the future observatory and carrying out current astronomical observations. He observed the planet Mercury seventeen times. In his report to Berlin he explained in detail the difficulties associated with the observation of his planet. He bolstered his opinions by quoting Copernicus, who also had experienced considerable difficulties while working with this unruly planet. Observation of Jupiter and Uranus counted as regular parts of his programme. He presented his planetary observations in form of a table, in which he incorporated the notes of his previously made observations. {107}

For the *Astronomische Jahrbuch* Zach collected and organised in an article all his previously collected data on the meridian distance between Greenwich and Paris. {108}

It was a source of great annoyance for Zach that he had to miss the observation of the solar eclipse of 3rd of April 1791 at Gotha. The day preceding and following the event were perfect. Even on the morning of the eclipse the sky was clear, but during the eclipse and the whole following afternoon the sky became covered by clouds. Many in Zach's entourage were looking forward to the event : the Bishop of Gnaden, 'Herr Coadjutor von Maynz', Baron Dalberg and many others were keeping their fingers crossed for the return of the clement weather. {109}

In addition to his work of observation, Zach had to find time for producing catalogues for more public use. In his communication addressed to Bode on the 11th of April 1791, Zach announced that he has already completed the manuscript of the occurrences of aberrations and nutations, and a 'Star-catalogue' with the description of more than 500 Zodiacal stars. {110}

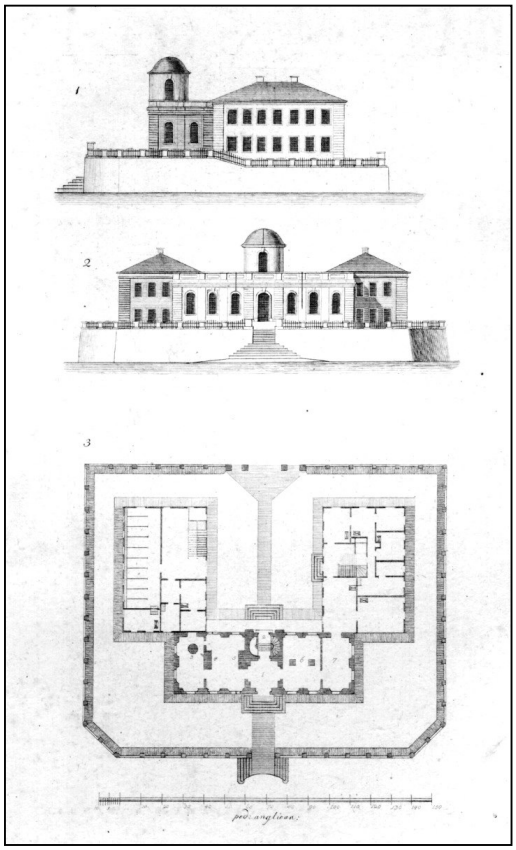
On the 11th October 1791 Zach observed a lunar eclipse in Gotha, and the eclipse of Jupiter by the Moon, using a Dollond type achromatic telescope. {111}

Zach has also received data from England. Miss Caroline Herschel sent the observational data collected on a comet, discovered by herself on the 15th December 1791, to Zach, so that after performing the necessary calculations, Zach could send them to Bode in Berlin. {112}

The most significant achievement of this period was the preparation of a Solar Table, which was based on Zach's observations made between 1787 and 1792. The Solar Table also included the Duke's observations and was published under his name. {113}

The New Observatory on the Seeberg {114}

The Duke has given Zach a free hand in choosing the place best adapted to the needs of everyday astronomical research. The hill named Seeberg, a few kilometres away from Gotha, proved to be the most suitable location. Zach aimed at building the most 'up-to-date' establishment, and in this aim he had the Duke's fullest moral and financial support. The remote location, quite a distance from the nearest town, has had its drawbacks, but Zach's painstakingly detailed plans provided a solution for these



The plan for Seeberg Observatory.

problems. The Duke even gave his consent for Zach to have his own apartment on the premises of the observatory.

The success and the quality of the subsequent work gave ample proof, that the plateau on the top of Seeberg was the right choice. The Eastern and Northern part of the horizon was free of obstructions. On a clear summer day the famous peaks of the Brocken were clearly visible. From the South to the Northwest one could see the chain of the Thüringer Wald, with its two outstanding peaks, the Schneekopf and the Inselberg.

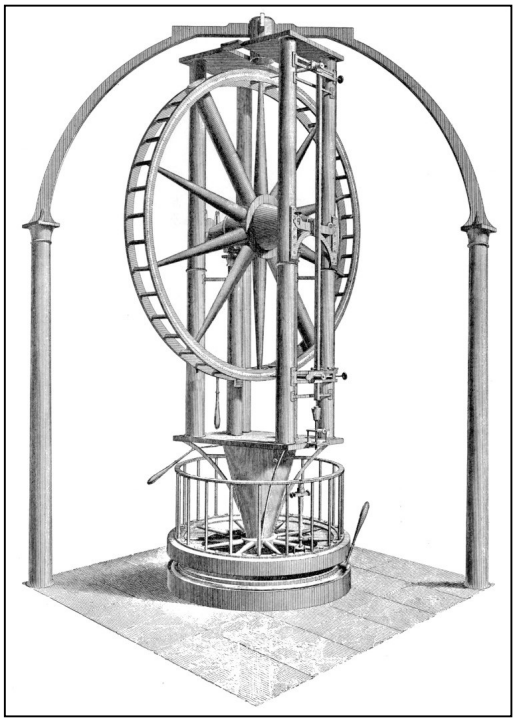
To the NW of the town there was another hill, the Krahnberg. This would have been just as suitable as the Seeberg, but it was closer to the town, and there was reason to think that the tall twin towers of the castle might interfere with some of the observations.

In addition to the observation building and living quarters Zach had a compelling need to have a workshop, dedicated mainly to the setting up and operation of the passage instruments.

The Duke wanted to preserve without change the present observatory in the castle, mainly for his own convenience, as his tower was of exactly the same height as the tower in Hyeres.

Zach stuck to his opinion about Seeberg being the best location for the new observatory. He prepared the first draft of the site-plan during July 1787, right after their arrival. He chose as his model the Radcliff Observatory in Oxford, whose comforts and facilities were well known to him from the times he had spent there in the convivial company of his friend, the astronomer Dr. Hornsby. The Duke himself was also well acquainted with the English observatories, which he had visited in 1786 in order to gain more experience abroad. This was the reason for his being able to suggest some minor, but sensible modifications to Zach's plans. After thorough discussions they were ready to mark out the foundations of the observatory to be erected on top of Seeberg. On the 8th September 1787. The Duke measured the altitude of the Sun with a chronometer and a 9" sextant, while Zach's instruments were an English made naval timekeeper and a 5" sextant. He managed to be back in town before noon, in time to mark 'midday' with a passage instrument. The Duke remained at the summit awaiting Zach's signal. They determined the meridian-difference between the Palace and Seeberg as 7.0". Next day, on the 10th September they have drawn the line of the meridian crossing the new observatory. Next day the work of the builders started. The beginning of the work was also blessed with good weather. When the weather changed for the worse, there was nothing else to do but to carve the building's foundation into the solid rock of the mountain. With the arrival of the spring, the work continued with laying the foundation stone. The foundation-stone had a small cavity, containing a short Latin quotation and a small lead casket, in which various coins minted with the portrait of the Duke, as the establishment's founder, and the plans of the observatory were enclosed.

On the 30th April 1788 the building was orientated according to the compass points. The determination of the meridian was also repeated.


Ramsden's Astronomical Circle in Palermo.

The building had two main entrances, on the North and South sides. The building consisted of two wings, which were again divided. One of the rooms was to house an 8′ passage instrument and its attached pendulum clock. The other room was intended for a northerly and a southerly wall mounted quadrant. The third part was to house a Zenith-sector. In the rooms where Zach planned to place instruments he purposefully left out any provision for heating. The fourth part of the house was to be his study/ workroom. In this room there was provision for a stove, so that, in winter, the workers engaged in observations had a chance to warm their frozen limbs. This little corner room was connected by a small door to Zach's private quarters, situated in the East wing of the building. The West wing was used for stables, coach-house and servants quarters. In the centre of the observatory a small turret with a moveable dome was erected, on secure and solid foundation. For this room an 8′ astronomical circle was ordered. Not far from the main buildings there was a circular shed with moveable roof, housing a large equatorial sector.

The observatory was built of carved stone. It was built by the architect Christopher Besser (1706-1800) of Gotha. The personnel consisted of (in addition to Zach) an assistant by name of Georg Hartung, various male and female servants to run the establishment, and a doctor. Security was provided by three permanently attached soldiers.

A library was also part of the establishment. Zach furnished his apartment in a simple and austere manner.

The view from the observatory was breath taking.

> "I have never seen such an observatory in England, France, Italy or Germany, which, built in the middle of a forest had such a free horizon, over which the air was always clear due to the free and unimpeded movement of the air. From above, we could see below us the chimneys of the township, and the smoke that covered the Old-city. Our building is exposed to the weather and the seasonal climate changes, and we could feel the northerly winds at double strength, but all these factors were taken into account when the our edifices were designed. The woods of Thüringia come up right to our gates."

In Zach's lifetime the inventory of instruments of the Seeberg Observatory consisted of:

- ⇒ 8′ passage instrument from Ramsden (1788)
- ⇒ 7′ Herschel type reflector telescope
- ⇒ 2′ astronomical circle from Cary of London (1796)
- ⇒ 8′ astronomical circle from Ramsden (1800)
- ⇒ 3′ astronomical circle from Troughton of London (1800)

⇒ 3′ equatorial refractor from Dollond (1796)
⇒ 3′ equatorial refractor from Schrõder in Gotha
⇒ 3′ duplex refractor from Dollond
⇒ 10′ refractor from Dollond (1796)
⇒ 2 ′comet-finders′ from Baumann and Kinzelbach in Stuttgart {115}

Excursion to the Harz Mountains and the Climbing of the Brocken

During the May of 1793 the weather appeared ′set fair′ for a long time. This gave Zach and the Duke the idea of going on an excursion with the aim of climbing the peak of Brocken in the Harz Mountains and determining its geographical longitude using astronomical instruments. This remarkable peak dominated the landscape of a sizeable part of Northern Germany, so the determination of its exact co-ordinates was certainly of more than just local importance. The survey maps showing the peak were usually very inaccurate. For example, on the map produced by Güssfeld in 1783 the Brocken is shown 11 minutes East from the Gotha meridian, while it can be seen even by the naked eye, that in reality it is to the West of it by about seven minutes. This difference on its own amounts to about one third of a Degree. In 1759 Berlin and parts of Germany were surveyed by Schmetau, Royal Marshal of Prussia using a parallax-circle. His survey included the Brocken, but its results have not been published in Zach's time.

Zach had the following instruments at his disposal :

⇒ A mirror-sextant of Hadley type, with two artificial horizons. One of these was made of marble of Carrara, and had a porcelain globe attached
⇒ One Emery type chronometer
⇒ A declinatorium to measure the declination of magnetic compasses.
⇒ Two portable barometers
⇒ One pendulum.
⇒ One etalon for measuring a distance of half of a metre.
⇒ A set of weights marked in British units (Troy Ounces)
⇒ One 2′ telescope by Ramsden {116}

Map of the Mediterranean.

2. Franz Xaver von Zach at His 'Apogee'

"We are placed on this earth to feel at home somewhere."

Áron Tamási

Although – ever since his childhood – Zach was fated to feel that wherever he found himself, his stay was only temporary, he felt himself really at home at the observatory built on top of the Seeberg. He had his four room apartment, built and furnished to his own specification, its door opening to the fragrant air of the Thüringian forest. He had servants galore – both male and female – to look after his creature comforts and he had his own horses in his own stables, ready to be harnessed and taken for a drive in the country. This environment, besides providing him with a sense of well-being, also proved to be the right background for carrying out scientific work of the highest quality.

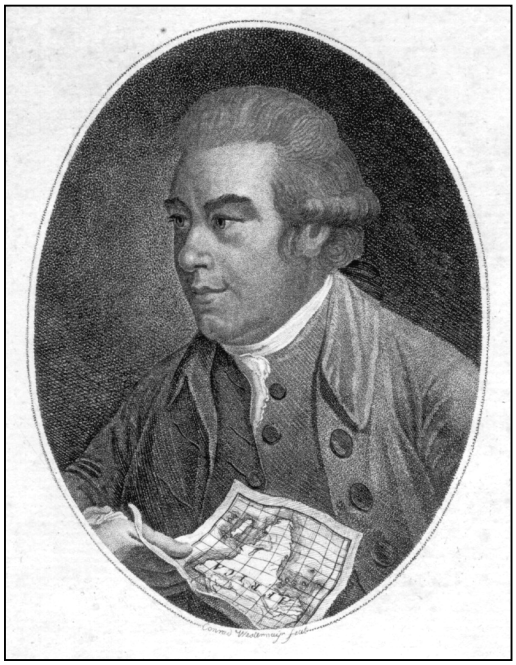
With the scientific achievements of his eighteen years at Seeberg, Zach gave ample proof of the effect one single individual scientist of genius and his well constructed and forward looking, but realistic program can have on the development on a whole branch of science.

In the previous chapters of the book many words were written about the wanderings of Franz Xaver von Zach. In his later life these 'drifting' years proved to have been an immense benefit to him. He made friends in practically all the countries of Europe. This made it easy for him to acquire the written publications and scientific news necessary for his work. With the help of his personal contacts he found it also possible to lay his hands on the most 'up-to-date' scientific instruments.

Although we can learn much about Zach's personality from his published works, more intimate insights can be obtained from the perusal of his letters written to his friends (A. David, Joseph Banks, Barnaba Oriani, Carl Friedrich Gauss, Ludwig Schedius, Caspar Horner, Rudolf Schiferli). {117} The picture emerging shows a warm hearted, generous humanist, a scientist of wide ranging interests and with a love of humanity. With his pleasant and unaffected manners he could charm 'Their Majesties' (his way of referring to 'his' Duke and Duchess) and everyone else in his circle of acquaintances. The style of his letters is equally attractive.

Zach enjoyed the company of young people during his whole life. The feeling was mutual, young folks enjoyed working with and learning from him. Many aspiring young scientists felt privileged to work with him. They expressed their appreciation through the quality of their work. This was one of the factors contributing to the excellence of work coming out of Seeberg. In their later life all these pupils – Burckhardt, Nieuwland, Bohnenberger, Horner, Gauss – were destined to make significant contributions to the science of astronomy. The mere fact, that he had the material and financial resources to have pupils, has caused a manifold increase in his effectiveness.

To provide a secure foundation for his future scientific work, he published two handbooks. {118} He started work on his Solar Tables in 1791, while still working at the Friedenstein Castle Observatory. He was greatly helped in this endeavour by the aforementioned Burckhardt. Simultaneously he was preparing for publication a table of aberrations and nutations to be of help during the ongoing observations. At last, further to consolidate the foundation of his work to come, he produced his own 'Star Catalogue', listing the positions of the stars, based on his own determinations of improved accuracy. He continued his practice of making known to his colleagues the results of his work in the



Joseph Banks, the President of Royal Society.

relevant yearbooks, published in Berlin. In 1792 Zach was joined by a new colleague, Nieuwland, the Dutch astronomer, who later became a member of the Leiden Observatory team and the professor of astronomy at the local university. It is not known how long he stayed there, but in the following year he is mentioned in one of his master's letter, written from Seeberg.

During his employment with the Count Brühl in London, the young Zach already had an extensive correspondence. The letters were mainly of scientific nature, in connection with papers published in the *Astronomisches Jahrbuch*.

The letters, written at Seeberg, had more personal content in addition to the scientific material.

Zach met A. David, an astronomer from Prague, in 1789 in Karlsbad, {119} where he spent the summer taking the cure with 'his' Duke and Duchess, who were also quick to take to their heart the Bohemian Canon. David and Zach exchanged letters – with some interruptions – during the whole Seeberg period. This correspondence presents a detailed picture – like a personal diary – of their everyday life, the students and the frequent guests and visitors. They also habitually informed each other about the results of their observations. Zach regularly forwarded David's observational data to Bode in Berlin. Because of the times they lived in – the beginning of their acquaintanceship coincided with the outbreak of the French Revolution – it was unavoidable that in addition to purely scientific matters sometimes news of tragic events had to be included in their letters. As a believer in the ideas of the Enlightenment, Zach was painfully affected by the horrendous events unfolding in France. Not even astronomers were safe from the depredations of the 'blood-hound' (as Zach was wont to refer to Robespierre). One of the leading scientist of the age, Jean Sylvan Bailly, author of one of the first book on the History of Astronomy, became one of the victims. Zach published Bailly's obituary in the Yearbook *Connaissance Des Temps*, a copy of which he sent to his friend in Prague. {120} There are also some personal references. We learn from one of his letters written from Seeberg, that in 1792 his younger brother, Karl lost his life in Italy, fighting against the revolutionary armies, and that the life of his elder brother, Anton – who later became an Austrian general – was also constantly in danger. {121} The latter was also acquainted with David, who was instrumental in conveying a small parcel from Zach to him.

Even when not in the best psychological state, Zach could still take an interest in the lives of others. In today's language, he was a true 'managerial' type. He requested David to send him a short essay written in Latin, which he intended to read at the Academy at Erfurt. He hoped that with this act he could obtain the title of 'academician' for his friend from Prague. {122}

The Seeberg Observatory became operational in 1792, during the years when France was living under the rule of the darkest terror. At the same time Zach and his colleagues were able to work without interruption, although to a certain extent isolated from the mainstream of scientific life. In these troubled times, in addition to David, it was Bode, the editor of the *Astronomisches Jahrbuch*, who provided him with a 'line of communication'

to the world of science. Zach's work in astronomy was regularly reported in Bode's yearbook.

After the execution of Robespierre and the departure of the Jacobins Europe could breathe more easily and the people begun to hope for a better and more peaceful life.

Zach's old lines of communication were reactivated. In 1795 the German journal *Hindenburgische Archiv* published a paper written jointly by Zach and Brühl. Sir William Herschel sent his two articles to him at Gotha. {123} His French contacts came to life again. His old friend, Lalande, who was appointed as director to the Military Observatory in Paris after the collapse of the revolution, corresponded with him frequently and sent him regularly the new volumes of the *Connaisance des Temps*, together with Cagnoli's new tables of the logarithmic function. {124}

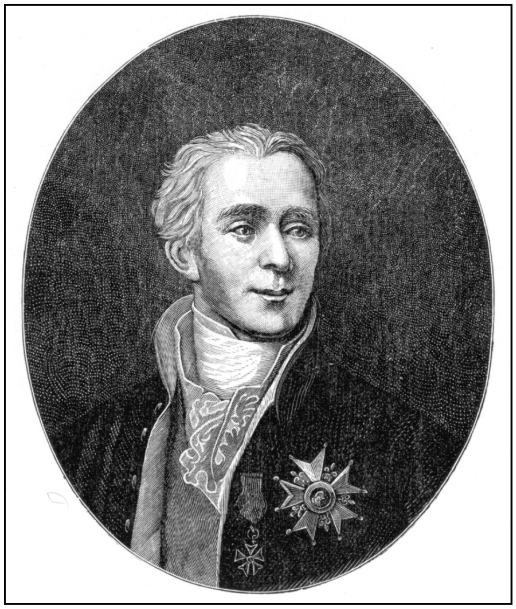
Carl Friedrich Gauss

In 1796 Seeberg was visited by a cousin of Lalande, a catholic priest, who had seen much persecution during the revolution. He was very cordially received and his sixtieth birthday was celebrated by the whole community. Duke August, brother of Ernest II, even composed a poem for the occasion. Zach, himself a Catholic, was deeply touched by the kindness shown by the family of the Protestant princes to the old catholic priest down on his luck, who was even persuaded by the Duchess, using her great resources of tact, to accept a new suit of clothing as a present from the family. Lalande was very grateful and – being a great admirer of the Ducal family – he made use of every opportunity to proclaim their excellence. Zach has also sent Prince August's poem to David in Prague. {125}

In his letter, which Zach wrote to his friend on the 25th of July 1796, he approached him concerning a very interesting matter. He asked David to purchase for him a collection of papers from the estate of the astronomer Hagecius (T. Hajek), a friend of Kepler. {126} Zach probably needed these papers for his evaluation of the 'Harriot Papers'. In 1618 Hagecius also observed the so called 'Kepler Comet' at the same time as Harriot did in Oxford.[4]

In his letters to David Zach often included detailed descriptions of scientific instruments and critical assessments of their makers. Zach maintained a personal contact with Ramsden, Emery and Arnold, the renowned instrument-makers in London. He had a special regard for Mudge, a master craftsman, building nautical chronometers, whose work he immortalised in many of his articles. {127} Zach regarded the 'Hadley sextant' as the most important instrument used in the determination of ships' position, although it was not very well known in the German-speaking countries. He mentioned in one of his letters to David, that this was the instrument of choice for his cousin, the baron Nolcken,

[4] Apparently this plan never reached fruition. During my visit to Prague in the nineteen-seventies, I had occasion to have these papers in my own hand. Unfortunately Dr. Horsky, who was in charge of editing these papers for publication, has recently died unexpectedly, so I do not know anything about he further fate of these valuable papers.



Pierre Simon Laplace

who was a guest at Seeberg in 1796, accompanied by Euler, a resident of Leipzig. {128} A few weeks later Duke Rumovsky and his cousin, named Jakovlev spent four weeks at the hilltop. It was he, who appraised Zach of the fact that the Tsarina Katherine the Great was herself an ardent amateur astronomer. {129} We know from Zach's letters that beside his pupils and astronomer friends the institute also attracted numerous visitors of high rank and social standing.

Zach used the interval of relative calm and tranquillity to visit his brother, the General Anton Zach, who at this time served in the highest circles of the Austrian Army Command. {130}

Due to the temporary relaxation of political tensions, it became possible to receive data on astronomical observations from Zach's English and French colleagues. These found their way to the Yearbooks in Berlin, as previously, through the mediation of Zach.

During this time the resolution was ripening in Zach to publish his own monthly journal, so that he could make a permanent public record of all the fresh information he received.

In 1798 he prepared for publication Olbers' Handbook on Comets. {131} Zach had a lion's share in its publication, as not only was he the source of a significant part of the observational data, but it was also necessary for him to perform the calculations necessary for their presentation and evaluation.

On the 1st of June, 1797 a new correspondent came into Zach's life. It was Barnaba Oriani, the director of the Milan observatory. {132} It did not take long for their relation to pass the limits of scientific correspondence and grow into a warm personal friendship. In this development a certain part was played by the new First Consul of France, Napoleon Bonaparte. Zach met Oriani for the first time eleven years before, in 1786, when he was travelling with his Duke to Brussels. It was Zach who initiated their correspondence. He started his first letter with the words : "Liberté, Egalité, Astronomie", then continued : "Oriani, Friend of Bonaparte, do you remember me?". Oriani's reply was immediate. {133}

Zach was overjoyed on receiving this reply. He promised Oriani, that in whatever language he sent him his communications, he, Zach, would have them translated into German and see to it that Bode received them in that language. In general, his letter to Oriani is written in a more intimate style than the general run of his correspondence. In his firs return missive he was already sending Oriani greetings from the Duke and the Duchess.

In his letter dated on the 25th of August, 1797, Zach informed Oriani about the new journal he was planning to start.

> "Finally, I should like to inform you about my *Allgemeine Geographische Ephemeriden*. You will have heard of my plans. It will contain the results of the solar eclipse of the 14th of June. (…)
> All the eminent astronomers will contribute to my Journal : Count Brühl, Le Duc Malborough, William Herschel, Aubert, Lalande, Delambre, Duc La Chapelle, Thulis, Rumovsky, Nicander, Prosperin, Bode, Barry, Triesnecker, David, Strand,

Gessner, Schröder. It is rather difficult to find correspondents from Italy. It is very seldom that we receive a reply from Cagnoli, Piazzi, Toaldo, Capelli, etc. It seems easier to get news from Philadelphia than from Italy."

The same letter contains some personal words in praise of the Duchess.

"Finally, I should like to relate, that not only the Duke, but also the Duchess is interested in astronomy. The reading of your letters gives her a great pleasure, particularly the parts where you talk about her meeting with you in London. (…)
She is very emphatic about my giving you her regards, and about telling you how much she is enjoying your presents. The Duke himself is sending thousands of good wishes to his old friend and remembers the times we spent together in London and later in Milan. (…)
Your letter, in which you speak well of the calculations that I sent you, has given great pleasure to our good and eminent Duchess, who is herself familiar with astronomical calculations, and was referred to by Lalande in his L'Histoire de l'Astronomie in the following terms :
»… In addition to the fact, that the Duke of Saxon-Gotha has built a first class observatory and endowed it with unstinting generosity, the Duchess herself also takes an interest in astronomical calculations, which she can perform with verve and precision, earning the admiration of all.« (…)
It was she, who has computed the elements of the new planet's orbit using your equations, and carried out the tabulation of the data acquired from the planet Uranus, also using your formulae. For these reasons she is often asking about you, and writes down your name times without number. This was even mentioned in the *Literary Gazette of Gotha*. (…)
The Duchess regards Bonaparte as a hero. This lady, – an aristocrat born and bred – admires republican ideas. She is a woman of great personality, who would be a worthy occupant of a mighty throne, to the benefit of science and of humanity. It is not for nothing that Lalande described her as a 'Goddess'. It was she, who defended the catholic priest, Lalande's poor cousin, who arrived in our neighbourhood in miserable condition, more dead than alive, without clothes, without money or any visible means of support. She gave him food and clothing. The poor man was at the end of his tether and lost his will to live. The Duchess' generosity gave him a new home and a fresh lease of life. (…)
The Duchess also owns a collection of statues, for which she would like to acquire a bust, made by Franchi, of Napoleon, She also commissioned Hendon to create busts of D'Alambert, Franklin, Bailly, Washington, Newton, Tobias Mayer, Kepler and Leibnitz. She placed additional orders with Hendon for statues of Laplace, Lalande and Lagrange. Her fondest wish is to acquire one of yours. (…)
She also has portraits of famous astronomers, such as Tobias Mayer, Lichtenberg, Tycho Brahe, Fixlmillner, Copernicus, Kepler, Bianchini and Flamsteed."

In his letters to Oriani mention is always made of the Duchess, but using a perhaps less exalted voice. The obvious conclusion is that with the growing intimacy between the Duchess and himself, he had to make a special effort to hide the strength of the affection that existed between them.

In his letter to Oriani – dated 25th August 1797 – Zach informed Oriani that the wife of Count Brühl, Lady Egremont, who was known and loved by both of them, had recently died in London. The Count remarried, but this time he made a less fortunate choice. The new Countess could not stand his children from his previous marriage. The unhappy fate of Count Brühl became a recurrent motive in Zach's subsequent letters to his many

correspondents. "The years spent in her society were unforgettable." – he wrote in one of his letters written immediately after his departure from London in 1786.

Oriani also caused Bonaparte to enter into Zach's life. The French astronomers, among them Lalande and Laplace, his most intimate friends, were maintaining a close association with the great man. Lalande proudly related the news that the great man – who has an excellent head for mathematics – "calls him 'grandfather' ", and sometimes spend the night with him, examining the sky. {134} Bonaparte made Laplace a senator. Laplace and Lalande suggested Oriani's name to the consul for the same honour. In one of his letters written to Zach, Oriani related with considerable pride that he received one hundred and twenty gold pieces from the first consul, so that he could purchase a pendulum clock from Arnold, and use it in the survey of Italy, recently decreed by the great man himself. {135}

All this took place in the year of 1797. Within the same year, all the readers of the correspondence columns of Zach's Journal AGE would be acquainted with these visible marks of the consular favour. {136}

The Publication of the "Allgemeine Geographische Ephemeriden" (AGE)

Zach informed David in the September 1797, that the first number of his projected Journal, including a paper of David's, would be ready for publication in the following November. {137}

The *Allgemeine Geographische Ephemeriden (AGE)* was the first Journal to undertake the presentation of the latest scientific achievements for astronomers and geographers on a regular basis. Its first number was published on the 1st January 1798. Zach was thinking in terms of a thousand subscribers. {138} The Journal was published for two years, and its contents embraced information from many fields. We find in it narratives of journeys undertaken, together with information about freshly completed (or to be completed) maps and other similar items. Special attention is given to Zach's life-long interest, the theoretical study of the methods of determining the position of geographical localities with astronomical methods. In addition to publishing astronomical data, *AGE* also contained a lively correspondence column. The range of books reviewed included not only books on astronomy and geography, but also statistical surveys of various lands, reflecting the contemporaneous conditions prevailing in the countries in question.

According to Zach's desires and expectations, scientists from nearly all European countries were represented among the Journal's contributors.

During the second half of the XVIIIth century, the virtual uselessness of the contemporary maps was a fact equally known to and deplored by the members of the military profession on both sides.

In 1797 Oriani was commissioned by Bonaparte to carry out an accurate cartographic survey of the Cisalpine Republic. {139} General Anton Zach was entrusted in 1798 by the Austrian Hof-Kriegsrat with the establishment of a triangulation network. {140} Lalande, Méchain and Delambre were engaged in measuring geographical latitudes and longitudes in France. In Paris, Lalande was assisted in his work by his 'children', Madame and Michel Lefrançais (this was the name Lalande generally used to refer to his adopted niece and his spouse, sometimes using the same appellation even in his astronomical papers).

The publication of *AGE* augmented the respect Zach enjoyed in the astronomers' community, and added many new members to the circle of his already existing friends.

Under the then existing reasonably tranquil political circumstances it appeared natural, that this group of friends, held together by the person of Zach and the *AGE*, should also meet in person. A significant part of the motivation for such a meeting

was provided by the ageing Lalande (Bonaparte used to call him the 'grandfather of astronomers'). He had not set foot in Germany since the time of Friedrich II., but for many a year he managed to maintain close contact with the German astronomers. His foremost desire was to meet Bode, who was his corresponding partner for several years.

The accurate mapping of the earth's surface was not feasible without the organised and sustained co-operation of the astronomers, but to improve the accuracy of the orbital prediction of celestial bodies, the need was – in addition to improving the methods of computation – for precise measurements, independently confirmed, if possible, by other observers. The time was ripe to replace the old catalogues with new, more accurate ones. For example, Bode was engaged in compiling such a catalogue, in which effort he was helped by Lalande, who regularly contributed by sending the results of his latest observations. In 1798 Lalande was informed by the astronomer Piazzi of Palermo about his having started work on a systematic survey of the sky, with the intention of compiling a new catalogue of celestial bodies. To help Piazzi to make his work more effective, Lalande immediately responded by sending Piazzi the already completed pages of Bode's celestial map. In 1798 countless French astronomers were obliged to accompany Bonaparte on his ill-fated Egyptian expedition. A narrative of this event can also be found in the pages of the *AGE*. It was thanks to the successful intervention of Lalande, that Burckhardt was allowed to remain in Paris, and to carry on working with Laplace on the new edition of the *Méchanique Celeste*.

There are many interesting historical anecdotes found on the pages of the *AGE*. For example, we are informed that among the manuscripts of Delisle, Lalande found many records of Ibn Yusuf's observation. {141} Among the records of more than hundred medieval events, there were about thirty describing eclipses.

Lalande, who was one of the principal contributors to the *AGE*, used every chance to heap praise on the ruling couple of Seeberg. He went as far as to call Ernest II the worthy successor of the Elector Wilhelm IV.

The International Meeting of Astronomers in Gotha

It was in 1798 that Zach organised the first international meeting of astronomers at the Seeberg Observatory. It happened at just the right time. Many a year had to pass, before historical conditions were again conducive to the repeat performance of such an event.

Lalande expected from Zach to take him to Leipzig and Weimar. {142} He was accompanied by one of his 'children', the wife of Michael Lefrançais. The lady's presence proved to be a stimulant in the company of the participating twenty-four astronomers, hailing from England, Germany, France and the Netherlands. Lalande, in addition to his 'child', also contributed the etalon of the 'metre' to the store of scientific materials being exhibited. The instruments shown by Zach, which were of high quality and up-to-date by the prevailing standards, were also admired by all.

The most important tasks facing the participants were : {143}

- ⇒ To produce a new, more reliable catalogue and map of heavenly bodies by their co-ordinated efforts. This was the subject nearest to the hearts of Lalande, Bode and Zach. They also wanted to pool their efforts for the production of a new and better mathematical method for the processing of observational data.
- ⇒ Promoting the use of the decimal system for scientific calculations and the adoption of the 'metre' – which was introduced by the French – as the basic unit of measurement.
- ⇒ To introduce the use 'mean time' in geographical surveys, and to establish a common European time reckoning.
- ⇒ To declare the Chronometer and the 'mirror sextant' to be the most suitable instrument system for measuring angles.
- ⇒ Recommending names for some newly discovered heavenly bodies.
- ⇒ To organise a 'working group' to search for new planets.
- ⇒ Involve the astronomers in the editing of the *AGE*.

On the 26th January, 1799, in his letter to Lajos Schedius, he gave the following account of the meeting :

> "The letter of my dear friend, Lalande, the grandfather of astronomers, reached me in Roneburg. In this he informed me of his intention of arriving in Gotha earlier than he had anticipated. I had to return home immediately, and to erect my instruments again in 'double quick' time.
> I could not even think of entering into a correspondence. The *AGE* had a deadline to keep. Then I had to look after some unexpected visitors, Bernouilli from Berlin and van Marum from Haarlem. The latter remained with me for three weeks. After I had finished, Lalande turned up with his niece. They were followed by other astronomers. My house was as full as an egg. Lalande, his niece, his cousin, an émigré priest, Bode, van Marum, Wurm, Feer, Horner, and Schaubach stayed with me at Seeberg. Klügel, Gilbert, Pistor, Kühler and Seyffert from Dresden, Seyffer from Göttingen and Butler from Cambridge were quartered in town, but were my guests in the mornings and evenings. Can you imagine, my dear compatriot, the hectic time I was having?
> I am a bachelor. I live far from town, on top of a hill. My household consists of two serving women, three man-servants, four horses, one doctor and one soldier. Lalande was intent on visiting Leipzig and Weimar. My right hand, Burckhardt, I had to send to Paris. Can you imagine the effort necessary to make everything go smoothly?" {144}

Bad News from England

Oriani tried to employ Zach as go-between in acquiring an 'Arnold pendulum', which was to be financed by Napoleon. Zach approached his old friend, Count Brühl. Unfortunately the Count was in no position to help, as he was bed-ridden with a severe illness in his London flat His new wife hated his children from his previous marriage, and used every means at her disposal to persecute them. The Count could only watch his wife's machinations helplessly from his bed. But this was not all. In contemporary England everybody was under suspicion who was not English born. In the Empire, every foreigner was regarded as one of the Jacobins. Dollond, the well known instrument maker, in one of his letters written to Zach, expressed his hope that he would not have to suspend their friendship for reasons of politics. {145}

Zach's Hungarian Connections

With the help of the *AGE* Zach succeeded in renewing his contacts with his homeland. On the 7th of May, 1798 he received a letter informing him that Ludwig Schedius, professor of aesthetics at Budapest University, had started working on the construction of a small scale map of Hungary. Zach was very pleased to hear from his native land. He requested Schedius to act as a permanent correspondent for his Journal and from time to time to acquaint him with local events and supply him with short critical reviews of new books published in Hungary.

In his reply to Schedius' letter Zach expressed his regrets over the paucity of astronomically defined reference points in Hungary. He quoted Hell, who said that "Geografia sine astronomia nulla est.". Already in this, his first letter, he mentions the gifted young officer, First Lieutenant Lipszky, who, in the past few years has already made some progress towards an accurate and reliable 'Karte von Ungarn'. {146}

The University Council entrusted the performance of astronomical observations, which were necessary for Lipszky's Atlas, to the astronomer Imre D. Bogdanich. From this time on, the progress of Bogdanich's expedition became the central topic of Zach's and Schedius' correspondence.

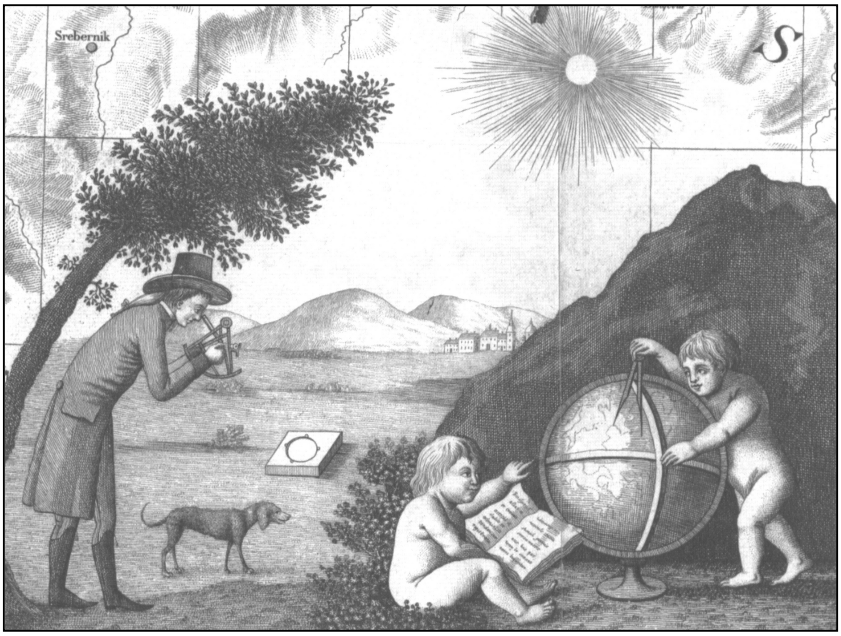
In his letter to Zach, dated 16th of November, 1798, Schedius announced the start of the expedition.

> "We have joyous news, and we want to share our joy with you. Our beloved governor, yielding to the entreaties of First Lieutenant Lipszky, consented to permit the present principal lecturer of the Observatory (who is a 'first class brain'), to carry out determinations of geographical latitudes and longitudes, at public expense, over the territory of the Hungarian Kingdom. (…)
> By the end of the month Bogdanich was already on his way to Fiume, so that he would be in time to perform his measurements on the nights of the 15th, 19th and the 27th. (…)
> As his tools, he took with him a telescope, a quadrant and a pendulum clock, made in Buda by the renowned watchmaker Seifner. … Both Lipszky and Bogdanich are our fellow countrymen, and want their observations to contribute to the work of Seeberg Observatory and the *AGE*."

Zach's comment to Schedius' letter, published in the *AGE*:

> "Our distinguished fellow countryman László Lipszky (sic) is an officer, formerly in the 'Graben', presently in the 'Vécsey' Hussar Regiment. As regimental adjutant, he has been involved since 1784 in the performance of geographical measurements intended to obtain reliable data for the construction of an accurate

and up-to-date map of his country. During his service life he had an opportunity to acquire a detailed knowledge of the geography of Hungary. The depth of his Astronomical and Mathematical knowledge provides him with sufficient intellectual resources to bring a grandiose project, such as he is presently engaged on, to a successful conclusion …" {147}



A detail of *Mappa Generalis Hungariæ*.

Still on the subject of Lipszky, he complained that there are very few countries which are more difficult to chart than Hungary. One reason for this is the multiplicity of languages spoken in the area. Having to quote the name of localities in five different languages does not make the cartographer's work any easier.

He wrote about Bogdanich in the following manner :

"The Croatian-born Bogdanich was the pupil of Johannes Pasquich (Dalmatian by birth), Emeritus Professor of Pest University, a mathematician renowned for the excellence of his writings, who is now living in Leipzig in retirement. When Bruna replaced Pasquich at the observatory, he was in turn replaced by Bogdanich. Last summer I made the acquaintance of Pasquich in Leipzig and he told me that Bogdanich is an extraordinary genius, one of the best mathematicians in the Austrian Empire. We should feel fortunate to know that our important project has been placed in such capable hands." {148}

There is a short list in existence of the instruments carried by Bogdanich on his survey :

A horologium (made by Seifner)
A telescope (made by Dollond)
A quadrant with magnetic compass
A celestial sphere {149}

❋

Imre Daniel Bogdanich started from Pest on the 16th December 1798 and returned on the 19th January 1800. From its beginning Zach followed Bogdanich's progress with great interest.

Quotes from Zach's letter to Schedius (26th January 1799) :

> "Please apologise for me to von Lipszky. I shall be writing to him very soon, but until then please assure him of my high esteem, and explain to him the high opinion which I have formed of his industry, resourcefulness and versatility ..."
> "In my next parcel you will receive the map of Bohemia I have so often referred to. As an example, I shall also enclose a short tabulation of sideral time, which was compiled by the Duke of Saxon-Gotha himself. I shall send additional copies for Lipszky and Bogdanich ..." {150}

In his letter of 31st January 1799 Schedius notified his friend at Seeberg about the start of the exhibition :

> "On the 16th December of last year an astronomic/geodesic expedition started work under imperial warrant, with the intention of establishing the geographic co-ordinates of the most important settlements in Hungary. On this day Daniel Bogdanich, principal assistant of the Royal Observatory, set out, together with his instruments, towards Fiume, which is his first designated station. … It is a pity that he has neither a Hadley type sextant nor an Emery or Arnold type chronometer, but he has – as you have been already informed – a good quadrant, a good telescope and an excellent Seifner type pendulum-clock, which we have already subjected to tests in our observatory, lasting several months. … Alas, the cold weather causes Bogdanich to be in constant danger." {151}

In his letter, dated 17th February 1799 Schedius informed Zach of the bad news :

> "Bogdanich drove himself too hard and now he is down with fever. In January he spent three full nights out of doors without as much as a minute of sleep. He has already finished in Fiume, and was planning to leave for Carlopago and Zeng by the end of January. I haven't heard a word from him ever since."

From Zach's reply :

> "In the name of his friends and all astronomers, please entreat Bogdanich to take better care of his health." {152}

The observations sent by Bogdanich were published in Zach's Journal. Lalande also took notice of Bogdanich's work.

Finally, towards the middle of the second winter, the long awaited astronomical instruments, the Emery chronometer and the Hadley sextant, have been delivered to Bogdanich. The chronometer was bought by Count Ferenc Széchenyi, and the sextant was acquired by Baron József Podmaniczky with the help of Count Brühl.

Zach commented on Schedius' letter of 14th January 1801 :

> "... I have just received a letter Bogdanich sent from Pest, together with his observations of Mars taken on the 14th November 1800. I find that his determinations of the planet's nodal point are worthy of attention. … His magnificent letter engendered feelings in me which defy my powers of description. My country is fortunate to have such a talented young scientist. We have high hopes for his future not only because of his scientific prowess, but also for the pure divine fire illuminating his person. ..." {153}

Alas, these high hopes were never to reach fulfilment. Never fully recovered from his ailment acquired in his travels, one year later, on the 31st of January, Daniel Imre Bogdanich died at the age of 37 years.

Zach, and his guests Johannes Pasquich and Tobias Bürg were deeply touched by the untimely death of the talented young astronomer.

The story of Bogdanich ends here, but the connection between Zach and the Mappa Hungarica survived his death. Zach kept his eye on the activity surrounding the preparation of the map right until its publication, and in his new journal, the *Monatliche Correspondenz*[5] *(MC)*, he regularly published reports on its progress.

János Lipszky wrote in his pamphlet 'Karte von Ungarn' : "Your advice, full of essential insights into the ideas of geography, which was extremely helpful in bringing to life my map of Hungary, is still in the front of my mind. Please, accept my gratitude. This is why I feel, that after finishing the work, my first duty is to render a detailed and faithful account of my endeavours. Above all, I owe you a debt of gratitude for your co-operation and for your helpful advice, without which, I feel, my efforts would not have progressed beyond infancy." {154}

Zach was always happy, when he had a chance to be of service to his country, a land to which he was never allowed to return since the age of nineteen years. In addition to the news concerning Bogdanich, Schedius has seen to it that the AGE was given much valuable information about events in Hungary.

Johann Pasquich, the 'Mutual Friend' of Schedius and Zach

In his letters Schedius frequently mentions their 'mutual friend', Johann Pasquich, whose first meeting with Zach took place during the winter of 1798, in Leipzig. {155} They were of the same age. Pasquich, a former professor of mathematics at Pest University and author of numerous important books on the subject, was a scientist of considerable renown among the German astronomers. {156} He has left Pest under a cloud. It is probable that he was suspected by his fellow professors of being involved in the 'Martinovics conspiracy'. He retired from his job with a pension. At first he settled in Vienna, but after a while, fearing persecution, he escaped to Leipzig, where he led, according to Zach's description, the life of a 'private individual'. At their first meeting Zach was sufficiently impressed by Pasquich's personality and mathematical knowledge to extend an invitation for him to come and work at Seeberg. At this time Pasquich was undergoing a serious crisis of conscience. He wanted to get married, in spite of being an ordained priest of the Roman Catholic Church. In one of his letters to Schedius he has also expressed a desire to convert to the Lutheran Faith. {157} In December 1799 Zach wrote to Schedius informing him that Pasquich was working with him at Seeberg. {158}

Hungarians were also proud of Zach's achievements. During the Winter of 1799 he received a visit from two Hungarian noblemen, the Counts Teleki. They were studying in Göttingen, from where they organised an excursion to pay a visit to the astronomer of Seeberg on his hilltop home. {159}

Pasquich spent a year and a half at Seeberg. In April 1802 Zach wrote to Schedius :

> "Pasquich and Bürg have left us. The former will never find his inner peace on this earth. I have asked him where he was going. He said he did not know himself. These are secrets I shall never fathom. … The problem is locked in his nerves and in his temperament. Here, we brought down the moon for him, the Duchess did everything for him that was in her power, but all went for nothing. He could not stand the climate. Pest was too hot, Gotha was too cold for his liking. We all begged him to stay on. He was a charming man, a special favourite of the Duchess. She would do everything for him. She even accompanied him on his garden walks, but alas, to no avail. He was born restless." {160}

[5] From 1800 onward

It is difficult, if not impossible to establish the real nature of the relation that existed between the two scientist during the time spent on the Seeberg. Pasquich was a very talented mathematician and theoretical astronomer and Zach is sure to have derived great benefit from the eighteen months they spent together. For ten months Bürg – who was also fond of Pasquich – was also present. All three of them were enlightened men of culture, whose company was certain to be agreeable to the reigning couple. At the same time, it is not possible to rule out completely the possibility of a certain degree of jealousy on Zach's part. This undisclosed sentiment will acquire a possible significance in connection with 'Pasquich's affair' twenty years later. {161}

Zach's relations with Tobias Bürg remained unclouded till the end. "I have let him go on the understanding that he will return." {162} so wrote Zach in one of his letters to Oriani. They had very much in common. Bürg, a non-military scientist, belonged to the circle of van Swieten, who, in common with Zach, had many enemies at the Imperial court. Bürg, in addition to being an outstanding observer, was also well versed in the mathematical aspects of celestial mechanics. He had spent several years working on revising the lunar tables of Tobias Mayer in order to produce a new, more reliable tabulation.

In 1798 the Bureau de Longitudes, which was founded three years before, invited competitive essays on the subject 'Aus einer grossen Anzahl der besten, zuverlässigsten alten und neuen Beobachtungen wenigstens 500 an der Zahl, die Epochen der mittleren Länge des Apogeums und des aussteigenden Knotens der Mondbahn'. Members of the 'awards committee' were : LaGrange, Laplace, Delambre, Legendre and Méchain. The prize, one kg. of gold, was provided by Napoleon. There were two winners, Johann Tobias Bürg and Alexis Bouvard. Bürg, being afraid of the displeasure of the Austrian Imperial Court, would not take a chance on going to Paris in person. This prompted Napoleon to send Brühl a message, informing him that the prize would be doubled if he were to receive it in person. This reminded Zach of the words of Voltaire :

"Être Supréme, j'admiré la Sagesse profonde
Mais à quels plats Tyrans a tu livré le Monde"
(Supreme being I admire your profound Wisdom
but what dull tyrans have you given the world)

❋

Returning to the subject of Pasquich, it should be told, that in the end he returned to Buda, where he even managed to acquire a benefactor at the court of Joseph, the regent. This can be deduced from the fact, that he produced a book popularising astronomy, which he dedicated to the ladies of the regent's court. Thirteen years later, it was from money granted by the regent, but under Pasquich's scientific guidance, that an Observatory, modelled on the Seeberg establishment, was built on top of St. Gellért's Hill, on the Buda side of the Danube.

Franz Xaver von Zach and Carl Friedrich Gauss {164}

In September 1799 Zach was contacted by a new correspondent. The young Carl Friedrich Gauss informed him of his intention to learn about the secrets of the sky in the Seeberg establishment, as he was advised to do so by their mutual friend, Lequoc, in whose opinion Seeberg was just the place for the acquisition of such knowledge. Zach, although he did so very politely, turned him down. From this time they established a close relation through correspondence, but four years had to pass before Gauss had his wish and met Zach in person.

In his first reply Zach wrote in September 1799 :

> "I must apologise to you for not answering your two letters, and not thanking you for you kind words that gave me so much pleasure. Only if you were acquainted with my present condition … the precarious state of my health. Now I shall try to answer all your questions. At the present time your plan to visit me is not feasible. I can't have anybody working with me at the observatory. For years I had a number of astronomers staying as my guest at my own expense, and now I have to stop using my house as a public hostelry. Nieuwland, Calkoen, Bohnenberger, Camerer, Burckhard and many others stayed at my house »gratis«. My present state of health and my condition does not allow me to extend hospitality to anyone. … The Duke does not like to have his precious instruments handled by beginners. This is not a university observatory open to the general public." {165}

Later, working on the orbital calculations of minor planets Gauss and Zach established a close and intimate working relationship, but Gauss could never forget the initial rejection.

Foundation of an Astronomical Society in Lilienthal

Encouraged by the success of the astronomers' convention, Zach and his German astronomer friends endeavoured the foundation a new astronomical society. Schröter's Lilienthal observatory was chosen as the venue. The initial meting was held on the 13th – 20th September 1800. The founder members were : Ferdinand Adolf von Ende, Johann Gildemeister, Dr. Heinrich Wilhelm Mathias Olbers, Karl Ludwig Harding, Franz Xaver von Zach and Johann Hieronymus Schröter.

The founders intended the Society to be international in character. The following astronomers were accepted as members by acclamation : Johann Elert Bode (Berlin), Joseph Tobias Bürg (Vienna), Thomas Bugge (Copenhagen), J. C. Burckhardt (Paris), Sir William Herschel (Slough/Windsor), Prof. Hurth (Frankfurt am Oder), Georg Simon Klügel (Halle), Dr. Koch (Danzig), Nevil Maskelyne (Greenwich), Prof. Melanderhjelm (Stockholm), Pierre Méchain (Paris), Barnaba Oriani (Milan), Giuseppe Piazzi (Palermo), Schubert (Saint Petersburg), Prof. Sniadecki (Krakow), Charles Thulis (Marseille), Johann Friedrich Wurm (Blaubeuren), Ferdinand von Ende (Celle), Johann Gildemeister (Bremen), Karl Ludwig Harding (Lilienthal) Prof. Svanberg (Uppsala), Wilhelm Olbers (Bremen), Johann Hieronymus Schröter (Lilienthal), Franz Xaver von Zach (Gotha). {166}

The names listed above can all be found as contributors in the *AGE*, or its successor since 1st January 1800, the *Monatliche Correspondenz.*

The newly founded astronomical society set the following tasks for itself :

- ⇒ A complete survey of the sky with the aim of finding the hitherto undiscovered planet between the orbits of Mars and Jupiter.
- ⇒ Discovery of comets visible only through telescopes.
- ⇒ Determining the parallax of fixed stars.
- ⇒ Searching for variable stars.
- ⇒ Using the *Monatliche Correspondenz* to acquaint astronomers with their colleagues' work and establishing co-operation in the interest of creating an improved celestial map. {167}

This program illustrates the quality of the well thought-out and forward-looking programme prepared by the six astronomers who met in Lilienthal.

It was just an ironic coincidence, that the small planet they were searching for so diligently was finally discovered by chance in Palermo, on the 1st January, by Piazzi. After its discovery, this small planet remained invisible for nearly a year. Many of the French astronomers doubted its existence, but Zach, who knew the impeccable observational

technique of Piazzi, remained a firm believer. In the end, he was proven lucky, as finally he ended up with getting the credit for the discovery. {168}

Zach informed Oriani on 7th July 1801 that, together with Bürg, he was "chasing a small planet". In the same letter he also mentioned that he had visited Arnold himself, with whom he placed an order for the pendulum for Oriani. He also commented on Arnold's fondness of money, but did not think it would have any influence on the punctual delivery of the instrument. Zach also gave Arnold Oriani's address in Milan. He also expressed his intention of spending a few days in Göttingen, where the library of the university stayed in permanent contact with England. With the help of Heyne and Blumenbach, the librarians whom Zach counted among his close friends, he could peruse the English scientific literature, which was not easily accessible on the war-torn continent. {169}

Between the 4th and 16th of August Zach had a very welcome visitor, A. David from Prague. They spent two pleasant weeks together. The Ducal couple also derived great pleasure from passing the time with the Canon from Prague. {170}

In the autumn Zach and Bürg continued their 'chase of a small planet'.

In his letter of the 10th November 1801, Zach thanked Gauss for the orbital calculations he performed. He also sent Gauss his own calculations, which fitted Piazzi's observations very well. In his letter Zach also informed Gauss, that in his opinion these were the calculations providing the best fit for Piazzi's observed positions. He sent Gauss Piazzi's original observations, and asked him to try to compute some orbital segments of elliptical shape, because it was his hope that he could publish those in the December number of the *MC*. Zach was of the opinion that Piazzi may have used Delambre's solar tables, which could account for the inaccuracy of the data. To improve the accuracy he sent Gauss his own solar tables, so that he could try to use them in his calculation of the planet's orbit. As a curiosity, Zach informed Gauss that Klügel thought the new planet was a meteor. {171}

On the same day Zach also posted a letter to Oriani, sending him Gauss' calculations. Oriani was also informed of two minor problems that arose regarding the pendulum Zach was in the process of acquiring for him. The instrument was dispatched to Hamburg but the bill was sent to Zach for payment.

Zach Succeeds in Re-Identifying Ceres

On the 18th of December 1801 Zach sent Oriani a detailed account of the fifteen days he spent trying to prove the existence of the new planet. He wrote :

> "Since the 7th of December I have found three stars which were not listed in Bode's catalogue. The one I saw on the 7th December I could not locate anywhere else."

On the 22 December 1801 he sent Gauss the observations of Méchain and Delambre, and declared his intention of finding Ceres. At this time he did not realise that his purpose had already been accomplished. {172}

It was with great pleasure that Zach informed Oriani on the 14th of January 1801, that he was convinced that it was really Ceres that he found on the 7th of December. The same planet was also found – independently from Zach – by Olbers a few days later. Zach also wrote that, excepting him and Olbers, nobody has yet found Ceres, which he first described as of the ninth magnitude nine, later changing to the seventh magnitude. He was also pleased to report that he had already had confirmation from England and France, and since his 're-discovery', nobody had any doubts about the existence of Ceres

any more. He also remarked on the apparent paradox that his telescope was of too high magnification, and the actual 're-discovery' happened using the 'comet-finder'. {173}

The flow of correspondence between Zach and Gauss grew with leaps and bounds. Zach managed to procure a copy of Laplace's *Celestial Mechanics*, which was published in Paris, for Gauss. The work associated with the minor planet, the observations and calculations were reported in full on the pages of the *MC*. An ever increasing number of readers came to recognise the importance of the Journal for the co-ordination of the astronomers' work.

Gauss' calculations secured him a central position among the journal's correspondents. Even so, in his letters Zach used every argument at his disposal to discourage him from becoming a full time astronomer, although their face to face meeting was still hidden in the future.

> "My experience, which I gained working with many amateurs and experiencing the hardships and frustrations one has to contend with, taught me that the astronomer's lot is not a happy one. The eye-condition you were referring to is causing the fact You could no read instruments sufficiently sharply during nocturnal light conditions. A very extensive optical parallax is needed. Consider my case : I am suffering from a dangerous eye-condition, which I attribute solely to the use of the 'mirror-sextant' and to carrying out solar observations. Please read the May 1801 number of my journal, from which you can learn that Herschel and Schröter have 'Hawk-eyes'. You are an outstanding mathematician, well versed in analysis. For you to engage in astronomy would be a waste of time. If somebody is very good at doing something that only very few people can do at all, then he should not busy himself doing what many others can do. It would be just as sinful as it would be for me to renounce my thirty years of experience in order to become a clerical worker. This is my principle. (…)
> Please, do not misunderstand me. I do not mean to dissuade you from observational work altogether ... This summer I shall dispatch to you a sextant, an artificial horizon, a chronometer and a telescope... For you to master practical astronomy would cost an excessive amount of time. (…)
> The news, that your Duke has seen fit to reward your diligence, has filled me with great joy. The Duke thereby did a good service not only to you, but to the cause of Scientific progress also." {174}

Herschel and Maskelyne observed Ceres simultaneously. Joseph Banks also wrote from London, saying that he, too, had observed the new planet.

The Discovery of New 'Minor Planets'

Things started to happen at an ever increasing speed. In Bremen, a few months after the discovery of Ceres, on the 28th March 1802, several new 'minor planets' were found by Olbers. He announced his discovery on the 10th March 1802. Between the 4th and 7th of April 1802 Zach was already busy with observing Pallas. He immediately forwarded his results to Gauss in Braunschweig and Oriani in Milan.

Zach also informed Schedius of the joyful tidings with the following words :

> "Again, a new planet. If only I could fly to Buda and to observe Ceres and Pallas there! You can see that I still have a true Hungarian heart beating in my bosom." {175}

At this time the calculation of orbital perturbations of the planets' orbits began to assume an ever increasing importance. Many astronomers took an interest in this problem. In addition to Gauss, Klügel and Wurm in Germany, Burckhardt in Paris,

Oriani in Milan, Schubert in St. Petersburg have all made their contribution. The *MC* was full of these calculations, all following different mathematical principles.

According to Olbers the 'asteroids' (so named by Herschel) followed elliptical orbits and were originally the fragments of a fractured planet. In his letter dated on the 4th June 1802 Zach explained his theory, according to which there had to be a third asteroid with an orbit very close to the other two's. In the same letter he expressed the idea that astronomers might find the minor planets useful for improving the accuracy of their determination of solar parallax. This idea was reintroduced by Galle almost three quarter of a century later.

Zach's Opinion of the French Astronomers

With the passing of time, Zach's opinion of the French astronomers became more and more jaundiced. He habitually referred to Laplace as 'the great senator'. In one of his letters he explained that the French were endowed with great spiritual qualities and excellent talent, but their hearts left much to be desired. They still felt that the science of astronomy could be led and directed from Paris, when in fact the majority of significant advances were now being made in Italy and in the German states. {176}

Contacts in England

In the May of 1802 Zach had to turn again to Sir Joseph Banks. He needed help in obtaining some English publications he could not put his hands on in Göttingen. He also reminded Banks of the deplorable fact that although the Duke of Saxon-Gotha was a Fellow of the Royal Society, he had not had his copy of the society's *Transactions* for several years. {177}

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Meanwhile, after various vicissitudes, the Arnold pendulum has finally arrived in Milan. The funds necessary to pay for it could only be transferred to Padua with the active help of General Anton Zach.

Astronomical Methods for Determining Geographical Position. The Subject Revitalised

Chasing minor planets could not divert the astronomers' interest for very long from their other important area of activity, that is the determination of geographical longitudes and latitudes in the interest of making more accurate and reliable maps. In his letter of the 15th January 1803 Zach informed Gauss about the visit his brother paid him a short while ago by Imperial command, concerning the geographical survey of Austria. In the 1803 issues of the *MC* Zach published the results of his brother Anton's survey of Italy. {178}

Napoleon had commissioned Oriani to carry out a survey of the Northern parts of Italy. {179}

The king of Prussia entrusted the task of establishing a network of triangulation points in Thüringia to Franz Xaver von Zach. The first intimation that by now Zach was also desirous of meeting the young Gauss in person can be found in his letter, already referred to, dated the 15th of January.

> "I should like to invite you to visit me, but alas, my house is full as an egg. I have just been visited by a Duke from Hessen. By the Spring, I shall have room in my house at the foot of the hill, in which Burckhardt, Bohnenberger and Camerer have also stayed. Should you visit Gotha next year, you would be welcome to

stay there. There is a footpath leading up to the observatory I am very much looking forward to make your personal acquaintance." {180}

Like Ceres, Pallas was also lost to sight for several months. It was rediscovered by Harding in Lilienthal, on the 19th February 1803. The extremely accurate ephemerides of Gauss were a contributory factor in the discovery. Pallas was found at the place where its presence was predicted. He wrote to Banks on the 1st March 1803, stating that in the future there could be no impediment to finding Pallas again. {181}

Surveying in Prussia

In his letter written to Banks on the 1st of March 1803, Zach informed the President of the Royal Society, that the King of Prussia commissioned him to establish a network of triangulation points and

> "… he intends to reward me with a gold ring with diamonds and a Royal seal of distinction." {182}

During the same day he also informed Oriani of his newly acquired responsibilities :

> "… I must inform you, that I have been approached by the King of Prussia about a commission to carry out a geographical survey of Thüringia (as you know, the King's domain lies right next to ours). In my reply I said I would accept, but only if he could guarantee that I would be doing my work under the same conditions as Delambre, Méchain, Roy and Oriani did theirs in France, England and Italy. It appears that the King accepted my conditions. He promised me a diamond studded medal, similar to the one given to soldiers. This medal is supposed to convey a general officer's status on the wearer. I keep reminding myself to start the work in time. At first I have to mark a base-point at the foot of the Seeberg, not further than ten thousand fathoms away. My marking stick is very similar to yours, very handy and accurate. For night observation I have two repeating circles. In addition, I also have Indian fire, a parabolic mirror, five chronometers, Arnold, Emery and Berthoud types. Using these chronometers, light signals and stellar occultation, I have already determined numerous longitudes and marked out the culminations. I have also completed some azimuth determinations of the Pole Star, the Sun, the meridians of Mira, using a special combination of instruments, augmented with a six foot passage telescope. I have developed a special procedure, which produced very interesting results … this was necessary due to the well attested fact that the shape of our earth is rather irregular. It is not like an orange, as it is usually shown, it can be better compared to a potato. First you have a bit of concavity, then a convex surface, followed by a sudden rise and then a flat area, and whatever. The whole thing has to be looked at as a unity. This is why it has to be surveyed from all sides, like a building, where it is necessary to specify the overall plan, the dimensions, latitudes and longitudes. It is not possible to know what lies under the surface. Apropos! I must mention here the survey my elder brother did in Venice, the description of which you will find in my Journal. You knew, did you not, that he came to stay with me at Seeberg, spending some time helping me in my astronomical work as my apprentice. He has shown me his work, and I found it good. At first I was prejudiced against him, but now, I can recommend his work without reservations. I am sure you will find his work better than the surveys of Beccaria and Boscovich.
>
> My brother started his work at the Padua Observatory. … I smoothed his ruffled feathers by telling him that Cagnoli was neither a rock of reliability you may

safely depend on, nor was he infallible in the determination of his observatory's location. In my opinion Cagnoli is not too well versed in the art of observation." {183}

On the 29th of July 1803 he wrote to Gauss in the following vein :

"I do not know whether you have returned from Lilienthal and Bremen. I am sending this letter by Mr. O. A. R. von Ende, who is at present staying in Braunschweig. I am using his good offices to help me to persuade you to join me in my survey. I have asked Ende to deliver a chronometer into your hand as a present from me. We shall spend fourteen days on the top of the Brocken. We plan to leave on the 7th or 8th of August and intend to stay until the 25th. What a pleasure it would be finally to make your acquaintance." {184}

On the 23rd of August the following report was dispatched from the Brocken to Milan, for Oriani :

"Your letter of the 3rd of August found me on the summit of the Brocken, which is the highest peak in Northern Germany, rising 3300 feet above sea level. Since the 8th of August Bürg of Vienna is also with me. The printed circular has reached every astronomer living within sight of these mountains. I have solicited their advice and help. I have established a miniature observatory on the Brocken's summit by erecting a two foot passage telescope, and a repeating circle for the night. In addition there are other instruments … From the house I dwell in, I fire a signal-shot every day, which can be observed from the distance of 20 German miles. I have German astronomers and amateurs stationed at several points with a task of keeping the sky under constant observation. A few Prussian army officers have also attached themselves to the project, who are determined to take part with me in fulfilling the task with a 'split second' accuracy. I have erected a Hadley type sextant augmented with an artificial horizon, a chronometer and an achromatic telescope. These people are watching my signal-lights day and night, at ten minute intervals. I make my men to fire a pound charge of gunpowder, this produces a flash, which I observe from the distance of twenty German miles through my telescope of twenty-fold magnification. At night the work is simpler. My light signals, timed at nine and ten o'clock from Gotha are as clearly visible as lightning. Gotha is fourteen miles away from the Brocken … (…)
… We are planning to stay here until the 28th of August. Gauss is here, he followed me from Braunschweig. Afterwards he will come with me to Seeberg. Although I do not, as yet, know him well enough, I can safely say that as a mathematician he is outstanding, as an astronomer less so, but this will be corrected during his stay with me at Seeberg. We also have here a thirty years old doctorand from Kassel. I have already met him in his home-town. He is very good at applying mathematical methods in astronomy. He gave me one of his papers for publication in my Journal. …" {185}

The Glorious Time at Seeberg Comes to an End

Alas, the fruitful years at Seeberg abruptly came to an end after the death of Ernest II, in April 1804. At first Zach was confident that the new ruler, August, the first-born son of the Ducal couple, who was Zach's friend from his adolescence, would ensure the continuation of work at the observatory. He was mistaken.

On the 13th September 1804 he could still write to Oriani :

> "The death of the Duke did not bring many changes in the state of astronomy. I am still at the court, acting as a minister of the Duchess, in charge of promotion of science. I am going to carry on with the Journal, and I am not going to interrupt the longitudinal surveys either. …"

This time Zach, who was usually a very astute judge of his position, made a big mistake and proved himself to be extremely naive. For years, the courtiers looked on him as an alien and costly parasite, waiting patiently for a chance to settle accounts. Also, his close relation with the Duchess must have been an open secret.

Strangely enough, the development of the intimate friendship between the Duchess and Zach did not spoil his relationship with the Duke. Of course the Duke's 'sentimental adventures' were also an open secret, known to everybody. The only thing that bothered Zach was the Duke's interest in Astrology, a pseudo-science, for the practitioners of which he maintained a feeling of profound contempt. He agreed with Kästner, who said that astronomers should demolish astrology, otherwise they will look as priests holding up the Devil by the tail. {186}

The Last Observations Made at Seeberg. Harding Discovers Juno

Franz Xaver von Zach made his last observations at Seeberg in September 1804. On the 15th of September he sent the following news to Oriani :

> "My news concerns nothing less than the discovery of a new planet. The details you will find in the next issue of my Journal (August 1804), which will also contain Gauss' calculations of the orbits of Ceres and Pallas … Mr. Harding was busy in Lilienthal fitting celestial circles of great accuracy to the Zodiac, when the new planet happened to come to his notice."

The new ruler designated Eisenberg as the Duchess' new residence. Zach had hopes of being able to continue their work in a new observatory to be erected. They have spent the autumn of 1804/05 in the South of France. During the second half of 1805 they returned to Gotha for a short while. In 1806 they moved to Eisenberg.

Due to the tense pre-war situation followed by the fighting itself, the survey of Thüringia was eventually terminated.

Official Recognition for Zach during His Time at Seeberg

Zach had numerous tokens of official recognition during his time at Seeberg. He was member of the Academies of Prague, Leipzig, Brussels, Göttingen, St. Petersburg, Paris, and Lyons. In April 1804, a few weeks before the death of the Duke of Gotha, he was made a Fellow of the Royal Society (FRS).

In 1801, Emperor Franz I. elevated him and his brother Anton, to the rank of Baronet. When he was congratulated by Schedius, Zach disclaimed the honour by saying that the baronetcy was merited by his brother only, and he got into "whole thing" only "as a dog into the sausage-shop". {187} On the other hand, it can be read in the official Imperial edict, published in the *Imperial Gazette*, that Franz Xaver von Zach was elevated to the baronetcy in recognition of his meritorious achievements in general and military science. {188} In his letter, written as a reply to Schedius' congratulations, the following sad words can be read :

> "My country does not want to acknowledge my achievements. I have received 'Letters of Commendation' from England, Spain, France, Switzerland, Denmark, Italy, Russia, even from America, only my country did not see fit to extend me any signs of recognition …" {189}

For this, he had to wait for another thirty years. When he was made a member of the Hungarian Academy in March 1832, he was in Paris, lying on his death-bed, so we can not even be certain that the notification of this honour had reached him in time for him to read it. {190}

Coat of arms of Anton and Franz Xaver von Zach of baronage.

PART 4
FRANZ XAVER VON ZACH AS MAJOR-DOMO AT THE COURT OF DUCHESS CHARLOTTE AMALIE

On Freud's Eightieth Birthday

They say the love leads
the living toward death
Yet we crave pleasure
As we crave bread

Attila József
(Translated by John Bátki)

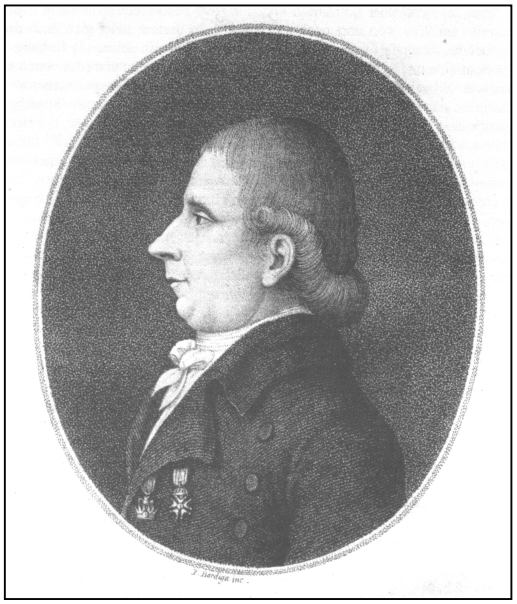
1. Saying 'Good-bye' to the 'Seeberg Years'

The years 1803-1804 were years of transient tranquillity in Europe.

On the other hand, the future appeared to be unpredictable. The same uncertainty of outlook was characteristic of Zach's plans concerning his personal future. At first, he felt optimistic, confidence in his own strength and in his friends serving as the basis for his optimism. His principal purpose was to preserve the continuity of his own private and professional life and carry on as before. Only the partial collapse of the Seeberg Observatory made him realise that, for him, something has come irrevocably to an end.

❋

Zach's doings and whereabouts between 1804 and 1809 are amply documented in the volumes of the *Monatliche Correspondenz* and in his correspondence with Carl Friedrich Gauss and Barnaba Oriani. Zach's correspondence with these two friends is divergent in character. Oriani, similarly to Zach himself, was an admirer of Napoleon, at least during the Emperor's early career. At the same time, Zach also realised, that this sympathy may not be shared (for reasons obvious) by his German colleague. On the other hand, when writing to the Protestant Gauss, he did not have to hide under a bushel his strong hostility towards the Jesuits, while he had to exercise a considerable amount of tact, when discussing this subject with Oriani.



Barnaba Oriani

The subject matter of his letters to Gauss is generally restricted to scientific and professional matters, while in his correspondence with his Oriani – his close personal friend – he did not feel restrained from expressing the warm humanity of his feelings and from occasionally giving went to his feelings of anger and hurt.

Duchess Charlotte Amalie

A document of particular interest to those interested in the fortunes of Zach is the travelling diary[6] of the Princess Charlotte Amalie. It describes the authoress' everyday life during six months, from 1897 June to December. As it was not meant for publication, it discloses many interesting details of the extraordinary relationship of Zach and the Duchess. {191}

Continuing with Astronomy in the Months Following the Duke's Death

During the summer and the early autumn Zach could still carry on with his observations and with his work on the measurement of the geographical position, which he begun in Thuringia. He also regarded it as one of his most important tasks – just as in the previous years – the collection and publication of new experimental and theoretical researches on the subject of 'new planets'. In his letter, written to Gauss on the 15th September 1804, he could still talk of his future plans in an optimistic vein :

"Our mutual friend, the excellent Dr. Olbers, has just sent me some information on the discovery of a new planet, the third in a row. The discoverer is Harding. I have finished with the work of triangulation and returned to Seeberg in a hurry. I was lucky enough to be still in time to observe the new planet. It is very probable that it is another brother of Ceres and Pallas. I am sending you, the spiritual father, my first observations of the newborn baby. (…)
Because of my recent absence, this time I could not observe the other two brothers. I am sending you the observations I made so far of Pallas and Ceres. I shall be sending some new observations in the near future. I am very sad that I was unable to observe the opposition of Pallas. The weather was always bad. My only hope is that I shall be able to see Ceres in 'contre jour' light. (…)
Our mutual friend, Olbers, gave me some joyful tidings by informing me that he was in your company at the summit of the so called Georg Platz, when you both saw the Brocken, lit up in a plethora of lights. This is of special interest to me, as this observation point is even further to the West than Hammel, from which point it is possible to see Hanover and Minden at the same time. I have made great advances after my Signal expedition. I intend to repeat it next year on the Brocken, determining the location of Oberläuwitz and Keulenberg at the same time. I intend to signal with gunfire, to the method proposed by Canon David for the Bohemian Mountains and the Prussian General Lindner for the »Schleissischen Riesenbürge«. I hope I can count on your help with these experiments. If you accept this offer made in friendship, I shall send you a chronometer, a sextant, a telescope etc. You will be lavishly equipped. I am not

[6] Published in 2003

unduly bothered by the presence of Franco-Hanoverian Army officers. The leader of the Epailly Brigade is going to be my good friend, Ende. These gentlemen are not adequately equipped, the most they will have may be a chronometer. Methinks I shall set off in the early spring and try my luck with gunpowder. We are usually having wet and rainy summers, and the same can be said about the autumns. If you can make time to be my partner, I shall send you my full plan. For me the Western point is the best defined, and I should like you to take on the determination of the Rehberg. If I understood his letter correctly, Dr. Olbers also intends to take part in the expedition. As far as the Eastern point is concerned, I should like to do it myself, using the services of a Prussian officer for sending signals to me from the summit of the Brocken." {192}

His next letter to Gauss was written two weeks later and it was still sent from Seeberg.

"… What will come to light about the three newly discovered planets is anybody's guess. Olbers – very cleverly – predicted the point of their coming together, using the assumption of their orbits being elliptical. I am eagerly looking forward to read about its confirmation in the book *Elemente des Hardingischen Planetes*. Although I have not done many observations myself since my last paper was published, I want to publish those I receive in as short a time as possible. To a wonderfully talented genius of computation, such as you are, my highly esteemed friend, one single observation may mean more than a dozen of them can mean to others. These should be enough for you to perform the necessary orbital calculations. If I receive any more data, I shall not be tardy with forwarding them to you. I have just recently returned home after a long series of measurements in Prussia, and now I am busy with processing the data obtained from them. I only have a few hours for night observations. However, I realise that his task is of such importance, that I must leave no stone unturned in order to supply you with reliable data.

Therefore, I hope you will forgive me for making this letter as short as possible. You are well acquainted with my Prussian observations, which kept us occupied from morning to night. This encourages me to hope that you will not take offence and will be still prepared to send to the *MC* your exquisitely accurate observations and calculations. In the light of our data acquired until now, it appears that there is no complete planet can be found between Jupiter and Mars. What used to exist was consequently broken up with shards flying away following elliptical, parabolic or hyperbolic paths, or left the solar system altogether. This is why the planet between Mars and Jupiter has no definable shape. Until now, we have found three of the broken pieces, but with a bit of luck, we may find some more. For the present, before I completely exhaust you with my cosmological fancies, I am hereby sending you my observations."

In a post-script to the letter, he told Gauss about the disappointing experience he had in Braunschweig. Gauss requested Zach to draw up plans for an observatory to be built for him. For reasons unexplained, his reception by the Duke of Braunschweig did not come off well.

"As far as the observatory in Braunschweig is concerned, I do not anticipate any further discussions between the Duke and myself.

Pro primo: The Duke did not offer me a firm commission.

Pro secundo: I was informed by reliable sources, that the Duke has found my visit embarrassing. I have knowledge of many more things, to elaborate which

would serve no purpose. I am, for your Duke, a 'persona non grata', just as he is for me, and my visit to Braunschweig was based on a misunderstanding. I must inform you, 'sub rosa', that it is totally impossible for me to be involved, in any manner whatsoever, in the building or design of your observatory. To do so would be embarrassing for me, but even more so for you. You know my principles, perhaps better than myself. I never want to thwart or alter other people's intentions.

My dear friend, I think I owed this 'sinful' confession to you, after having it bottled up for the last ten months, until I was prompted to 'clear the air' by your mentioning in your letter. I count you among my friends, and I felt I had to clarify the situation. Perhaps this letter surprises you, just as I was when I found myself an uninvited guest in Braunschweig. This sort of thing could happen to me only once, never a second time." {193}

This visit to Braunschweig took place during the December of the previous year, while Ernst II was still alive. At this time, Zach was not yet used to be treated in such a cavalier manner. After all, it was only a few months ago that he received a diamond-studded medal from the King of Prussia.

Astronomical Observations in the South of France during the Winter of 1804 – 1805 {194}

During the autumn of 1804 the Princess – as so many times during the previous years – was suffering from a severe attack of rheumatic pains, for which the only effective cure appeared to be the spending the winter in the South of France, where several times she experienced an alleviation of her symptoms. It was with a heavy heart, that Zach left Eisenberg, where was trying to establish an observatory comparable to the one at Seeberg.

He wanted to make use of the time spent with the Duchess to do some scientific observations. He was not yet used to what later on became his natural way of life, that is, to dedicate all his time and all his person to the service of his Princess. His plans included the establishment of the geographical co-ordinates (longitude and latitude) of several locations using methods based on Astronomical observations.

The Easternmost point, which the English General Roy quoted in his book 'Account of trigonometrical operations, Sect. 6 XVI', was the city of Strasbourg. In his calculations, the general took into account the following locations :

⇒ Strasbourg
⇒ St. Victoire, near Aix
⇒ St. Clair, near Cette
⇒ The Isle of Planier, near Marseille {195}

Zach spent the November of the previous year in Strasbourg, where, due to an unusually rainy season, he waited for the appearance of the sun in vain. Here he met an old friend, Brigadier Henry, whom he liked very much, and who had previously spent some time as Zach's guest at Seeberg. He was well known to the readers of the *Monatliche Correspondenz* by his articles about the work of the land-survey of Bavaria. For the winter of 1804 Henry set himself the task of determining the longitude and latitude of the city of Strasbourg. Consequently, he was very pleased to learn that Zach was working in the same area, so he could use Zach's data as a basis of comparison for the results of his own.

Henry accompanied Zach to Colmar and placed all his instruments at his disposal. From here, Zach travelled on to Besancon, while Henry returned to Strasbourg. {196} Zach and his companions travelled to France through Switzerland. Stopping over in Basle they

met First Lieutenant Weiss, who informed them of the success Henry had with the accurate determination of Strasbourg's co-ordinates.

Cassiny de Thury, former director of the Paris Observatory, in his book, 'La Méridienne de'l Observatoire Royal de Paris, verifée dans toute l'etendue du Royaume par nouvelles observations', gave an account of the determination of latitude and longitude, made by the Abbe de la Caille, of the Mount Victoire (near Marseilles) in 1739. Both end-points of his survey were fixed at a hermitage, built on top of a prominent hill. One of them, the 'Ermitage Notre Dame des Anges', is hardly three miles from Aix, the other, was erected on St. Clair's Peak near Cette. This was one of the Mediterranean seaports in Languedoc, six miles South-West of Montpelier. {197}

Zach knew that his stay in France would extend to several months, so he decided to replicate the measurements of Cassiny de Thury and de la Caille, using these self-same mountains as his terminal points. He wanted to rely on the help of his three friends and fellow astronomers, Thulis, the current director of the Marseilles Observatory and his two co-workers, St. Jacques Sylvabelle and Bernard. Zach knew them for more than twenty years and he was pleased with their having survived the vicissitudes of the Revolution.

They arrived in Aix on the 1st of December 1804. After arrival, Zach immediately made enquiries about the possibility of climbing Mount St. Victoire. He agreed with his friends regarding an excursion, although Bernard lived thirty miles from the city. {198}

They arrived in Marseille on the 3rd of December. Thanks to the hospitality of Thulis, they have spent the night at the observatory. Zach entrusted his Duchess to the care of Thulis, for the time his measurements kept him from Marseille. On his return to Aix on the 15th December, he made the acquaintance of Mr. Alary, a young and enthusiastic Spaniard, who could also speak the local language, Provençal. He was also helpful to Zach in acquiring the permits necessary to work on the hilltops during the experiments.

Between the 14th and the 17th Zach carried out a great number (thirty or forty) of solar altitude determinations from the balcony of his hotel room. During the night of the 14th of December, he observed the Pleiades from the same position. This observation was replicated by Thulis in Marseille and by Flaugergues in Vivier. {199}

Excursion to St. Victoire {200}

Zach started his ascent of this mountain on the 18th of December. His party included M. Alary, a peasant (from whom the horse and the mules were hired), his servant, in charge of leading the pack-mules loaded with their instruments, Zach's servant and a runner, who joined the party at the foot of the mountain. Thus, the climbing party was made up of six persons, all told. They set forth at 3 a.m. in moonlight. By 7 a.m., they reached Cabassol, a small town at the foot of the hill. They climbed as high as the ugly little peasant-house of Mme. Prevote. This woman was a genuine country person, speaking only Provençal. During the revolution, the paintings from the monastery of St. Victoire were deposited with her, for 'safekeeping'.

The expedition left the horses in Cabassol and took along only the pack-mules carrying the instruments. They aimed straight for the peak, afoot, on paths untrodden. There were no trees or bushes to break the monotony. There was nothing to see but patches of lavender, thyme and other, reputedly medicinal herbs. The mountain wore a cold and frigid aspect.

They reached the summit at half past nine. There they found the chapel, with a crude inscription: 'la liberté ou la mort; vivre libre ou mourir'. Nearby there was a fair sized building, in ruins. It was disfigured by its broken windows and doors and collapsed stairwells. In a cave under a terrace, they found an old hermitage, with a scary chasm

underneath. The terrace provided a spectacular view towards the South, the Southwest and the Southeast. Zach was looking for a spot from where he could send signals, by exploding charges of gunpowder, which could be seen both from the Observatory in Marseille and from Mt. St. Victoire. On their way down, the moon was already up when they reached Cabassol, where they had to spend the night, under rather revolting circumstances, in a peasant's house.

An agreement was reached with a leader of the expedition, according to which, during the next year Zach would install a stove in one of the rooms of the hermitage, so that he could work there.

Next day, at 2^{30} p.m. Zach and his friends made a measurement of the Sun's elevation. Following this, they returned to Aix via Cabassol, and by 10 p.m. they had reached their destination.

On his arrival to Marseille, Zach immediately started the preparation for his gunpowder signals, to be set off from Mount de l'Etoile on the 7th February. Three of his friends from Marseille, M. Fantanieu, Doran and Rougier, undertook the task of setting off the charges on the mountain-peak at the appointed time.

Early in February, a letter arrived from M. Alary, informing Zach, that Mount Victoire was under a thick cover of snow and the pathway from Cabassol to the hermitage was impassable. This did not prevent Zach from travelling to Aix on the 5th of February, and from equipping his friends, who were willing to attempt, with a good watch and detailed advice and instructions. Thulis remained in his Observatory in Marseilles. The man, whose services Zach engaged in Cabassol, then arrived and confirmed the news about the impassability of the road. He, himself, had had some difficulty getting through with his donkey.

During the morning of the 7th of February, Zach made a few measurements of the Sun's altitude, while at midday, he determined the hotel's latitude as 43° 31′ 36″. Around 3 p.m. he watched his friends at the peak of Mt. Etoile, through his telescope, as they were setting off the agreed twelve explosions of gunpowder.

During the evening, he observed the Pleiades from his balcony. Simultaneously, these objects were also observed by Thulis at Marseilles and by Flaguerges in Vivier.

One point of the Aix-based triangulation measurements was set at the Church of St. John, which miraculously survived the events of the Revolution. In Zach's opinion most of the destruction of the churches was caused not by anti-religious sentiment or vandalism, but by human greed.

About the town of Aix itself, Zach remarked, that although the local university was rightly famous for its legal and philosophical scholars, it contributed nothing noteworthy to Mathematics or the Natural Sciences. {201}

On the Island of Planier {202}

This little, rock-surrounded island is situated to the NW of Marseilles, about nine miles distant. It was rather dangerous to stay there, as this little fleck of land – whose only notable feature was a lighthouse, erected in the early 1700s – was often completely covered by the sea. Zach found this place eminently suitable for the making of observations that may be useful in the determination of geographical longitudes. With this in mind, during the night of the 11th – 12th of February, he carried out some observations of eclipse of δ Geminorum while it was obscured by the Moon. In this work, he was given a helping hand by Thulis, who provided the time signals from his observatory by explosions of gunpowder.

Zach approached the island on board a hired boat, packed with the necessary instruments and equipment. He also carried a bed and sufficient provisions, everything

he could conceivably need on this God-forsaken island. His companions included his friend from the Observatory of Marseille, Jean Louis Pons, famous for his discoveries of comets, accompanied by Philippe, his inseparable manservant. They started their sea-voyage at the first gunpowder signal, in clement weather, at 5^{30} a.m., on Saturday, the 10th of February. They made their landing four hours later.

The island (or rather the lighthouse) was inhabited by two ancient mariners, looking back upon and more than willing to talk about their long life and adventures on board the various ships in which they served. They took Zach to show him their 'Summer & Winter Palace', a windowless hut, whose only light-source was the open door. This vaulted room had to serve as kitchen, cellar, 'drawing room', bedroom and sitting room. There was also a second storey and a spiral staircase leading to it. The two old sailors usually spent their nights sleeping on it. The only light able to penetrate the darkness could do so only by filtering through the nooks and crannies of the decrepit old walls. The glass dome, where thirty-six lamps with hard wicks provided the illumination during the night, could be entered by an oily ladder. The lamps were cleaned regularly in every two hours. The two stalwart mariners were happy to share their meagre household goods and accommodation. They also tidied up the room to make space for the erection of the instruments. The base of the lighthouse could not be more than forty Parisian feet; its height was estimated as seventy-seven foot. The inside diameter was eighteen and a half foot, and the walls were three and a half foot thick. Of vegetation, there was none on the whole of the island, and outside the lighthouse, every step taken was fraught with its own danger.

Even so, on the first day the installation of two chronometers was accomplished. The first gunpowder signals from Marseille were observed after 10^{30} a.m. They were strong enough to be seen by the two mariners through the naked eye.

During the next night, a fearful storm visited the island. The occultation came to pass during the night of the 11th, at 4^{33} a.m., but, thanks to the storm, it was impossible even to reach the door, let alone to go outside. On the 14th they have managed to measure a few solar elevations. The have also determined the latitude of the island.

During their stay on Planier Island, the weather was so pleasant, that there was no need to use the brazier, which was provided for winter. On the 15th of February, they returned to Marseille, after saying 'good bye' to their kindly hosts.

The Island of If {203}

The Island of If – later made famous by the novel *Count Monte Christo* by Dumas pére – is found in the Bay of Marseille. It was also earmarked by Zach for astronomical observation. The Chateau of If was built on this island. The officer commanding the island extended to Zach and his companions a cordial reception. He even let them visit the prison and made it possible that they could not only see the prisoners, but could also talk to them. They also met Gen. Lajolais, with whom they could converse in German, as he was a native of Strasbourg in Alsace-Lorraine. In the Chapel, they could see General Kleber, {204} who was embalmed in Egypt before being brought here for burial. They arrived on the island on the 25th April, and accomplished a comparative determination of solar elevation, using three different chronometers. They established the longitudinal difference between the commandant's room and the Observatory of Marseille as 10″06

During his stay, which lasted several months, Zach collected all available data on the history of astronomical research in Marseille, and published them as an article in the *Monatliche Correspondenz*.

The Hyères Observatory {205}

Zach and the Ducheess spent the time between the 11th of March and 15th of April in Hyères. Miraculously, they found the tower, built by the Prince more than twenty years ago, still in satisfactory condition. On the 20th of March, Antares was eclipsed by the Moon. To observe this event, Zach travelled to the Island of Porquerolles, where no astronomer had set foot since 1719, when M. Laval, then the director of the Marseilles Observatory, has carried out some observations. Thulis remained in Hyeres, while Pons stayed in Marseilles. Thulis selected the observatory in Hyères for the location of his activities.

Zach succeeded three times in performing some extremely accurate observations of the Moon. These activities were aimed at producing corrections for the town's geographical co-ordinates, previously determined by Cassini.

Concerning the island itself, his only comment was an expression of his incredulity concerning the reputation the town had, in the eyes of both locals and foreigners, of being a paradise for owners of citrus-fruit groves. In the year 1805 Zach claimed to have seen not a single branch of an orange tree, or even a single tree, let alone groves of them.

In the April of 1805, Zach and the Duchess started on the homeward-bound leg of their journey. The end of the month found them back in Avignon. They left Avignon on the 4th of May, planning to travel through Lyons, via Switzerland.

In Frankfurt – her native city – the Duchess became the victim of a serious ailment. She drew up her first 'Last Will and Testament'. The journey home was not completed until the 1st of July.

In Gotha, they extended their hospitality to two persons of eminence. They were M. Henri Grégoire, Bishop of Blois, and Eustachio Degola, famous as a Jansenist philosopher and scientist.

Hopes of Eisenberg

On the 25th of November 1805, a letter was sent to C. F. Gauss, expressing confidence regarding Zach's future.

> "It is now for more than a year, that I had to make do without your letters. I could not even get round to thank you for your excellent contribution, with which you were kind enough to honour the *Monatliche Correspondenz*. My travels in the South of France – necessitated by the apparently mortal sickness of the Duchess – completely ruled out the building of the new observatory in Eisenberg and any continuation of my geographical measurements, started last year in Thüringen. I was cut off from all my friends and correspondents. But for Bernhard Lindenau, even the *MC* would have faced bankruptcy. It is only now, during the last week or two, that I could devote some time to surveying the state of my own affairs. You are among the first of those, my dear friend, with whom I am desirous to maintain a life-long connection.
>
> I should like here to say a few words about my present plans and future prospects. The hereditary estate of the Princess is about eleven kilometers away from Gotha. This winter I am going to move to Eisenberg, where an observatory will be built not far from the castle. There will be a gallery, through which I shall be able to reach my ten-foot passage instrument from my study-room. It is also my intention to extend the area covered by my triangulation network to Kassel, and finalise my results as far as the Wilhelm and Hercules. Of the beautiful Inselberg and the Brocken, I have already finalised my results.

Even in France, I did not restrain myself from working on the determination of geographical co-ordinates … I visited Mount Victoire, where Cassini and La Caille were the first to use gunpowder for signalling. The gunpowder signals that I have produced were received in Marseille. I did the same on the Island of Planier, where the accuracy of previous measurements made by Gen. Roy had left much to be desired. It will be possible to read all about this in the 1806 Volume of the *MC*, which, from now on, I should like to have printed in Eisenberg.

I have not neglected your newly discovered planets and derived some pleasure from being reacquainted with them. It was Lindenau's belief that Pallas would never will be seen as far North as to come before your eyes again (*MC* XI Bd. April 1805 S 383). If the sky was not overcast, I could observe the planets from my present position, and found it possible to document their opposition. … Until then, I am sending you the few results I could obtain in the South, in the hope that they may be of help in improving the accuracy of your orbital calculations. On another occasion, I shall send you a notification of the appearance of a new planet, which was found by the French. During my stay in Marseille, I heard of Vidal reporting such a discovery in a journal in a rather pompous manner. We, Thulis and I, should have liked to observe this newcomer immediately, but we were forced to conclude, that this 'new' planet was none other than Ceres. In Paris, this bit of news was not given printed publicity and in Germany, it also remained unpublished. Thulis voiced his opinion of this miraculous discovery : »Such will ever be the boys of Gascony«. This was the answer to my question.

A few lines from you would make me a very happy man. Please send your letters to Gotha, I am sure they will be duly forwarded."

❋

The letter Zach sent to Gauss on the 5th February 1806 was sent from Eisenberg.

"Your letter, my Honoured Friend, found me not in Gotha, but, as a sick man, in Eisenberg. At first, I had pleurisy, and then I contracted influenza, a fashionable ailment in these days. Had I not had these, I would have been in a position to thank you for both your letters, and to congratulate you on your happy marriage. {206} This expression has its origin in your letter. As you can read in the *MC*, Thulis' observations are in a poor agreement with what we know about the two comets, so I have asked him to send me his original notes. On arrival, I shall forward them to you. It is unfortunate that his observations of the second comet lasted only until the 2nd – 8th of December. At the same time, I also observed the object, and I doubt that he would have continued his observations until January. I think that Thulis' observations are of limited value and they are not good enough to prove the validity of your orbital calculations. Thulis never 'centered' any planets with which he could have compared his results obtained from the comets. I hastened to examine one of them; I wonder what is your opinion about the second comet being identical to the comet seen in January 1772. {207}

I am no further concerning our three planets. Pallas was one of the three observations I have sent to you. I have specially recommended this planet to Thulis. In his reply, he told me that he only saw it once in the last fourteen months, but he did not perform any observations.

Of Ceres, Harding sent only one observation … Pasquich's results, obtained in Buda, reached me through Lindenau. I do not think these results are very reliable, they strongly disagree with the ephemerides calculated by you, especially with regard to the data on declination. The method of calculating their

average values should be improved. How are you getting on with your real problems? Are you entering the contest for the Paris Prize? If you enter, who would stand a chance against you? It is an easy matter to predict the outcome. There are bound to be other contestants, one of which must be Oriani. Schubert is still recovering from his Chinese journey, and the National Institute is not in a position to put up a 'contender with a chance' against you.

My ten-foot passage instrument has still not arrived in Eisenberg, so I have to await the arrival of more clement weather. Until then, I still have fall back on my six foot Dollond instrument, and I hope I can make good use if it for observing Pluto. During the experiment, I have also determined the 'elevation of the Pole' of Eisenberg. For the determination of the longitude, I used the chronometer I brought with me from Seeberg. I had no luck with the occultations of stars, but I have managed to observe the lunar eclipse.

What do you think of the position determinations in Sweden? You will find their complete description in the *MC*. The original was written in atrocious, hardly comprehensible French and in my opinion it does not reach the necessary degree of accuracy. The French failed to present their opinion."

The letter, dated in Eisenberg, on the 28th May 1806, is still full of plans for the future. It is characteristic of Zach's generosity of spirit, that although he took to heart the ill-mannered treatment meted out to him by the Duke of Braunschweig, he was willing to put aside his ill-feeling and devote his time again to the planning of the observatory to be used by Gauss.

"By this time my plans of your future observatory will probably have reached your hand. Now my sole desire is for them to merit your approval. At present, in my opinion, the most important thing is to have the Duke's permission to erect the building itself and to secure the finances for it. I wonder if the budget, which I have recommended, has been drawn up, and 'pro temp' legislation enacted for the building, subject to future modifications, if necessary. You must make a detailed plan of a reinforced ground floor and the foundation of the stairs. This is the foundation on which everything else rests. If your dwelling is to be built sufficiently close to the observatory to make it at all possible, I should advise the building of a corridor leading thence to the observatory. Alternatively, a permanent private home could be built for the astronomer, providing him with accommodation independent of the whims of his landlord. In my opinion this dwelling should be owned by the Duke, and assigned, 'in perpetuity', to the use of the resident of the observatory. Bernouilli and Bode also lived in accommodation owned by Royalty. Perhaps your wealthy patron could build a house like this, which would be an ornament to the town and preserve his name in the celestial account book. So be it …"

The rest of the letter bears witness to the poor condition of Zach's nerves, seemingly contradicting the hopeful tone of his ambitious plans.

"… I am heartbroken about missing my meeting with Dr. Olbers, but it is entirely his fault. He maintains that it was all caused by my letter. I have sent letters to him in Berlin, Leipzig and Karlsbad, but neither of them managed to reach him. He has written to me from Gotha, informing me of the date of his arrival. He has believed, mistakenly, as it turned out, that we should be meeting in Eisenberg, where he also expected to see an ailing senator. To this end, Olbers made a detour of twenty miles (eleven, actually). Thus, due to a fatal mistake, I missed seeing and embracing Dr. Olbers, my old friend. I am inconsolable.

I wanted to travel to Leipzig to meet him. I was going to use my own horse to fetch and transport him to Weisenfalls. … I have received no answer to my proposals. Even from his last letter, it was impossible to deduce his intended point of departure. I thought that he must have been coming from Karlsbad, as the only subject he mentioned was the need for him to 'take the waters'. His next letter came from Gotha, while I have sent Legendre's book to his address in Göttingen, where it was his hope to receive this present. {208} The postal service from Eisenberg proceeds at 'a snails pace' at best, so the book never caught up with Olbers, who was reluctant to spend more time than necessary in Göttingen. I have written a covering letter, asking for the book to be handed to Olbers if somebody chanced to meet him. Perhaps you might know his present whereabouts, whether he is staying in Karlsbad or in his house in Bremen."

It is a sad thing to notice the underlying sadness of this letter's tone. Zach must have had a premonition that the best time of his life was coming to an end, and the friendship he has built up with the German astronomers was shortly to follow suit.

❋

During the subsequent period it was Barnaba Oriani, who became his best friend and the closest of his colleagues.

A letter to Oriani, sent from Gotha on the 28th May 1806, presents some information about Zach's new life.

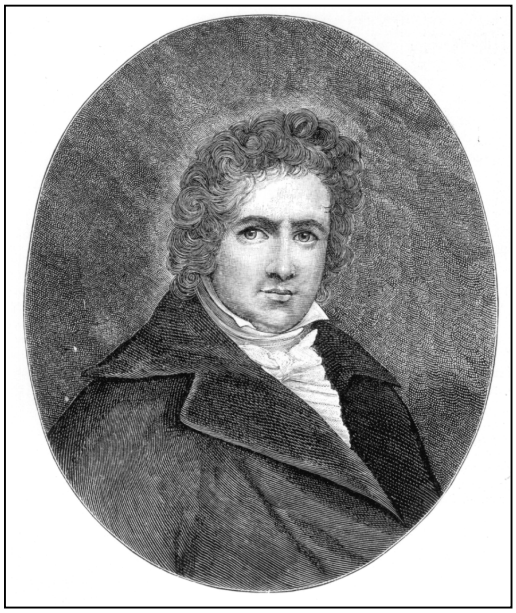
"It is beyond my powers to describe the pleasure I derived from your letter of the 5th of May, mainly because it is a token of our continuing friendship, by which I regard myself greatly honoured. Secondly, for the accurate data you gave me, which I have already forwarded to my friend, Gauss. My third reason is that now I can be sure of the continuous observation of Pallas using your equatorial sextant. Your letter is welcome for additional reasons to do with the impossibility of observing the three new planets in Germany during the last winter.

I have spent the previous winter in the South of France, as Major-domo to the Duchess of Saxon-Gotha. We visited Avignon, Nîmes, Aix, Marseilles, Toulon and Hyères (etc.). You can also see from my Journal, that I did not neglect astronomy either. I have repeated and confirmed the geographical measurements of Cassini and Lacaille, which they started in 1740 on Mt. Saint Victoire.

The Duchess would very much like to visit Italy. This plan pleases me no end, all the more so, because you will have a chance to meet the Duke's widow, which, I am sure, will be a welcome experience for you too. The Duchess holds you in the same esteem, as did her late husband. {209} She is also longing to make your acquaintance. This little excursion should be a safe and enjoyable one, provided the King of Marengo and Fra Diavolo is found still alive and well. Prince Friedrich of Saxon-Gotha, the Princess' second son, is staying in Italy for the present. Has he visited you yet in your observatory? My Journal is being published continuously, without letup.

The booklets you expressed a need for have been lost in the troubled times following the war. At present, you need the February, July, September and December issues of the year 1805 …

If you are really bent on my enrichment and disbursing money, then please look up the banker Borgnieres in Milan. He will somehow manage to get the money into my hands, perhaps using the services of his brother or his cousin, who owns a house at Mayer's in Frankfurt and who knows me personally, having been, for



Friedrich Wilhelm Bessel

a short while, in charge of the financial management of our Court, where I had occasion to meet him on numerous occasions.
What could I offer you in exchange for your excellent observations?
Here are the observation results of Ceres, obtained in Buda …
Have I written to you about the opinion some individuals hold about the Comet of 1805 being identical with the Comet of 1772? {210} A young astronomer by the name of Bessel made some calculations in this context. What is your opinion of the new method of calculating the paths of comets, which were recently developed by Legendre? Do you still prefer Olbers' method? What about the row between the 'astronomers of the true faith' and the Catholics? Behold, the English heretics went so far as to measure the pole itself. The results of General Roy, Dalby and Mudge seem to show that the length of the Earth's equatorial radius exceeds the length of the North-South axis by as much as one fiftieth!!!
If this proves to be true, it may cause irregularities in setting the plumb line, which, in turn, would make the accuracy of the French results open to doubt. Good-bye to the angular co-ordinates of geography, to the 'gram', to the 'metre' and to all 'universal systems of measurements'. The Earth has a dent at both poles. This would affect the pendulum and every phenomenon observed by the astronomers … When the Duchess and I arrive in Milan, we shall be discussing it in great detail, as this is one of my very favourite subjects. …
I implore you, my most eminent friend, to send me a reply to this letter, as the time of our meeting in person is drawing near and I need to know whether you want me to bring along a repeating circle (made by Throughton), which can be used by only one observer? Will there be any problem with this instrument because of its being English? Can you obtain a customs-pass for us? We intend to travel trough France.
God bless you, old friend, I send you my heartiest embrace …"

His letter to Gauss, sent on the 3rd of June 1806, indicates that Zach still did not give up his hopes of being able to carry on with his work in Eisenberg.

> "I am in your debt for your specially interesting and informative letter of the 20th of May, which filled me with so much pleasure. I am full of admiration over your ability to make so much of the Marseilles results. It exceeded even my best hopes and expectations. Your results are especially valuable now, that the comet you so completely described is not visible any more, although I have not given up all hope of seeing it again. Thulis has ceased to take an interest in it. Since I have received his article, I have received no more letters from him. He dwells in Southern climes, and as such, he is a bit lazy and in need of an occasional prod. I am going to dispatch a letter to him right now, in which I am going to tell him of what you were able to produce from his observations. I am also to ask him for the remaining seventy-five, together with readings taken on the 10th, 11th and 12th of November, which you would also like to peruse. Perhaps you were lucky

enough to be able to continue your observations into January, and to use data so obtained to complete your remarkable and conclusive orbital calculations. From your letter I think you may not have seen the observations of Bouvard in Paris, or the new work of Legendre, which I have mentioned in my last letter written to you. I enclose these works with this letter. …

Dear friend, it has been a long time since I last heard from you. Presumably, you had to give the earthly Venus so much of your time that you had none left for the celestial one. I, as a confirmed old bachelor, am anxious to tell you about the charming Juno. Oriani sent me some exquisite measurements he made in Milan with his Ramsden type quadrant and the supporting calculations. {211} It would be very interesting to compare those with your calculations of the orbit's elements. …

Oriani determined the obliquity of the ecliptic to be 23° 27′ 54.8″. He calculated the virtual longitude and latitude from the Equinox. From this the nutation is given as -18″, the longitudinal aberration as -8.9″ and the aberration of latitude as -2.5″. All these can be compared to your orbital elements calculated for Juno, so that the average error can be determined therefrom …

What do you say, my best friend, to the new method proposed by Legendre for the calculation of comets' paths? I am very much looking forward to have your views on the subject, and I would be even more in your debt, if you could see your way to contribute a small article to the *MC*.

What is your opinion about the English, who extended their survey of the angular co-ordinates right up to the North Pole …"? {212}

❋

It was still from Eisenberg, that Zach wrote to Oriani on the 10th of June 1806.

"… You gave a great pleasure to me and through me to Gauss, with your observations of Pallas and Juno. Not many of those were made lately and this fact will add to their value. Please, accept my special thanks for these valuable presents for my Journal.

You are stating a profound truth when you say that Gauss has started a new era on Astronomy. I would go even further by saying, that what Gauss wrought is not only a new era, but amounts to a revolution in the determination of comets' orbits. You have also shown me great courtesy by so expeditiously despatching to me the results of your observation of these new planets. In return, I am sending to you the completely new ideas of Gauss concerning the mathematical reconstruction of the planetary orbits.

I believe that in my previous letter I have mentioned that Bessel has computed the elliptical orbit of the second comet and expressed his opinion that this is not identical with the comet of 1772. Gauss has a different opinion. {213} Have I already told you, that Gauss has found a reference to this comet in a note about the eclipse of 1731?

Not only did Gauss succeed in fitting a parabolic orbit to the path of this comet, but he also managed to do so while eclipse conditions were prevailing. What do you say to this? The comet is rather small, so similar sightings are bound repeatedly to happen, before it finally disappears the same way Uranus, Ceres, Pallas and Juno did during the course of this century. Gauss thinks that it is identical to the comet of 1772. He made very accurate predictions of the perturbations from the alterations of the measured orbital segments. The first and most important consequence of these observations is the discovery, that the

orbital elements of this comet form a complete ellipse, of which the previously suggested parabolic orbit can be regarded only as an approximation. Or, stating it more succinctly : The observations are consonant with an elliptical orbit, whose average distance is 2.82 … Secondly: we know very little about the real size of a comet's path. Thanks to this uncertainty, we are accustomed to assume a parabolic orbit for the observed comets, which can be forced to fit our observations, but only to a certain extent … Due to this assumption, in case of many comets we are incapable of imagining the farthest limits to which their path may extend, as these distances also stretch outside of our imagination. The second comet of 1805, describing a geocentric arc of 81° in twenty-four days is a very good example of the uncertainties associated with real orbits. In Gauss' opinion, this comet moves in a small orbit, which is not parabolic, as assumed by Bessel, but elliptical, consistent with a time of revolution of thirty-three years. You will find a more detailed description in the July number of my Journal. I am exceedingly busy with the March and April editions and I maintain a continuous and close association with Gauss. He was pleased by the kind reception you gave his results. I should be grateful to receive your ephemerides, which have been completed since 1800. Please also send me your data on occultations you and your colleagues observed in Italy.
With cordial embraces …"

❋

His letter sent on the 20th of June 1806 to Oriani indicates that Zach was able to maintain some contact with his astronomer friends and even received some of the scientific news.

"I am sending my replies to your three letters, which gave me great pleasure. I intend to use them in my '*Correspondenz*' for the benefit of science. {214} Your observations of Pallas were already sent to Gauss, who has already succeeded in correcting the VIIIth orbital element of this planet. Time waits for no one; so I enclose the ephemerides within this letter, although you will be able peruse them later in my Journal.
Dr. Gauss has already corrected the Vth and VIth orbital elements of Juno. There is not a great difference between them.
You have sent me your observations of Ceres and my friend Gauss is interested in your formulae. According to what he wrote to me, he has been using Legendre's book for some time … The Scientific Society of Utrecht issued an invitation for papers on the subject :
»If the two hemispheres are different from each other to a slight degree, or are otherwise unequal, the effect of this difference on the magnitude is to be observed, and an explanation to be sought as to its causes … is there a constant difference in the angle of deviation from the orbital plane during summer or winter. Can an explanation found to shed light on this question?«
They expect a reply before October 1808. The prize for the best paper is a medal of thirty golden ducats in value. The address : Rossyn, c/o The Scientific Society of Utrecht.
This is all the news I can tell you." {215}

❋

From his letter from Eisenberg to Gauss, 20th July 1806 :

"My esteemed friend, you can never send me a letter from which I do not derive the greatest benefit. The present one, true to form, does also contain useful insights, treasures for science, which were until now not included in your letters. Every new letter from you fills me with awe and admiration. Thousand thanks for all your communications. Now I hasten to answer your questions, which are close not only to your heart but also to my own.

1) You solicited my advice regarding the language in which your book should be published. I can answer without hesitation: in French. Your book is a work of universal significance, it is written for all nations of culture, so it must be made public in the language that makes it accessible for the greatest number of readers. There is no need to introduce reasons for the inferiority of Latin for this particular purpose. You seem to be worried by your French not being good enough. Never mind. Write it in German and somebody will be found to translate it into French for you. For the best publishing house, I recommend Schöll & Leurant in Paris. I know them personally, and I can undertake to transport your manuscript into their hands. In case you should insist on a German publisher, I recommend La Garda in Berlin.
2) I am acquainted with the instrument of Count Hahn, although I use a different one myself. The 'Dollond' type passage instrument would not be suitable for you. I think you deserve something better. Heaven knows what use this instrument could be to you. It is a decrepit and rusty specimen, costing a lot of money. The Duke of Braunschweig should acquire a good instrument for you. For Dr. Gauss »Aut Caesar aut nihil«. The watch from Hahn is also unsuitable. This was made by Klindwort in Göttingen. What you need is an 'Arnold regulator'. Among Hahn's instruments, his achromatic telescope is the only item worth buying.
3) My dear friend, please have a bit more patience. I have an agent in London. In his time, this artist was working with Ramsden himself. Dollond has left everything and retired to the country. Throughton declared that he has severed all connections between us. He is still holding an astronomical circle he made for me, even though I have paid a deposit on it. Now he has sold it to a gentleman from Smithfield, name of Lonien Draper, who is intent on building an observatory on his Blackheath estate. I have placed an order with Fiedler for six sextants (three of those I enboxed). You will be awe-struck when you hear my true opinion of this master's handiwork. You will see that there are still enough artists left in England to be contacted. For the same money they will sell you good new instruments, instead of poorly maintained second-hand leftovers. There is a Jewish mechanic in Berlin, one of the sons of the renowned philosopher Mendelsohn, who has spent a long time in »black Paris«, before settling in London, where he is engaged in a state supported project of constructing a healing machine (Heilmachine), which has not received official recognition as yet. Finance Councillor Bose has written, informing me that this was work shared between them and appending his letter with the words : »Old English Forever«. I also reached an agreement with Birch, finalised in a letter a few days ago, about the delivery of a lens and five eyepieces for the erection of a five-foot achromatic telescope. The stand and the tube will be made locally, giving us an instrument as good as any, and, at the same time, allowing a reduction of transport costs and shortening the time of delivery. On receiving the Fiedler sextant, I shall have to notify

London immediately. By that time, I hope I shall have received from you an answer about whether you need the lens of the specified enlarging capacity and the eyepiece only, or do you want an achromatic telescope complete with stand and tube. In addition to all this, would you also like a Fiber type microscope?

4) I am in complete agreement with your suggestion concerning the stairway leading to the northern dome. The equatorial instrument should be placed in the Southern, the parallax instrument in the Northern dome, utilising one of the windows for the purpose.
5) The reason for my using such a broadly based averaging procedure for the circle has nothing to do with the observations in the asimuthal direction. It is connected to the observations done using the meridian circles. My design is aimed at giving you the freedom of using the Meridian circle not only as a wall fixture, but also to use it for various other observations using the methods recommended by Baumann and Reichenbach. I designed a slot sufficiently wide to let you make observations fifteen minutes before and after the culmination. Think of the advantages! Should you want to perform multiple observations, such as customary with the most important planets, then all you should do is to set the circle to meridian and use it as a wall-quadrant … (…)

Now you can see my plans and designs concerning your observatory and you may give some thought to them. I am curious as to what is going to meet with your disapproval. Perhaps it may be thought too elegant or ostentatious. In my opinion the current Duke of Braunschweig can well afford it and should not put up with mediocrity …" {216}

Zach Is Beginning to See the Darkness Drawing in

The Battle of Jena took place on the 14th October 1806, only a few miles away from Eisenberg. In this battle, Napoleon dealt with Prussia and Austria, with his customary efficiency. This event finally induced the Duchess and her minister to leave Eisenberg for good.

❋

Regaining some of his composure, after a pause of almost half a year, he wrote again to Gauss. This is the first letter in which he refers to his struggles with the Jesuits, and puts down his true feelings on paper. The reason for Gauss being the first of his friends in whom Zach confided in this matter may be that Gauss, himself a Protestant and a German, might have been assumed to share Zach's lack of sympathy towards the order. Oriani was a Catholic, so in letters written to him Zach could refer to his problems at most tangentially.

"… Hearing the news about you and your being well was a source of special pleasure to me. During the conditions prevailing during the recent past, my thoughts dwelt on you thousands and thousands of times. I have put my trust in what I have heard from Oriani a couple of days ago in his letter written from Milan : »I seek comfort in the hope that you and the eminent Gauss and Olbers came to no harm during the hostilities as the French have high regard and respect for scientific merit.« As far as I am concerned, I have nothing to say about the French, as none of them got as far as this place. Nevertheless, being only three kilometres away from Jena, we have gone through a lot. I am sure that this battle will retain a prominent place in history. The exhausted and spent

soldiers and murderers were quartered on and looted our lands. Eisenberg – miraculously – remained untouched, not even a single lock of hair was disturbed. We can only hope that this will remain so in the future. If 'your circles were to be disturbed', you would only have to send a letter to the French Senate, to have you restored to your previous state. This is my hope. More of this next time. During the whole of this interval I stayed in Eisenberg, not leaving my Duchess' side even for a moment. I can foresee a darkening future before all of us. What good can you expect from a patricide?

My dear friend, you placed me in your everlasting debt with your calculations of ninth orbital elements of Ceres. Oriani had only a modicum of success with his observation of the planet's opposition. Pasquich's observations show a good agreement with the Milanese ones. I am in haste to send you these.

I have read parts of your letter, which inform me that you are continuing the great work on planetary orbits, with abiding interest. Until now, it was very difficult to find a publisher for this work. As I have already recommended, you should try to bring it out in French, the translation promises to be an easy task … Unfortunately, Schöll became bankrupt. Treuchtel and Würtz are Jews. In Paris, I know only Bernhard; he is the official publisher for the Imperial École Polytechnique, which has already published a multitude of works on Mathematics. Théophile Barrois has published a number of books on navigation and he also sells books in foreign languages. Delambre would be only to pleased to recommend you … It may not be particularly useful, but I still want to forewarn you, that the publication of your book may be regarded with a certain amount of jealousy by Chancellor L. P. (Laplace).

You are asking whether I have published my tables of aberrations and nutations. I should like to say, that, but for the visiting Frenchmen, the work would have been finished by the previous St. Michael's Day fair. The work is set for printing but for the last five pages. Delambre's tables appear to me as too long-winded. I should like to make some improvements, which may earn me some gratitude.

My Highly esteemed Friend, you can clearly see that Güssman is a true Jesuit. Above all he is a »Bonne Espace«, an »Erz Matador«, who has already done me considerable harm. He is an »Erz-Zelote«, an »inquisitor«, who ought to be banned from the pulpits of Vienna. Ha wrote papers against Herschel, he tried to convert Moses Mendelsohn, he persecutes Pasquich and Bürg, whom he would have preferred to burn at a stake. He is an enemy to every scientist who is not a Jesuit. As a young man, I have heard him speak-out against Delambre and Clairaut He counts Laplace, LaGrange, Euler, Olbers and you as his enemies. 'Boscovich is the pupil full of mercy, whom I acknowledge as an untainted benefactor' – once I have heard him say. His work concerning comets – which you mentioned in your letter – is unknown to me, but, were it really so good, I am sure it could not have failed to come to the notice of such luminaries in Vienna as Pasquich and Bürg.

They can always preserve their anonimity in their Mischief-making. I do not have Boscovich's works, but I shall obtain them for you if this could help to open your eyes to see Güssman's work in true light. I am a »black sheep« in the Jesuits' eyes, as I have always stood up against those evil men. And this affair is not finished yet. After you receive Güssman's publication, I should be very much obliged if you could send me a copy. My being banned from the territory of the Austrian Empire is also the work of the Jesuits. I had three principal enemies: Liesganig, Metzburg and Güssman. Two of them are already with the Devil, the last one is still around, but still, he cannot succeed in getting me to the stake.

My best wishes go to you, my dear friend and please send me some happy news about your welfare, and I hope that my wishes will have their desired effect." {217}

Such hard words are very seldom found in Zach's written legacy.

A few days later, in his letter to Oriani on the 26th October 1807, he frankly discusses the events of the last few months and the difficulties of his circumstances, but he has still not given up his hope in the possibility of being able to carry on his work and retain his former way of life in Eisenberg.

"Thousands of thanks, my highly esteemed friend, for the obliging letter you sent me on the 24th of last month, and for your observations of Ceres. I beg for your indulgence for my tardiness of expressing my gratitude for kindly correcting the ninth orbital elements of Ceres.

You have asked me, my dear friend, whether we had suffered any harm during the warlike circumstances. Concerning my own person : we all had a very anxious time at Eisenberg. Jena, the scene of a battle ranking in importance with Marengo and Austerlitz, is only six miles away from Eisenberg. Eisenberg is the residence of the Duchess of Saxon-Gotha, the widow of our one-time benefactor, Ernst II. After the events I was appointed as major-domo to the court of Her Grace the Duchess. I have left Seeberg, of which, by now, only ruins remain. The present ruler does not care for Astronomy. He is the kind of fool, who keeps the telescopes in glass cases and devotes all his time to his footmen and grooms. This degenerate son made his worthy father die of a broken heart. On his dying bed, the father declared that it was his son, who put the dagger through his heart. I had hopes that he would mature under the cares and responsibilities of ruling his country, but I was disappointed. He is as great a source of pain and sorrow to his mother as he was to his late father.

The Duchess had planned to build an observatory in Eisenberg, and, but for the war, by today it should have been finished. The only thing still missing is the roof. We are going to have better instruments than we had at Seeberg. The greater part of the most important instrument is already there. The passage instrument with a ten-foot telescope is due to arrive in a short while. Our observatory is being built quite near to the palace. From my Journal, you can see that I have already determined the geographical longitude and latitude of its position. We succeeded in salvaging all of the instruments from the collapsed tower of Seeberg, which has gone to the Devil. Should anybody ever want to reconstruct this observatory, he would have to start re-erecting the building itself after a different model.

An abusive article was published in the press, attacking my person. I have responded to it, which caused quite a stir. The scandal was caused by the new Duke (August), who publicly admonished his father, declared his will null and void and cast doubts on its authenticity. The war came to us unexpectedly, we were ruined, and the Duchy of Saxon-Gotha may have fallen under the influence of the Saxon king, whose only purpose is to avoid conflict and be on friendly terms with the entire world. Contrast this with the great Napoleon, who went out of his way to create a favourable environment, where we could carry on with our scientific work under the supporting hand of Ernst II. His gracious widow inherited her husband's taste and his moral outlook.

My work of triangulation has gone to the Devil, the same as yours. Prussia is no more.

The Duke of Gotha is submerged in the work of ogling theatrical performances and making debts. My work of triangulation was bled to death by the theatre.
Dr. Olbers is in Bremen, Dr. Gauss is in Braunschweig. Their intellectual life is such as it can be – it is impossible for them not to suffer. What the future will bring is written only in heaven. Gauss' work is delayed; we are trying to find him a publisher, in ways different to what we are used to. Not before very long we shall be printing Astrology … Thousand thanks are due for the ephemerides, which reached me through a good port of entry, not speaking of the copies of the *Memorie della Societae Italiana*, which are a joyful thing to possess. Unfortunately, the illustrations supposed to go with your study, appearing in the Jan. 1806 number of my Journal, and were enclosed with other interesting books in another parcel you sent me, have gone astray.
God bless you, my memorable friend. I long for your reply, and wish you the peace of mind, which I also wish for myself in my present situation." {218}

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His letter to Gauss, sent on the 7th April 1807, is not as frank as those letters sent to Milan. His letters to Gauss always retain their attitude of scientific detachment.

"For sending me the 'Güssman Brochure', and even more so for our opinion expressed about its author, I am in your debt. I shall immediately include it in the May edition of my journal, anonymously, in accordance with your wishes. I should not have minded putting your name to it, but naturally, I shall respect your peace of mind. I am also pleased that you acceded to my request and confirmed my opinion, and have shown up this bad man and his associates in their true colours, thus protecting persons excluded from their circle from shame and from having their reputations sullied. Such meritorious work is not only serving a good cause, but is also in the interest of good friends. You have my everlasting gratitude.
Some lamentable news reached me from Austria. The *Astronomischen Ephemeriden* is to cease publication; because the government will provide no more financial assistance and other publishers cannot be found. You will read in the *MC* what the good Father Heinrich has to say on this subject, supplemented with my own comments. I await with breaking heart to hear your opinion of this, together with Olbers', Bessel's and Harding's. I shall have in print as fast as I can. My dear friend, I want you to promise me one thing only, that is, that you will carry on publishing the Ephemerides of the three new planets, which will be obtainable now only from your office, and do not begrudge sacrificing some of your valuable time to this task. I should like to obtain from Prof. Harding a map showing the movement of the three planets and their monthly occurrences correlated with the movements of the Moon.
When I received from Mr. Bessel the collection of his own occultation, I thought that they came from Olbers. This made me anxious about Olbers' possible discontinuation of his extensive medical practice. From Bürg I should like to obtain the midday and midnight positions of the Moon. I set myself the task of everything to do with the Sun. The old planets and the eclipses of their moons can go to Heinrich and Wurm. This way our Ephemerides may reach an acceptable state. Each edition will have a short introduction, as it is customary with the other Jahrbuch's. I am going to pay the expenses and pocket any profits. Alas, my dear friend, the publishers of today find no profit in Astronomy. I have to state with profound regret that my MC would have also closed down had I not

used every means at my disposal to keep it going. But this is only a temporary condition, a transitory state of panic. In a short while, everything has to return to normal, and the 'lamp-trade' will also return to its profitable state. I live for this hope. Any day of the year may prove the correctness of my attitude – or see me bankrupt...please let me know your opinion when we discuss the details of our plans and share with me your plans and thoughts about enriching the contents of these Ephemerides. For this I shall always remain in your debt." {219}

❋

Only a few months before leaving these lands for good, Zach is still making plans and building his castles in the air. He is worried about the future of Astronomy if the Annuals, started in Vienna by Hell and regularly providing him with a background of tables necessary for his Astronomical work, should cease publication. His immediate idea was to reserve his task for the MC, in the form of appending his Journal with a yearly supplement.

A few days later, in his last letter sent from Eisenberg on the 10th April 1807, he told his friend, Oriani, some important news.

"It is in haste, my dear friend, that I inform you of a new planet, discovered by Olbers on the 29th March 1807. This discovery did not come by chance, as, for the last three years, Dr. Olbers has kept a permanent watch on the part of the sky, where, according to his predictions, the shards of the disintegrating planet had to be found. His perseverance is now crowned with success. Here are the observations of the planet's position, which should make it easier for you to locate the object for yourself. It is as bright as a star of magnitude 5. According to Dr. Olbers, it can be seen with the naked eye.

It is my hope, my friend, most highly esteemed, that I shall receive from you many data, which I, in turn, can transmit to our eminent friend, Gauss, who wasted no time in starting to compute the orbit of the new planet.

Now I should like to bring up another important subject, which is to proclaim the new law in Italy. Meanwhile, I cannot pass by without a remark the fact that Dr. Gauss has found a mistake and had asked me to warn Carlini. This was found in his notes on the observation of Ceres that he sent me. During the determination of this planet's declination from the observations this error amounted to a whole arc minute (Vide *MC*, p159, 1806 February).

This can not be a copying error, as one minute is also missing in the calculation of latitude, and it was not necessary for Carlini to misread this in his calculation of the planet's orbit … please send me news about the new planet as soon as possible … Until I hear from you again … we shall keep our eyes firmly on the firmament.

God bless you
(Signed)
A Happy Astrologer" {220}

❋

The Battle of Jena was only the straw that broke the camel's back, an addition to the series of terrible events during the last months in Eisenberg. What life had really been like was revealed only much later, in Zach's letter, written to his Swiss friend Schiferli on the 1st May 1822.

"… Apropos, in your letter you have mentioned relatives. One of the Duchess' kinswoman asked whether it had been too difficult to live so far removed from her family. The only thing I can say to you, my best friend, from whom I have no

secrets, whose discretion stood firm through so many tests, who is so well acquainted with the family life of our rulers – with some of this knowledge based on personal experience – that I have frankly to disclose all the hidden cards of this tragedy, to devote a few brushstrokes to the sketching of the real situation and to the introduction of the principal participants. After the Duke's death, the Duchess was allocated the doom-laden castle of Christiansburg in Eisenberg, for her widow's residence. This was morally equivalent to a sentence of being exiled to Siberia. The Duchess has lived there for six years without having been visited by any of her relatives, not even once. The Duke, the present ruler, having travelled through his domain to Altenburg (six hours travelling time from Eisenberg) or to the resort of Ronneburg (two hours travelling time), could not be bothered to pay a visit to his mother, even though I have been tutor to both of the old Duke's sons, and have got on well with them. »There are more things in heaven and earth, Horatio« – says Hamlet – »than are dreamt of in your philosophy …« (…)

We counted it as a special day, when we were visited by the Duke of Weimar … The Duchess of Coburg, who was well acquainted with the Duchess, once asked : »My dear Lotte, how could you live here at all?« ... The Duchess was sick every winter, in body and in soul … The Duke knew what a warm climate meant for the Duchess, that is why we spent the winter of 1786-87 in Hyères.

This is why we have spent a month in the Provençe, but we returned to our barren and unfriendly Eisenberg. Here things went from bad to worse, both physically and in the moral sense. (…)

Dr. Grimm, who has looked after the Duchess for the last forty years, the last morning before his return to Gotha, confronted me with the question : »Do you want to keep the Duchess alive for a long time? If yes, take her to the South.« (…)

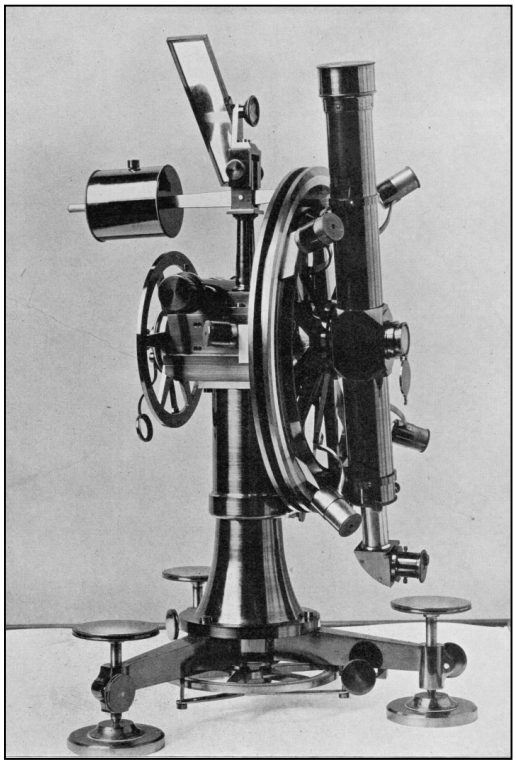
Thus we returned to our beloved Marseilles, where we spent eight happy and contented years together … until the fall of Napoleon." {221}

❋

Looking back on the period between April 1804 and September 1807, we cannot help noticing that Zach's life underwent a complete change. The biggest change was caused by the disintegration of the security of his existence. His position was undermined by the changes occurring in the world outside. From 1783 to 1786, his security was based on his friendship with Count Brühl. In Gotha, in the court of Ernst II, all his wishes were looked upon with understanding and sympathy. Zach did everything to serve his patrons well; their relationship was always based on mutual respect. Both these aristocrat-statesmen were men of the world, well travelled, steeped in culture and secure in themselves, so, as amateur astronomers, they did not find it beneath their dignity to defer to Zach's superior knowledge in his own field, or respond to his cultivated and well-informed mind. At the same time, Zach's masters were widely respected and popular men of high renown, so Zach also derived some benefit from their reflected glory. Until the death of the Duke, Zach had not been made to realise, that in the official world of the Court of Gotha, he was not more than a person 'on sufferance'.

After his official appointment as Director of the Seeberg Observatory, his dependency was to some extent ameliorated by having a regular personal income.

He looked upon his personal security as the solid foundation of his scientific work. He took the broad view, and accurately defined the nodal points of possible international co-operation, such as scientific publications, conferences and jointly executed research projects. He was a powerful engine for progress. Due to various factors, such as his belief in himself, the support of Ernst II, and the thorough planning and meticulous execution



Reichenbach's Astronomical Circle.

of his scientific plans, Zach carved out for himself a special niche in the community of Astronomers.

Reading his letters written between 1804 and 1807, one cannot but feel that Zach was perhaps seeing himself playing the wrong role. It took him a long time to realise, that the Duchess Charlotte Amalie – being an exile herself – was not the right person to provide a secure foundation to his scientific endeavours, in addition to becoming more and more capricious under the stress caused by her uncertain position and deteriorating health. Zach, while expending a great deal of energy on organising the Eisenberg Observatory, did not fully appreciate the changes occurring in his circumstances and did not realise that he has effectively lost control over his own destiny. His future plans had to be subordinated to the ever-changing ideas of his Gracious Lady. It was brought home to him, that he had completely to give up his independence, if for no other reason, than the emotional entanglement with his lady, which was becoming increasingly difficult to conceal. The heaviest burden Zach had to bear was not so much the difficulty of planning for ever changing circumstances, as living in a permanent state of anxiety, which was enough to paralyse all his emotional energies. At the same time he had to face up to the total collapse of his past life, to the cessation of all scientific work at Seeberg and the consequent loss of many of his friends.

During these years, he tried to continue his programme of observations, but he had to face the fact, that working in an unpredictable environment and without his old instruments, his present output was bound to fall below his previous standard. His geographical survey carried out in the South of France is amply described in the *MC*, of which he still remained the editor.

❋

In Eisenberg Zach became seriously ill, he contracted influenza, followed by pneumonia, but he had a quick recovery, and in his reports about his activities in the South of France, the old courageous and life-loving Zach can be recognised.

The Battle of Jena was followed by a brief period of peace in the German principalities although many of these sided with Napoleon through joining the Rhenish Federation. Even so, Zach was well aware, that great many of his friends had actively fought for the victory of the opposing side. His closest friend and disciple, Bernhard Lindenau, the next director of the Seeberg Observatory and future editor of the *MC*, has personally taken part in the fighting.

Zach and his Lady finally left German territory and lived on lands occupied by Napoleon until his downfall.

Outside German territory, the Duchess and the Master of her Court were becoming increasingly open about the intimacy of their relation. In the company of their newly acquired friends, they have had some good times together. Barnaba Oriani became closely attached to both of them.

Zach's had an ever deepening perception of his own situation, and came to realise that looking after the personal needs of his Duchess was becoming his main occupation. By this time, Zach managed to gain the respect and sympathy of some of the Duchess' kinfolk, who, in turn ceased their opposition to their relationship. The Duchess also found pleasure in the affectionate companionship of Zach's young cousin and nieces.

"Peace! Peace! Peace!" – Drawing by Franz Xaver von Zach

2. Enforced Peregrinations

In February 1807, the Russian armies suffered a momentous defeat at the hands of Napoleon. During the summer of 1807, the King of Prussia and the Tsar of Russia staged a joint campaign against Napoleon. The decisive battle was fought at Friedland on the 14th of June 1807. Napoleon – although only after heavy fighting – has won the battle and with it the victory over his enemies. Queen Louise, wife of Friedrich Wilhelm II, begged Napoleon on her knees for equitable terms. The peace treaty was signed in Tilsit (9th July 1807). The Prussians were obliged to pay war-damages. Berlin and various other Prussian towns were placed under occupation until the said damages were to be settled in full. At the same time the Prussian King and Tsar Alexander II had to acknowledge Joseph Bonaparte as King of Naples, Louis Bonaparte as King of Brussels and Jerôme Bonaparte as King of Westphalia.

Friedrich August II (Ruling Prince of Saxony), after joining the Rhenish Federation, has been given the title of 'King' and received the Principality of Poland in fief, after it was detached from Prussia.

After correctly assessing the war situation, Duchess Charlotte Amalie, accompanied by Zach, took her final leave of Eisenberg on the 6th of June, southward bound in search of warmer climates and more secure conditions. In the course of their travels, they passed through Bamberg, Nuremberg, Regensburg and Munich, where they arrived a few days after the signing of the Treaty of Tilsit on the 14th July 1807. They were also accompanied there by Franz, a cousin of Zach.

Between June till December of 1807 the Duchess Charlotte Amalie kept a diary, which tells a lot about their personalities and shows tell-tale signs of their developing intimacy. {222}

This diary reveals the depth of the Duchess' religious feeling. Although she was herself a Lutheran, she was drawn to Catholic churches, mainly on account of their architectural beauty and the music played therein. Zach himself, in spite of his irreligious reputation, was often seen escorting his Duchess to church practically every day. She had to have very strong reasons to miss divine service on any Sunday.

The diary is dominated by the personality of Zach, who was allowed to make most of the decisions and even took it on himself to set strict limits on the Duchess' spending.

This time of their life was rich in the rewards of their companionship. The political configuration of Europe was also congenial to them. At this time, Bavaria was also a member of the Rhenish Federation, so their susceptibility to Napoleon ideas did not hinder Zach and his Duchess in gaining the respect and sympathy of the aristocratic society and townspeople in equal measure.

The diary also shows, that they were received together, as a 'couple' by the friends and admirers – among them several members of the aristocracy – they acquired at the various stages of their travels. They visited theatres, museums and art galleries in each other's company. In Munich, they were granted an audience by the King of Bavaria. At the same time, the Duchess enjoyed the company of Zach's scientist friends, who were equally charmed by her gracious personality. {223}

All this goes to show, that leaving Eisenberg liberated them both from the previous restrictions. While in Eisenberg they suffered from loneliness, now their only complaint could concern the overabundance of entertainment. It appears that the company of

interesting and charming people had a healing and revitalising effect on the Duchess. She was especially pleased when their visitors came accompanied by their children.

❋

They arrived in Bamberg Monday, the 8th, and stayed there until the 26th.

They visited the cathedral on the very first day of their stay. The Duchess was deeply moved by the funeral mass, the day being the exact anniversary of her sister's death. {224} If Zach had no time, then his cousin, Franz Anton Zach was deputised to escort the Duchess to the church. They went to the theatre practically every night. The Duke of Braunschweig was closely connected to Countess Rothenhahn, and he also made the Duchess welcome in his royal box. Zach liked to keep busy with his scientific work, but in the evenings, he was happy to accompany the Duchess to the theatre. When they returned to their hotel, they usually had supper in the company of their learned friends. {225}

Zach even managed to make some time available for scientific work and for writing some scientific papers, although the Duchess, naturally, was not overly pleased with these interruptions. As a woman, she did not really feel happy when she was not the centre of his attentions.

P. Ulrich Schiegg, the astronomer and mathematician, lived in the same hotel. He and Zach co-operated in taking some observations, which were later published in the Journal *Correspondance Astronomique*. {226}

Besides being a regular theatregoer, the Duchess liked to visit libraries and museums. She was also a regular guest in the salon of Countess Rothenhahn, where music making was a way of life.

They left Bamberg with heavy hearts on the 27th of June, and were on the way to Nuremberg.

They reached their destination at 5^{30} PM, and went to the theatre at the same night. They took lodgings in the inn 'Red Pony'. There was a wedding in progress, and the travellers were immediately invited to join in the celebrations.

In Nuremberg, the Duchess received some news of her son Friedrich, from whom she had not heard for some time. She was even more pleased by the visit of a Mr. Bockhoffen from Gotha, who presented her with a picture of the young man, painted by himself.

The 14th July found them in Regensburg, where they paid a visit to Kepler's memorial. They made friends with Fr. Heinrich, who had shown them around the monastery and the 'Cabinet of Physics', which was deposited there. {227}

Fr. Heinrich accompanied them as far as Munich.

❋

They arrived in Munich on the 24th July and stayed there until the 17th September. This town was the most significant stop on their journey. They were received by the King of Bavaria in his palace on the first day of their stay. The Duchess wrote in her diary :

> "Zach and I had a long conversation with the King about the Emperor and other subjects. He spent some time with us and he suggested that we should have supper with him next Monday." {228}

The Duchess was invited to the theatre by Count Preysing, who placed his box at their disposal for the evening's performance.

On Sunday, the 26th, they made the acquaintance of three local instrument-makers, Reichenbach, Utschneider and Liebherr. Zach and the Duchess quickly established friendly relations with the first two. While the men spent their time studying the

instrument-makers' studios, and weather permitting, engaging in observations, the Duchess had a happy time with the women and their children. Having tea with good companions in the garden of Mrs. Utschneider was a pleasant way to pass the time. {229} The evenings were usually spent in the theatre, just as in Bamberg. They usually had their supper together, in the hotel where the Duchess and Zach had their rooms.

By this time, Reichenbach and Utschneider were engaged on furnishing the St. Gellert Hill Observatory (in Buda) with the necessary instruments. They allowed Zach to look into the plans of the establishment. {230}

During the whole of their stay the King has showed great goodwill towards the travelling couple. He invited them to the Royal Box in the theatre, and when he learned that medicinal waters tended to relieve the Duchess' symptoms, he gave her unrestricted access to the Royal Baths. {231}

On one occasion the King instructed his major-domo to escort Zach to a reception given by Prince Charles, the heir-apparent. Zach also paid several visits to Otto, the French Ambassador. On several occasions they had supper together. As the North of Italy was under French rule, they needed passports to continue their travels. {232}

Next Sunday, which was Assumption Day, the Duchess attended Mass in the Cathedral, while the soldiers of the French garrison were celebrating Napoleon's birthday.

They celebrated the Countess' birthday (11th September) together, with a great show of affection.

During his stay in Munich Zach's portrait was painted by the painter Etlinger.

They left Munich on the 16th September. The first stop on their route was the glassblowing workshop of Utschneider in Benediktbeuren. The lady of the house received them with a show great graciousness. Frau Utschneider presented the Duchess with a beautiful cut-glass dish.

Next day they were on their way to Innsbruck. They were accompanied by Herr Utschneider.

On the 18th of September Zach completed a few astronomical observations in what used to be the Jesuits' College. On the 19th they were on their way once again. Next day, in Trient, a broken axle of their carriage held them up for another day. After driving all the way through the romantic Tyrolean Mountains, they crossed the border of the Kingdom of Northern Italy on the 22nd September 1807 and arrived in Verona on the following day. The foresight shown by Zach, in securing from Otto a carnet for the scientific instruments they wanted to import into Italy, now proved very useful. Ambassador Otto's letter introduced Zach to Signore Prina, the Minister of Finance of the newly established Kingdom of Italy. Zach's party wanted to reach Milan through Padua and Venice, intent on visiting their old friend Barnaba Oriani.

> "Yesterday we crossed the border of the Italian Kingdom. I am waiting for the moment when I shall be embraced in your arms. I am also looking forward to introduce you to a person, whom I idolise, whose notes I have already forwarded to you, and who, in turn, derived great pleasure from receiving your lines sent by you to her … I am travelling with a Duchess, the widow of the late Duke of Saxon-Gotha, whose husband you have met in England nearly twenty years ago, when we visited you in Milan...We intend to 'drop in' on you at your home in Brera, on our return journey from Venice. You will meet a loveable Duchess, in whose company you will be as happy as you were once in her husband's."

Thus did Zach want to prepare the meeting of the Duchess with Oriani. It is known from his letter from Verona, written on the 23rd September 1807, that their stay in Italy was intended to be a short one, because the Duchess wanted to hasten their arrival in the

Provençe, which meant Paradise to her, for reason of having three times recovered her health in these lands.

Originally they planned to stay for some time in Venice and perhaps spend a few days with his elder brother, who used to be the Governor in the nearby Trieste. Unfortunately, Trieste was now occupied by Russian troops, so Anton could not get to Venice. {233}

On the 23rd September Zach promised Oriani to be with him within twelve days. It is impossible to say how many days they really spent there. The only thing to be known with certainty is that on the 6th November they were already in Genoa.

The other details of the journey can be gleaned from the Duchess' diary.

They arrived in Verona on the 24th of September. The first thing they saw was the Roman Amphitheatre. They were shown around by Cagnioli, and spent the evening with him in his home. This was the scene of an amusing episode: During a game of cards Zach happened to address the Duchess as "ein dummes Thier". She took umbrage over this undeserved title and felt so sorry for herself that she confided to her diary :

"My only hope is that I shall not live long …" {234}

❋

On leaving Verona they had another accident with their carriage. Consequently they had to find accommodation for the night in a small village, where they had to share a single room at the local inn. Next morning they had a hearty breakfast on the chocolate drink they had bought in Verona, which happened to be the Duchess' favourite beverage. Further entries in her diaries show that by this time the domestic peace was apparently fully restored. {235}

They arrived in Padua on the next day, the 26th. On arrival Zach immediately contacted the astronomer Chiminello, and carried out a few observations in his company, while the Duchess kept busy in her room doing astronomical computations. Zach has turned up for lunch a 2^{30} PM. At 6^{30} they left together for a walk in the city. Next day, after visiting the observatory, they went to St. Anton's Church. They were accompanied there by one of the scientists from the observatory. At midday they had lunch with the famous physicist Salvatore del Negro. In the evening they had a long walk through the dark streets of the city before retiring for the night.

Next day's itinerary led them to Arqua, where, in company of some friends, they visited Petrarch's Tomb. Zach also carried out a few observations from this location. The Duchess carried with her a small souvenir in form of a leaf, taken from the laurel tree growing next to the grave. They had lunch with an extremely pleasant parish priest, who had shown them the path leading to Petrarch's house. It was a small, three-roomed house with the indoor walls covered with frescoes. "Full of the most pleasant memories" – as the Duchess said in her diaries – they retired to their beds after the evening. {236}

In keeping with their regular habits they visited, in addition to the church, the Library, and the Council of Physical and Natural Sciences. At the latter place they met one of the good friends of Zach's brother, Anton, who spent some time in the town a few years ago on official business. {237}

On the 30th September they set off again, this time for Venice. They arrived there at four PM. On the next day the Duchess took to her bed with a serious illness. Zach was visited by two young Dominican monks, one of whose friends Zach had already met in Padua. Zach and the Duchess took them for a trip around the town in their own hired gondola.

"Zach has spent today in town, while I, together with my son Friedrich, spent a delightful time looking at the pictures of the Doge's Palace. In the evening we went to the theatre, where we saw *Tartuffe*."

Meanwhile Zach visited the Armenian monastery on a nearby island, where the Duchess could not accompany him because of the 'clausura'. Next day, on October the 8th, he returned to the island in the company of Werner and Fr. Calvi. For the obvious reason, the Duchess had to wait in a former Jesuit church, while the menfolk explored the monastery. Later they went to the island of Murano, famous for the beauty of glass objects produced in the local factory. Next day they went to see the visiting Russian warships, anchored in the local harbour.

Fr. Calvi became their regular companion. It was in his company that they visited St. Mark's Cathedral, finding pleasure in exploring the beauty of all its architectural details. In St. Mark's Square Zach met an old acquaintance from Galicia. His brother Anton sent a letter from Trieste, acknowledging the agreeable time his son, Franz, had during his travels. {238}

On the 11th the Duchess visited the Dome again, enjoying its beauty, while Zach occupied himself with making some observations from the spire. {239}

Next day they returned to Padua. Zach wanted to make some observations with Santini. They met again with the Abbot Del Negro, who was pleased to attend to their needs.

On their journey from Padua to Verona they had a stopover in Vicenza. Here they met the Scott family, whom they knew from their Weimar days, and with whom they maintained contact ever since. In Verona they also met Antonio, Cagnoli's brother. From now on the two brothers and their families became the travelling couple's constant companions. While Zach made his observations of the big comet of 1807, the Duchess busied herself with carrying out the necessary computations. {240} The scientific gentlemen spent their evenings in the company of their womenfolk, attending social functions organised for them. As a token of his respect, Antonio Cagnoli presented the Duchess with a copy of his book *Handbuch der Astronomie*.

On the 20th of October they set out for Milan through Brescia and Bergamo. They went by way of the scenic route skirting the shores of the beautiful Lake Garda. They arrived on the 22nd. On arrival Zach immediately contacted Oriani and introduced him to the Duchess on the same day. The first meeting was an instant success. Still on the same day she wrote in her diary :

"He seems to be a pleasant and likeable person."

In Milan they also caught up with their accumulated mail. The Duchess had letters from Pasquich and her son, Zach from Lindenau and Reichenbach. {241}

During the ten days they spent in Milan, the inclement weather often forced the Duchess to remain in her hotel room doing scientific calculations. Usually they spent their evenings with Oriani, for whom the Duchess developed an ever-growing friendship.

In connection with his passport Zach had to visit Sr. Prina, the minister, and present to him the letter written by Otto, the Ambassador in Paris. They often entertained the minister Moscati and De Cesaris from the Observatory of Brera. In the evenings they usually formed a group to observe the Comet of 1807, which was at the time still visible. {242}

They started on the next stage of their travels, this time to Geneva at 6 p.m. in the morning of the 3rd of November. Oriani kept them company until they boarded their coach. Farewells were said and hearts were heavy. The following lines reached Oriani from Geneva on the 6th of November :

> "Today I am making my pen wet once again. My first task, my greatly esteemed friend, is to thank you for your bountiful hospitality extended to us during our stay in Milan, and to apologise for the manifold vexations I made you put up with in entertaining us. I have also been asked by the Duchess to express her appreciation for the four hours you have spent in our company, also for the delightful salads and desserts with which you have delighted our palates."

They continued their travels through Pavia, where they had a few unpleasant experiences. The Chevalier Scarpa, their old acquaintance, was 'not at home' for them and Mr. Lotteri, the famous mathematician, to whom they have extended their hospitality in Gotha, had completely forgotten that they were coming. {243} Geneva was then regarded as part of France; consequently, on crossing the international border from the Kingdom of Italy, their papers were subjected to a thorough search. Finally, under these difficulties Zach managed to lose his passport, so he arrived in Geneva without any papers whatsoever. {244}

Plans for Erecting New Observatories in Genoa

The first acquaintance Zach met in this town happened to be Mr. Pezzi, a military engineer of Colonel's rank in the French Army, amateur astronomer and previously a professor at the University of Genoa. {245} He recommended the use of the spire St. Lawrence's Cathedral as an observation platform. Later on Zach made use of this location to make regular observations.

Among other things, Pezzi had dreamed of establishing a permanent observatory in this town. Zach also wanted to enlist Oriani's help for this enterprise.

In spite of Zach's intention to make his stay short one; he did not want to waste a single day without doing some useful work. So, he somehow obtained a copy of Mechain's determination of the town's geographical co-ordinates, and started to work on checking their accuracy.

In 1807 the weather conditions in Italy were rather inclement, so they were prevented from immediately travelling to Marseilles, as they had originally planned.

While Zach became increasingly involved in planning an observatory for Geneva, the citizens of Geneva, who, until the Napoleonic occupation, used to live in an independent city-state, did not think conditions were settled enough to support such a project.

Zach wrote to Oriani on the 8th of November 1807 :

> "When Mr. Labun arrived to organise the Ligurian Republic and to establish a French Institute, he brought one thousand Francs for this purpose. When the discussion turned to the subject, the good citizens of Geneva did not even bother to stand up or to open their purses. I think this action must have taken some guts. When the discussion turned to astronomy, the same thing happened."

He closed his letter with the words :

> "Weather permitting, we shall set off for Nice today." {246}

Five days later he had to inform Oriani about a change in their plans :

> "The deluge is upon us, with sea-winds to boot. We cannot tow the ship to her mooring, and we cannot retreat to the safety of the hills. To make our distress complete, we have nothing to do, due to the cloudy skies. I can see neither the Sun, nor the stars or the comet. The Duchess shows exemplary patience and self-denial sitting by the fire and calculating latitudes and longitudes, using your

formulae. I try to fight boredom by trying to seek new contacts in this town." {247}

Who could these new friends be, who are referred to in Zach's letter to Oriani?

One of them is Multedo, a "poor devil", and a respectable old bachelor, formerly Professor of Geometry at the University of Genoa. Zach thought him to be a shy and timid man, "a goat grazing only at the edge of the field, incapable of making his own way". He has not the gift of the gab. I would not let him defend me in court, though he is an obliging sort of fellow. Multedo did his best to talk Zach into applying for a professorship at the University of Genoa, just vacated by Volta.

Pezzi, already mentioned, was the exact opposite of Multedo. He always "ploughed his own furrow", and could twist anybody round his fingers using his fabulous intellect. It follows from the foregoing, that Multedo and Pezzi were not on the best of terms. Both were professors at the University of Genoa. Pezzi was a man who "has seen the world" and loved to travel. When he was away on his travels, Multedo had to stand in for him, without receiving any compensation.

Zach gave Oriani the following account of his new acquaintances :

> "I try to entertain myself in this town by making new personal contacts. I have met a very interesting person, a naval Commander, a Mr. Escalier by name. He has made several voyages to India and acquired a good knowledge of some oriental languages, he is the author of several books, the first among which is a large Seaman's Dictionary. He is a »gentleman born and bred«. He received me cordially, his manner being just as polished as the professors' from the University of Padua … I have also made the acquaintance of old Jacques Durazzo who lives on the Balbi road. He is a »dear old thing« who has a great interest in science. He has a library of majestic proportion and a neat 'scientific cabinet'. We spent hours and hours among his political publications, talking about matters of war and peace, about Englishmen, the Portuguese and the Danes etc., just light conversation without any pretence of scientific depth. (The importance of this contact for both of them will be revealed in 1815, when escaping from Naples to Genoa, Zach found a true home in his house, at least for a few years).
>
> I have also made the acquaintance of Viviani, Professor of Natural History, who is a man of great enthusiasms and many friends. He is of small and slender build, just like a blackbird. Mr. Jourdain, the surveyor, works in the land registry. He is from Naples, small but very active; he has a small circle of acquaintances among the 'night people' of the town. He and his circle appear to be soaking in oil. I have seen today a rather scruffy surveyor, using his dirty instruments. They reminded me of tunnyfish pickled in vinegar … I can assure you that the work of your surveyors in Lombardy is not worth more than 'four horseshoes on a cat with his legs manacled'. (…)
>
> By the way! I must tell you that the new professor of the University of Genoa was inaugurated today. Viviani has made a very grandiloquent speech. He has invited me to the festivities, and I did no fail to turn up."

The inclement weather forced them to give up their original plans of spending the winter of 1807-1808 in their 'Provencal paradise'. He conveyed the news to his friend Oriani (who was in the meantime elected Mayor) in an amusing letter, which is worth quoting verbatim :

> "Today we have 'made camp' and settled down in Genoa. You would be pleased with what I am doing. I am busy; I even have to snatch time from sleeping to write this letter. I am fully occupied with the building of my observatory, and

I have only very little time left for my friends. You will see that this observatory is going to flourish in this maritime city, and will make its mark on the progress of Astronomical science. The building had been left empty and neglected for a long time before I found it. The instruments are also in a very poor condition, there was nobody to care for them, and they were neglected and misused. Nobody took trouble over their proper storage, the room in which they were kept, the attic and the basement, were never cleaned. These premises did serve only as shelter for pigeons, hens and as miserable dwellings for rats and the concomitant cats. The latter carried on with their love life on the Dollond Quadrant, while the cock-turkey used the Canivet passage instrument as his perch to rest on. Putting an end to their forty-five year rest, I have sorted out and cleaned these instruments until they were brought up to the average European standards of maintenance. At present I can use the following instruments :

1) One passage instrument (3′) of Canivet. This is the instrument described in Lalande's Astronomie. It has a date mark of 1762. It is a portable instrument and it is in good condition.
2) A Dollond type quadrant on a circular pedestal, in rather worn condition, with a 15″ screw type nonius, a good enough instrument of its kind.
3) A Parallax telescope of 3′ 6″, made by your friend Meghele. The instrument carries a label: 'Jos. Meghele Prov. Austr., S.J.', dated 1773. This instrument comes with a circle divided by angular hours, and another circle showing the angle of declination. It is equipped with a rhomboidal net. This is an instrument of very mediocre quality, but it is still serving the state in its way. I am told that it was very much used by Signore Reggio.
4) A 2′ cathoptic telescope, made by Short, in good condition. I have cleaned its mirror using Herschel's method, resulting in complete rejuvenation.
5) An excellent 2′ 6″ achromatic telescope (…)

I call these instruments 'good', because they have remained in existence, surviving perhaps decades of neglect. When I took them away from the hens and doves, smiling at their puniness, they started to obey me, particularly the passage instrument, which it was very important to set up in the plane of the meridian. When I was setting up the chronometer, I felt as if I were visiting another century … Space is the main problem. Alas, science needs money and scientists are poor. The rich are reluctant to cough up, they are sadly lacking in spiritual and mental virtue. These compelling and urgent considerations forced me to select the Botanical Gardens of the University as the site of the new observatory. It is on the road to Balbi, and used to be owned by the Jesuits. Its Southern horizon opens to the sea, the Northern to the hills. From the East and West the site is completely uncovered; it is easy to observe from there the altitude of the surroundings. Around five o'clock it is possible to align the parallactic telescope with the meridian. Luckily, there is a little hut on the premises, which used to be a Chemistry laboratory, presently occupied by Viviani, Professor of Botanicals, who uses it s winter storage for his specimens. Fortunately I have already established contact with Viviani, who is in charge of the teaching activities. He takes pleasure in promoting science and has explained to me his research activities. I, in turn, consulted him about my ideas on the subject of the proposed new observatory. I have already succeeded in erecting two columns near the windows for the passage instrument and yesterday I have aligned it with the meridian. In addition, I have installed the parallax instrument and its moveable circle to their intended final place. The Duchess is very supportive of these activities, sitting nearby on a three-legged stool.

Having already subjected Viviani and Multedo to some tuition on the subject of practical Astronomy, I am now endeavouring to teach them how to use the instruments for the determination of the Sun's altitude and for the observation of stars crossing the meridian.
I have not yet succeeded in making an Astronomer of Multedo, as he is – using Philippe's word – 'ungeschickt'. {248} He tried twice, but cannot see anything through the telescope. He may go blind, if he perseveres and carries on with it. Viviani is much handier; he is the one who may turn out to be an Astronomer, unlike Multedo, who does not understand the Theory of Astronomy either. There is a living spirit in Viviani, on the other hand Multedo is slow in his movements and apathetic in his temperament, his limbs are paretic and slow in consequence. But this is not the most disconcerting thing about him, but his apparent inability to grasp the importance of the pendulum for our work, that without a pendulum there is no Astronomy. I do all my research in collaboration with the Genoese clock-makers, and I am delighted if I can find anything, however decrepit, to observe with. I am going to try to involve the Duchess in the observation made at the new observatory, she has promised to give us a good pendulum, as her contribution. In Marseilles I made the acquaintance of an outstanding clock against which the other clocks were calibrated, as the clock in Genoa perished during the fighting. My friend, I cannot tell you how anxiously I await the arrival of my trusty old clock from Marseilles. I think that its arrival can be expected in two months, if a good ship can be found in time. Then my friend, you will see the fire we are going to light with it. Without it anything we do in preparation to observe the coming solar eclipse remains dicey at the best. Circumstances permitting we hope to observe it on the coming Sunday. {249} We have made thorough preparations for the event. After completing our observations, we are going to compare our determination of Genoa's longitude with your previous results.
If we do not succeed, my dear and worthy friend, it will be only because of the instrument liberated from the chicken-coop. It would be interesting to see real science made with such instruments. At present it is owned by Franzoni, an amateur astronomer, a wholesale merchant, who played some unspecified role in the – by now – collapsed Ligurian uprising. Not wanting to return home, he has retired in Rome. These matters are important only because he is extremely unlikely to want to use his instruments in the foreseeable future, and he cannot find a buyer for them either. From various people I have learned all about his business affairs, I dug up the details one by one, and it was confirmed by Multedo and Viviani in my belief, that Franzoni would not return here for his instrument, the praises of which I sang to you so loudly.
In all probability, Franzoni will not require his dilapidated shack any more (on account of which he still has to pay rates, albeit only a small amount), and in time will be amenable to selling, and until such a time allow me to use it.
In addition to the finding the astronomical instruments I have made another discovery. I have unearthed some old manuscripts related to astronomy, dated from the years 1690 - 1700. Their owner was the Marquis Salvaggi, who dabbled in astronomy and even carried out some observations, which he published in the '*Memoirs*' in Paris. After making some enquiries, looking for his home, I was shown the 'Gate of Carbonaris'. He was also reputed to having had some instruments. I was very much interested in those, if for no other reason, on account of the observations. The Marquis corresponded with Cassini, Manfredi and other luminaries of our science. In reply to my enquiries I was told that the

Marquis also had left behind an amount of scientific papers. I have asked permission to see these. Their reply was that they are in the possession of a Sgr. Pinello, an odd and eccentric gentleman, at present living in the country, but expected soon to return home. The Marquis Hypolit and Philippe Durazzo promised to act as intermediaries and to inform him about my interest. I do not think that Pinello could have remained in ignorance, were these papers not genuine and to cause trouble if investigated in depth. Until then I have high hopes of gaining access to these documents as I am seeking data on past eclipses, which may help me in the determination of Genoa's geographical longitude.
I should very much like to return to Milan to see you in your mayoral robes."

Zach has probably had some hopes that Oriani, with his newly acquired influence, may be in a position to promote the case of the Observatory of Milan.

Since their sojourn in Milan, he signed his letters as 'A+Z', indicating the closeness of friendship binding them together. Zach always used an intimate tone of voice when writing of the Duchess, who was usually sitting on her chair, doing her calculations while Zach was composing his letters.

The couple kept up the habit of openly appearing together in Italy, just as they did in Bavaria. They shared an appreciation of music and the sciences, for the enjoyment of which they had ample opportunity.

The Duchess was very happy, because shortly after their arrival she had news of her son Friedrich, who was staying in Rome during this time.

She was also very pleased with the city itself. In her diary she wrote :

"Of all the cities I have seen, Genoa is the most beautiful. The ornamentation of the houses and the wide thoroughfares enchanted me." {250}

This time they stayed in Genoa only for a month. The 16th December found them already in Marseilles.

On the 2nd and 3rd December they had a steady stream of guests coming to say farewell.

They boarded a ship on the 4th December. The Duchess had a miserable time, suffering of seasickness. They made port in Nice, on the 12th of December. They stayed in the house previously tenanted by the Duchess' son, Friedrich. In the evening Zach succeeded in observing a stellar occultation.

On their arrival in Marseilles (16th December) they received a call from Thulin, who lost no time in contacting them. Their old cook has also turned up and prepared a welcoming meal for them.

Zach, who hitherto enjoyed nearly perfect health, contracted a serious illness shortly after their arrival, but recovered after only a few days. On the 22nd December he was already busy, making observations on some comets.

On Christmas Eve the Duchess and Zach gave a supper party for all the people in the house and the servants all received presents.

They spent New Year's Eve by walking among the festive lights of the illuminated city. {251}

❋

In a letter, sent to Milan in March 1808 Zach has informed Oriani about the appearance of a new comet. {252}

"Less than a month after your gracious and praiseworthy announcement, behold, the spell is broken by a newly appearing comet. Jean-Louis Pons of the Marseilles Observatory, the obsessive discoverer of comets, clapped his eyes on this celestial

wanderer, obscured by a small cloud, on the 25th of this month, in the constellation of Camelopardalis. It had no tail, and its light was so weak, that we could observe her only through a night telescope. In our achromatic telescope it was very difficult to see. It was prone to disappear from time to time, even in spite of the season. Mr. Pons was himself incapable to acquire a repeated sighting of his discovery before he paid us a visit on the 26th March. The comet has moved away from the favourable position in which it was first observed. Judging from what Mr. Pons could tell us during his visit, it would appear that the discovery was made at 9^{00} PM, on the 25th March. She passed the Meridian at 8^{00} PM next day, and was visible through a meridian telescope … We could also see her for a short time in the constellation Camelopardalis in the vicinity of star #24 (according to Hevelius)." {253}

After this he mentioned a few personal matters :

"… Until then I ought to let you know, that the Duchess wants to thank you for the 1'θ (?). No day passes without our talking about you and the stracchino, and the discussing the unpleasant events which make this century so hard to live in. We want to be in your company while waiting for the second coming. The Duchess is having an exceptionally strong bout of rheumatism, suffering severe pains in consequence."

It seems that this time not even a sojourn in the Provençe could relieve Her Grace the Duchess of her suffering.

In this letter the first reference is made to the nebulous matter of an instrument purchase, which was to cause Zach so much trouble in the future. {254}

"Did you receive the circles from Reichenbach? He has written to me saying that in a short while he will also inform you about them."

Unfortunately they had to take to the road again, as the incursions of the Royal Navy make it too perilous for them to stay in Marseilles any longer. His letter to Oriani, written on the 26th May 1808 was dated again from Genoa. It contains a lively description of the prevailing conditions. {255}

"We are back in Genoa. I feel compelled to acquaint you with our news. We have disembarked here, hale and healthy, on the 24th of this month. We crossed the sea in a privateer, from which we could clearly see the blockading Englishmen hunting in the distance, the signs of the bombardment and burning ships. I gave orders of taking over the ship's navigation, befitting a man of timorous character and an astronomer. Today I have seen the last man o' war through my telescope. To tell the truth, it took us five days to make the crossing from Marseilles to Genoa. All things considered, we had a pleasant passage in beautiful weather. The Duchess was not seasick, not even for a minute. Now in Genoa, we should like to rest and recover from our exhaustive journey before the summer solstice. I am not lacking in the company of astronomers, I have a group here that I have organised when I was here during the last year. I have observed the winter solstice in Hyères. During our stay in Marseilles I have acquired some results that are different from those of Delambre and Méchain. I am rather impatient to find out who is right. It would please me very much if you could inform me of the results you obtained using the Reichenbach circles during this solstice. Alas, my circle is very poor. I hope Reichenbach will correct it. He is a very generous man.

I am making some observations in the Genoa Observatory (next to the University in Balbi Street). The difficult problem is the determination of my observatory's latitude. My telescope is good enough to observe the Pole Star … I proposed this method in my book 'Aberratio und Nutatio'. Do you remember? {256}
… On arrival I have found the Naval Service in the state of complete upheaval. Commodore Escalier is just taking up his new duties (today of all days). He plans to establish a new arms depot in the Bay of La Spezia. This would involve the complete relocation of the whole Naval Service. The Commander in Chief and his full staff would, obedient to the Emperor's unequivocal command, would have to move to a completely new location. The Imperial Fleet must sail on the 1st of July, and must reach blue waters before the 1st of January 1809. Some people think this cannot be done, but you must also know many things that were done, in spite of having previously been regarded as impossible. While these things portend great changes in Genoa, Mr. Escalier has invited me to supper, and asked me to do some geographical surveying in La Spezia.
… Many thanks for your gift-parcel of stracchino, and remind you that you have promised to visit us in Genoa. I should like you to extend your visit and come to see me in La Spezia also. The Navy promised us a ship to use during our survey. I am going to use my astronomical circles for the determination of latitude, and signals for the longitude. If you are wary of the sea and the English, I recommend you stay in Genoa with the Duchess. It will be your task to stay with Her Grace the Duchess, mine to go to La Spezia. In Genoa I am going to leave behind two pendulums and a well cared for passage instrument. With the help of these you will be able to measure time easily and accurately, and to observe the signal fires we are going to light. I am going to make my observations on the beaches of La Spezia … You will be staying in the Albergo di Porta, next to the Plaza d'Annunziata. Please let me know before the 26th or 27th of this month whether such a trip can be fitted into your plans. I cannot leave Genoa because of the coming solstice. This time is also very near to the time when Escalier is planning to leave own. Please send your letter (which, I hope, is going to contain your assent to leave Milan) to me, 'c/o Post Office', as the PO is right across the street from our lodgings. The Duchess is longing to see you and full of affection for your person."

❋

In the end Oriani could not resist such a kind invitation and promised to visit Zach in Genoa. Zach wrote in his letter in July :

"You cannot imagine the joy you caused us with your answering letter, in which you promised to visit us in Genoa on the 4th of this month. First of all, I should like to answer your letter. You wrote that you have never attempted to carry out astronomical or land-survey work with military personnel. Never mind, I have similar experiences with the Major General, who refused to observe with me in La Spezia, although he did not tell me why. I only had one single man to help me, Escalier himself, whose help made it easier for me to handle the instruments. He has also put a ship, together with a pilot, at my disposal. I had to do the rest of the work myself, with my secretary's help. You did not find it necessary to take a part in this work. I have already recommended in my first letter, that you occupy my observation point while I have to remain in La Spezia. You could find room in the University, a few feet away from our hotel. I have also offered you my good passage instrument, a pendulum and a chronometer. You could determine the time with the help of my Werner, whom I could detail to work

with you. He could shout 'Top', when observing the signals I would send from Porto Fino and La Spezia during my observations. You wanted to share your time neither with soldiers and sailors, nor with the Duchess, with the Abbot and with Professors Multedo and Viviani, your two 'cronies'. You can see, My Dear Friend, that your reasons are rather weak, while mine appear to make good sense. In addition the shortness of your journey still leaves you in need of more of the good sea air, which could be so important for your health and well-being. You will not have heat induced choking fits if you stay with Multedo, who thinks Milan is much hotter than Genoa, which is kept fresh and well ventilated by the gentle off-shore winds. After considering all these reasons, your only decision can be to come to Genoa.

Well, My Dear Friend, would you like to know how we fared for the remainder of our journey? All right, as you are such a good boy, and promise to come, I shall tell you all about the details of our further escapades. {257}

If, in spite of all, you had not promised to come to Genoa, then, just to show our discontent, we would have gone to Turin via Alexandria, to progress through Savona and arrive home by way of Switzerland. But, as you are coming to Genoa, the Duchess has high hopes of meeting you, and – if it can be fitted into your schedule – to show us the University of Pave and the knight 'Scarpa Nera'. We shall share all our mundane little concerns with you, but you must promise quickly to visit us and to remain with us till the end of our stay."

The Duchess' desire to meet Oriani again is a constantly recurring motive through all their correspondence :

"The Duchess is 'addicted' to your letters, which are full of herself, and she asked me to express her appreciation and my gratitude to you. You can not conceive how much it would cheer her up to see you again … She refers to you jocosely as Stracchino and Mascarpino."{258}

❋

What kind of scientific questions were discussed in these letters sent to Milan? One ever-recurring subject is Zach's observations made during the last winter solstice and the results obtained which were significantly different from his previously obtained data. The problem, which was to be raised again many more times in Zach's correspondence, that is, the apparent unreliability of Delambre's solar tables, makes its first appearance.

"I am pleased that you have used your Reichenbach instrument for your last solstitial observations, proving the superior quality of this instrument, if I want to measure the obliquity of the ecliptic with better accuracy than derived from the thousands of data acquired by Delambre and Méchain, using their Lenoir type circle, which has an inherent error of a deadly five seconds. {259} (…)

I have already informed you in my letters, that the results I have obtained in Marseilles were very different from those presented by these gentlemen, but until now I could not find a convincing explanation for this. The atmospheric refractive index was very high during the solstice. The difference is greatest in case of the solar tables of Carlini and Delambre, which seem to indicate a similarity of principle. For this reason I was eagerly looking forward to the winter solstice. Twenty days later I could not resist writing a small communication on the subject, stating that the true value of the obliquity is the one obtained by me in Marseille. {260} (…)

You can see from the perusal of the data enclosed, that I have succeeded in rediscovering the four seconds that I have lost in Marseilles. Until then I shall

carry on with my observations, and entreat you to do the same and define the orbital parameters, which, until now, were never yet described with the necessary accuracy, either by Maskelyne, Piazzi, Méchain or Delambre. Let us give a lesson to these French gentlemen and garner the glory for Reichenbach against the Colossus of Ramsden as it was done long time ago by David over Goliath. {261} (…)

On the subject of my previous remarks, my main interest in Delambre's tables concerns my feelings that the tables of the great Delambre were in fact prepared for him by the 'little' Carlini. I have high hopes about my salvation and in learning the smallest details with your help in Genoa and Carlini's in Milan, so that Delambre may be smitten by a great sense of envy when I make my entrance through the 'Paradise'." {262}

❋

According to his plans, Zach wanted to observe the summer solstice from La Spezia with the help of his friend Escalier, but History, again, had something to say about 'the best laid plans of mice and men'.

"I do not want to keep it a secret from you, that all the plans about La Spezia came to nothing. I want you to share a secret, which also concerns you. Perhaps you would think it a blow if I were the only source from which you hear the story. Referring to my previous letter, inviting you to participate in the observations at La Spezia, I must state at once that Commander Escalier has been recalled. His kind and generous nature landed him in the focal point of events, and by his lack of the 'wisdom of the world' he demonstrated his inability of quickly establishing a workshop in La Spezia. He must depart by the 1st of January 1809. His resignation was his reply. He was informed that his successor would be Commodore Dordelin and he himself would be transferred to the 'Great Harbour' (Havre de Grace), which is the naval equivalent of being exiled. Mr. Escalier is due to leave in a few days. Dordelin has not yet arrived. I do not know him, but according to my information he has never participated in astronomical observations or geodetic surveys. He is not somebody like Mr. Escalier, with whom it was possible to develop a personal friendship. This is why I returned the La Spezia Commission. The Bay is infested with Frenchmen. Because we cannot work in La Spezia, I intend to determine some latitudes in Genoa. My second task will be the measurement of longitude, which is a much more difficult proposition. As a preparation for this, I should like to observe some occultations on the 7th of July. {263} (…)

I hope that you will be able to come and help me with the job. It is more accurate and reliable to have it done by two astronomers working together. The local land surveyor told me, that he has a series of good triangulations extending from Genoa to Voghera so I have made a few azimuthal orientations. Perhaps you should do the triangulations from Milan to Voghera. Then we can draw a line from Genoa to Milan using geodesic methods, and then compare it with our latitudes and longitudes determined by astronomy. So I shall augment the enclosed triangulation results with the results of your triangulations and distance determinations related to the meridian and the vertical direction of your observatory. I intend to compare these data with those of Voghera, Tortosa and Novi, these being the three towns, which the Genoan surveyors managed to connect with Genoa. The point of reference is the spire of the cathedral in Voghera, a tower in Novi and a ruined castle in Tortosa." {264}

Politics was not the only impediment to frustrate Zach's endeavours.

> "I am greatly vexed by the rain and foul weather. For example, yesterday, on the 21st of June (solstice day) I was unable to observe the Sun. Who would have thought that today would be even worse. I was hoping to achieve a good determination of the obliquity. I have made some good observations on the 1st, 15th, 17th, 18th, 19th and 20th of June, and by this time I have also successfully completed the relevant calculations. As far as the latitude of Genoa is concerned, I observed the Star β in the Ursa Minor eighty times, but could not observe the high position of its coincidence. I have processed all the data observed by Delambre and Méchain about this star in Paris, Barcelona, Dunkirk and Caracasse. I have also defined the Pole on the basis of Carlini's Tables of Refraction. I have also taken the value of average declination, as determined by myself, into account. Naturally, the values thus determined differ slightly from those of the French. I am using this instrument to obtain my latitude. There are not many doubts remaining, as both my determinations yielded the same deviation and gave identical results. The major part of the difference can be attributed to the different Refractive Indices. Using the Maskelyne type quadrant or the circles of Piazzi give different values for this number and this can account for as much as four or five seconds of the difference. I think the same applies to the Lenoir type circles, but not to the Reichenbach type, which, I think, is capable of settling this sensitive question. I believe this very strongly, and I feel that your calculations also tend to support this view. I also think that Carlini's Refraction tables – which are nearly identical with Delambre's – are also reliable, as they are both based on the same principle. Carlini took great pains over his Tables, and based them on his own numerous observations. Should a small difference still remain, they can be compensated through some minor alteration to Carlini's Tables. …"

Again, he closes his letter with feminine greetings :

> "… The Duchess entrusted me with so many things, that I would need a paper-scroll of several metres in length to account for them all. Come as quickly as you can, she is looking forward to your visit with child-like anticipation. If I were not so fond of you, I should feel jealous." {265}

❋

Fate has intervened and Zach had to change his plans again. The letter he sent to Genoa one day after Oriani's projected visit was dated from La Spezia. He is full of apologies for breaking faith and leaving the city instead of receiving his friend in suitable fashion.

> "… I am sending this letter from quarantine, where the Devil brought me after I observed the eclipse in Florence from the Cathedral where Dante himself has set up his gnomon. Please, do not be angry with me, my friend, for my untimely departure. All that happened is only that the Commander of the cavalry carried me away. It was robbery and violation. If it is of any use, I can quote you the ancient rule: 'Omnia Vincit Amor.'
> Mr. Viviani will carry this letter and will relate the whole adventure, he will tell you about my earthly troubles, his pelagic misadventures and his falling off of his horse in the best tradition of Sancho Panza.
> These events will not delay my homecoming by more than four days. For this I beg your indulgence. I am setting off on the 8th and I shall arrive to Genoa on

the 12th. Until then you will be in good company, in case you should feel bored, Multedo is not the one to keep you amused.
I shall need a day to get to Florence. I shall spend only a day there, another day to reach La Spezia and on the fourth day I shall be back in Genoa. Then you can vent your ire on me as much as you will want to. I shall take a vow of silence concerning the fact that you will enjoy the Duchess' company until my return. Under those circumstances I shall accept any punishment you care to mete out.
Although the weather was inclement, I was observing heroically all the time. I have no desire left except to embrace you and listen to the recriminations which you will, no doubt, heap on my penitent head." {266}

❋

The fact that Zach's next letter, sent from Milan on the 10th September, seems to indicate that Oriani's visit to Genoa was successful. In this letter Zach invited Oriani to visit them on the Duchess' birthday.

"The Duchess feels well today and wishes a 'Good Day' to you. I am organising a conspiracy for tomorrow, in which you are also invited to participate. Tomorrow she will be celebrating her birthday. She does not want to think of it but I do. I should like you to be the surprise guest, so, please come and have supper with us. We shall also invite Carlini, if you wish. {267}

❋

Their second stay in Milan was perhaps even more successful than the first one. The bond between the three of them was made even stronger, if this is at all possible.

"… It is with heavy hearts that we are leaving the 'Street of Three Cloisters' and the 'Land of Friendship' behind us. Now, in Lodi, we have reached the land of murders … we reached Cremona unharmed, where, from three PM to seven PM we devoted our time to admiring the beauties of the town. We did it without books, without travel-guides and we threw all discretion to the winds. This was a rare occasion. We have also visited an antique shop, where we made the following purchases: (1) - a passage instrument made of wood, (2) - a meridian, made in the XIIIth century, (3) - a chronometer, showing the hours but not the minutes and seconds. The first and the last items were real works of art, made in the workshop of Revizza, who, is - besides of being a watchmaker - a professor of mathematics at the local Lyceum. He is a good and respectable old bachelor, who had ample reservations about our guide. He took it on himself to show us the best paintings to be seen in Cremona, starting with 'The Dog and the Wolf', but you can relax, we are not going to emulate the professor of mathematics by inflicting on you a full catalogue of what we have seen, including the stoop. We are also going to spare you the repeat of the professor's lecture delivered on the subject of 'determination of the mean time', with him standing there with the famous spire serving as a backdrop to his exposition. The solstices and equinoxes were marked with dots, proving that this meridian already existed in the year 1200 AD.
I am thinking of a short scientific communication for my Journal. In this I should like to demonstrate that the equation of time was already known in the year 1200, otherwise this Meridian could not have existed until 500 years later. This discovery, even though it does not agree with our present knowledge, is important for the general public and for science. This Meridian is highly visible,

as the largest hostelry in town, the 'Arlequino e Colombina' is right across the street from the church." {268}

This was the first time when Zach enclosed another, jocular, letter with his own, ostensibly written by Jaco, the Duchess' favourite parrot, also well known to Oriani.

In the letter of the 9th of October there is an interesting description of the various stages of their journey to Bologna. In Cremona, after exploring the interesting things the city had to offer, they spent the evening at the theatre. From here they travelled to Mantua. This time the town resembled a swarming beehive in preparation to the Viceroy's expected visit. The Regent, Baron Greimer, organised a ball in his honour, to which Zach's Duchess was also invited. {269}

In Modena Zach had a pleasant encounter.

> "On the 4th day we arrived in Modena. I have paid a visit to Cachiani, the Commandant of the Military School. He introduced me to the Deputy Commandant, who was a Tyrolean-German, and had translated my elder brother's book on military fortifications. I also saw Prof. Bonferri and other gentlemen, who were kind enough to show me their interesting possessions, the most beautiful of which were some holograph letters of Torquato Tasso. Dr. Gall was proudest of a painting, which was authenticated as an original Coreggio. He also prided himself on being the possessor of a holy relic, which consisted of a mere two bones from the upper arm. No doubt it is a case of Centone di Reliquie …"{270}

Visiting Bologna Observatory

They arrived in Bologna at 4 PM, on the 7th October. Zach had planned to remain in the town for a longish spell and to make some regular observations in the local observatory. Consequently he did not wait until the following evening but visited the observatory immediately.

> "Immediately on arrival we went to the observatory without shedding our travelling clothes. I addressed my enquiries to the watchman, who was a big flabby man, rather scared. He looked me over from head to toe. It is my habit to travel in an old and shabby frock coat – which is not always as clean as it could be – in order to disguise the thickness of my wallet. This is my way of trying to avoid the attentions of undesirable elements.
> I told the watchman that, being a man very much interested in art and the sciences, I would very much like to visit this famous observatory, and would show my appreciation if he made it possible. He appeared impressed by my address. He has got hold of a huge key, hanging on a chain and opened the gate in the manner a warder would open the prison-gate. He went first, I followed. I passed a remark, commenting on the necessity of keeping the observatory so heavily protected. We passed through the door the watchman opened into a room full of Egyptian hieroglyphs, Chinese slippers, Japanese porcelains, etc. It is all right, but I wanted to see an observatory. So I was led into more rooms … Animals, minerals, a library, etc. Then we entered the hall of midwives! He left nothing hidden; we were shown everything, the children's doctors, illustrations for the nine months preparation, etc. We also had the added benefit of the watchman's commentaries.
> After this he gave us a lecture on Hannibal, told us about the »Lapis Lazzaroni« and about the inferior »foscoforo« of Bologna, »Caspari Calzedoni«, and of the

marble of Africa and Carrara. Finally, losing my patience, I demanded : »I want the observatory. Are you or are you not the watchman of the observatory?« The answer came : »No, I am not employed by the Observatory, but by the Academy Institute.« »Hell«, said I, »I want to see the Observatory and not the Institute.« »Well, Sir, if you insist, you must contact the Observatory.«

After paying him well, we parted company with the false guide. After waiting for more than an hour, we managed to have a conversation with Mr. Escalier, the real observatory watchman. He was a thickset, canny man, but he has shown us our way. We have found him more obliging and better informed than the previous one, although I can safely assert, that guides and watchmen are like mail-coach drivers. They obey their own instructions only, but they lie enough to make the very stars fall from the heavens. This guide proved to be of the talkative kind. Assuming the manner of a true artist, he seemed to derive great pleasure from showing off the instruments and explaining all about right ascensions, azimuths and declinations, and telling us everything there is to know about the nature of lenses. I asked him whether the Institute's director was at home. I was informed that the director was Mr. Ciccolini. To my inquiry, as to whether the director was a clergyman, the answer was noncommittal. I elicited the information that Mr. Ciccolini very rarely put in an appearance, and that mostly in May. The work of the Institute was carried out by the good Mr. Catureghi, who was at present busy preparing a guest-room for a German astronomer, a certain Baron Zach, due to be arriving from Milan to conduct some scientific work and to search the skies for comets. The guide did not know him personally, but he seemed to be well thought of in astronomical circles. At this point I made my hearty farewell, wishing him a hasty 'good night' and departed for my hotel, where I was supposed to serve desserts to the Duchess, my charming adventuress. I found her in a gay mood. Next day, on a Saturday, between 8 and 9 o'clock, we visited the observatory without informing them of our arrival. The same guide was in attendance as last night. He asked me if I was the Baron Sacchia, who was expected any moment. I gave same answer as Christ gave the gendarmes. He made a sound like a horse biting on the bridle. He asked me about my immediate requirements. Did I wish to see the director Ciccolini? He told me that he is at this time in his bed and he is the one who would show me everything, the observatory and the place where I can store my instruments and see to all my requirements. He is about to arrive soon, and I unpacked my chronometer and my pendulum. He did arrive soon, profoundly apologising and blaming the caretaker for not preparing the observatory for my arrival. He told me that I was in charge and shall have full authority over the whole observatory. He has opened up two rooms with a bed, just in case I wanted to spend the night in the premises. Poor Ciccolini! I think he is completely worn out both morally and physically. He is a man of poor health, full of loyalty and incredibly boring. He is like a badly baked, unsalted fish. I used this time to measure a few solar altitudes with this passage instrument … I made thirty measurements on the Meridian and determined the latitude and longitude of Bologna six times. (…)

The watchman was the same as last night. He pretended not to know me and asked me if this was my first time in Bologna and the first time I had visited the Observatory? He pretended not to know that last night I have visited the Observatory in 'incognito'. This made it clear to me that neither Ciccolini nor his pupils were informed about my previous night's visit. On my part, I have also refrained from referring to those events. And, I thanked the watchman for finding in Bologna what I was prepared for by my talks to Cesaris. Mr. Catureghi

> is the 'factotum' of the establishment; he is the only one who makes any observations at all. Ciccolini does not make any, confirming the watchman's information of the previous night.
> Sunday night … the Duchess was paid a visit by the Prefect of the Military District. He invited her to sit in his box in the theatre. The prefect is a gentleman, he knows my brother, with whom he had business dealings in Verona. I was accompanied by Ciccolini. He is a man well known in high society. He goes to the theatre frequently, just as he is welcome in the coffee-houses of the Bohemians. He is equally well known in the 'salons' of the well born ladies and the court of the Duke of Ercoli." {271}

Catureghi, the only active astronomer in Bologna, visited Zach in his hotel, handing him a letter from Lindenau, forwarded from Gotha. Originally Zach contacted Lindenau about publishing Carlini's Solar Tables. From the replying letter just delivered he has learned, that two big mines and several booksellers went bankrupt in Germany, when, on the Emperor's orders, huge amounts of old 'investment bonds' were returned, making the lead coins lose all their value. The *MC* itself is experiencing hard times, and it is expected, that like a big tree in the forest, will fall in the full glory of its leafage. Zach asked Oriani to convey the news to Carlini and spur him on to continue his work. He (Zach) will do everything in his power to have Carlini's Tables printed either in Pisa or Florence.

Zach closed his letter with the, for him, unusual greeting : 'Ave Maria'.

> "Pray for me to God Almighty, now and in my hour of death, Amen."

❋

In Bologna, Zach wanted make the best of his opportunity to have unhindered access to the observatory and its equipment. Ciccolini and Catureghi, although both were old and frail men, were willing to participate in his work and gave their help unstintingly. Their aim was the determination of the town's latitude with the greatest possible accuracy.

> "I have set up a triangulation grid across Bologna, giving special attention in our measurements to Becci's corner. I made azimuth measurements from the towers with Modena (La Guirlandina) and Ferrara (La Dome)." {272}

In the course of his work he made an astonishing discovery. His great predecessors, Cassini and Maraldi were irresponsible plagiarists. Instead of using the correctly measured value of the vertical direction, they used an estimated one. They used data obtained in 1728 by Manfredius, published on the page 41 of his book, but failed to notice that the latitude quoted in the book referred not to the observatory, but to St. Peter's Cathedral in Bologna. {273}

Zach did not like to use second-hand data, only data that he himself obtained or independently confirmed with his own instruments.

Zach kept his friend in Milan informed about the progress of his day-to-day work. At this time he was the only person whose advice he was occasionally willing to follow.

Alas, extraneous circumstances can sometimes upset the best of friendships. Fortunately, the upset this time was only temporary.

Zach did everything in his power to help his friend in Brera to obtain the best available repeating circle. In his opinion the best instruments of this kind were built by Reichenbach in Munich. Zach placed an order, and paid in advance, for a 15" astronomical circle, to be installed in the Milan Observatory. Later on Oriani thought the cost was too high, and that a 12" instrument, such as used by Zach, would be better for his purposes.

Because it was conceivable that Reichenbach misunderstood the order and constructed both instruments, Zach, never a parsimonious person, made a suggestion, for peace's sake, that his friend Oriani should keep the instrument which he thinks would serve his needs best, while he would keep the other one for himself. He also offered that, in case Reichenbach made only one instrument of 15", he would keep it, and would give his own 12" instrument to Oriani. Oriani's reply is not known, but from Zach's later correspondence it would appear, that he was in the mood to take offence in any case.

The problem caused by this instrument remained for several weeks a recurring topic in their correspondence. Reichenbach kept promising that he would deliver the prepaid instrument to Zach personally, travelling in a coach that Zach left behind in Munich especially for this purpose. Zach and Oriani were both looking forward to this meeting, but by the end of 1809 the war situation made it impossible.

The Duchess' peace of mind was also perturbed by other things. Friedrich, her younger son was coming to Rome to spend the winter. He transferred his whole household and lived there on his own, devoured by his anxieties. The Duchess wanted to meet her son at all costs, but she also needed reassurances about her own position and about avoiding any unpleasantness. But the situation in Rome was rather tense. The person of the Holy Father was criticised and he was under chastisement. Under the circumstances the sudden appearance of a 'heretical Duchess' might have been perilous, so she, with aching heart, gave up her plan and decided to winter in Pisa. {274}

The Duchess and Zach as Unwelcome Visitors in Rimini

On the 24th November Zach and the Duchess departed for Rimini. His aim was to repeat the longitude and latitude determination, which Roger Boscovich has carried out in that city. Both of them were looking forward to visiting this town, of which hitherto they heard only good things.

Their disappointment was proportional to their expectations. On the 19th of November Zach wrote to Oriani from Bologna :

> "I arrived in Rimini carrying an official residence permit and entered the office of San Marino's old and venerable Doge. I did so in the firm belief that I was about to enter 'Paradise on Earth' … but I was soon reassured by the rulers of the city that the passage of time did not mellow the old customs and usages of the city … they declared with the courage of asses, that I shall not be allowed to stay in the town for any length of time. So they told me to leave Rimini without achieving my purpose. I had this dishonour without flinching. They made it appear so that I was at fault for having bad manners and not they. I quote a Provençal proverb saying that a Provenceman is willing to tolerate a bit of spittle, but only on his moustache."

Finally Zach managed to complete his measurements with the help of the Abbot Don Paolo Barbetti. He lost no time in making friends with the abbot, who personally interceded with the city council on his behalf. There the Abbot was also shown a letter from the Senate of Milan, which stated that Zach – this man – "should not be given access to any material pertaining to past events that took place in Rimini". {275}

In the end they stayed in Rimini until the 25th of November. During this time Zach was able to identify the elements of the triangulation grid on which Boscovich's measurements were based. With the help of Barbetti, Zach could meet some of the surveyors who personally took part in Boscovich's original survey. In addition, they identified one of the original instruments used in the original survey. {276} The

rediscovery of the old survey-grid was not without difficulties, but all the obstacles were overcome with Barbetti's help, who also took part in the work.

January 1809 found them again in Pisa. The friendship with Oriani was still not completely free of stresses and strains. The cause : the old and insoluble problem. Reichenbach completed only the 15" circle. He has given his promise to deliver it in person in Milan. Zach was also preparing to go there for the occasion. Of course these trips were impeded by various reasons. The Duchess could not travel during the winter months. The winter climate in Milan is much harsher than in Pisa. The confused business of the instrument's purchase still preyed on Zach's mind. His letters to Oriani are full of excuses.

> "… I went so far as leaving my horses in Munich, so that your instrument could be transported to Milan. I plead 'not guilty' to the charge of being the cause of the eight weeks delay … After all, it is our business to see to it that, if the matters to discuss are of such importance, to see to it that the clouds themselves should not prevent us from reaching the great day. I hope that Reichenbach, if he does indeed come to visit you, will work strenuously for our reconciliation, I also hope that your esteemed colleagues are exerting themselves to this end. Pax, Pax, Pax, Amen. {277}
>
> I have written to Reichenbach to inform him, that the Duchess and her full retinue – including the miserable Jaco – will be in Milan around the end of February, but if this can not be, I shall travel to Milan on my own, while the Duchess may stay in Florence, in the company of her dear friends, the Duchess of Albany and Miss Gore, whose father and sister are bound to the Duchess with the threads of a twenty year old friendship. Even so, I am not very pleased to leave her on her own." {278}

Zach also informed Reichenbach by letter that he wanted to meet him and Utschneider in Milan. He asked them to remain there until the end of February.

> "How could I hope to express my joy over the prospect of meeting you, my dearest friend, and Utschneider in Milan? I wish I could fly into your arms. Alas, our precious Duchess must miss the pleasure of meeting you and Mr. Utschneider. I think, that I am presumed incapable of providing her in Milan with the appropriate nourishment. Please remain in Milan till the end of February. I have the Duchess' promise that she will come to Milan before then, together with the expected amelioration of the weather conditions. Otherwise, if you can not stay in Milan until the end of February, the Duchess will raise no objection to my travelling to Milan on my own, for a brief chance to admire your instruments." {279}

In his letters to Reichenbach Zach refers quite openly to the complications he 'got himself into' over the purchase of the 15" circle.

> "Oriani does not require the 15" circle any more, so I should like to keep it for myself. In its place I should let him have my present 12" circle and a simple 8" theodolite. Both instruments are in the same condition as they were when you have last seen them. All they need is a good cleaning, which perhaps you could do for me in Milan." {280}

❋

Zach continued to busy himself with editing the *MC*. He kept receiving occasional contributions from his astronomer friends and he also continued with his practice of

writing about his experiences during his peregrinations, the observations he performed at various places, and his geographical surveys in Italy.

He wanted to publish his Italian experiences in book form. In Pisa he even found a publisher. During his travels he came to like very much the incomparable ambience of the scientific life of Tuscany. {281}

Since the imprisonment of Pope Pius VII, the international situation was showing signs of increasing stress. The Italians came to regard the French more and more as occupying troops. Rumours were spread about the Pope's intentions about the restoration of the Jesuit Order. In his letter of January of 1809 Zach refers again to his old enemy, Liesganig.

> "You should know, that in Austria, where the survey of the 'heroic' Jesuit was repeated, it was found that Liesganig was 21° out in the triangle between Wildon-Urban and St. Magdalena. The plain truth is that it is impossible to see St. Magdalena from Wildon. Liesganig thought that the first chapel he sat eyes on must have been St Magdalena. Consequently, the Jesuit Church of Varad, which, according to Liesganig, is 3111 m. east of Vienna, is in reality 1422 m. to the west. This amounts to a difference of 4533 m. Meanwhile everybody is full of admiration for this charlatan. Next time when I go to Milan, I shall relate the whole story to the General, including the impending restoration of the Jesuit Order." {282}

February of 1809 found Zach and the Duchess still in Pisa. Reichenbach still kept promising that he would come. Lindenau had sent a trunkful of books for Zach and Oriani to Milan. The parcel contained, among others, Ephemerides from Berlin that were essential tools of the everyday work of the astronomers. There was no way for Zach to travel to Milan, as the Duchess was suffering from ill health during the whole winter.

> "We are poorly, as a dog with only the sun to feed him. This is the second day when I am under such a stress that even the small residue left of my brain is completely confused and perplexed. The Duchess is having a bout of rheumatism and fits of coughing. She is in pain all the time, subject to coughing and vomiting. It is like living in a hospital." {283}

In spite of all this, Zach kept working on the reporting his astronomical and geographical experiences during his travels. Prof. Rosini, professor of Rhetorics at the University of Pisa, was one of the best printers of his age. According to Zach, the beauty of his printing was rivalled only by Didot and Bodoni. The professor offered to print Zach's Travel Book and his Solar Tables.

> "When you see my small set of Solar Tables in print, you will realise, that there is no comparable printer in the whole of Italy. Even if I had had them printed in Paris by Didot, they could not have come out better. I have mentioned to Rosini the Solar and Lunar Tables of Carlini. The professor would be willing to print them also." {284}

Zach dreaded the Jesuits' regaining their old power. He was deeply concerned about the impoverished state of the ordinary parish priests. He was especially anxious about Father Del Rico, who, without a home and without enough money even to buy bread, was forced to resort to begging. Zach wanted to give him twenty-five Louis d'or, to make his life a little easier.

In his letter, dated from Pisa on the 20th of February 1809 Zach had enclosed a few whimsical notes to his friend Oriani. {285}

"Letter from Jaco, the feathered biped, to his Dear Friend,
the un-feathered biped.
If I did not love you as the 'apple of my eye', I would not have the audacity to disturb your peace with my plans and complaints about the undeserved sorrow, caused by your letter, full of good things about the good and meritorious masters, but ignoring your friend, the most faithful of your humble and obedient servants.
So, just for my own consolation, I have refrained from eating anything but nuts and tried to learn correctly to articulate the name Barnaba, so that when I enter your city again, I could cry out from the bottom of my little heart: 'O, Oriani'. Shame on the rooster, who would forget poor Jacot. Until then I shall do nothing but think of the happy times to come, when you will have some time for your most darling Jacot, whose mission in life is to prove that he can make glorious noises by singing your praises to earth and high heaven."

From the memoirs of Chamfort
"The public is like a modern tragedy: absurd, horrid and barren. In France there is no public and there is no nation. The nature of the French is a cross between a supine dog and a prancing ape. The French jump about like monkeys, but they are ferocious as dogs, but still manage to lick their master's boot."

Moniteur
"The spirit of commerce is unfathomable by mere man.
Commerce can create luxury, but ignores morality. It shuns the light as it thrives on speculation. It is impossible to find any upright men among the partygoers and the frequenters of public bars."

❋

Zach's hope of meeting Reichenbach in Milan was shrinking every day.

"To tell you the unvarnished truth, I believe that Reichenbach is not going to reply and is not going to turn up in person either. I think he is not going to finish his objective on time. He is like the alchemists, who can get only so far in their preparations, but never manage to produce real gold. I am afraid that Reichenbach's objective will be finished 'sometime', but not before. … {286}
… My Dear Friend, you will not believe the difficulties we are having. The Duchess is looking forward longingly to meet you again. Even Jaco himself is embarrassed. His heart cannot produce anything to be praised, as all the plans seem to be in ruins. This month I am preparing the 'bonny' nuptials and planning the 'get-together' between Leghorn, Pisa and Lucca.
Today I am suspending this holy matrimony. I am afraid of your letter to come, which, on arrival, is likely to disturb our triangle. I am afraid I am becoming a maniac about picking up two big sticks and measuring the bases myself … fertilising them with the small triangles, which are prone to transform into a huge force in an incomprehensible way … (…)
We spent nine days in Leghorn, where I have managed to perform a few observations. Now we are back in Pisa, to observe the forthcoming equinox. Because you made me so sad, I sought solace in the hills of Pisa. There I found three exquisite places : Verucca, Tanto and Sta. Juliana. From the first two Leghorn and Florence are clearly visible. I shall inform you of everything. The tables of triangulation are based on your specific proposals. You will have to decide whether the proposed nuptials are to your liking or not. I hope you are

not going to reject it and refuse to give your blessing. Please give me only fifteen days to collect the necessary official papers. I have already got the signatures. When we meet, I shall inform you of all the details." {287}

Writing about his Tuscan studies, Zach summarised his experiences for Oriani as :

"… I am sure you know that the scholars of Tuscany set themselves apart, and not only of others of their ilk in Italy, because they are acquainted with the Tuscan language. The peasants are reciting Ariosto, without understanding it. There is much to be known about them. When they get together, they behave politely with heartiness forced with total sincerity. There is much goodness in them, openness and loyalty; they dislike intrigue, troublemakers and 'mud-slinging'. They look at the world with clear eyes, their intentions are constructive, consequently the Florentine and Pisan scholars can live in peace and ride their individual hobbyhorses. Such are their positive qualities. According to Brunacci's memoirs, the whole of Tuscany is obsessed wit the spirits of the Macchiavellis, the Vivianis and the Scipios. Due to my limited knowledge of Latin, I cannot say more on this subject and anyway, I know how much you dislike politics. … (…) The Duchess has to be content with sending her greetings until we acquire an apartment in the Street of the Three Cloisters, although I have my doubts on this score, because I heard in the local cabaret, that war is unavoidable. So Mr. Reichenbach will not be able to finish his objective, he will not travel to see us, and he is not going to arrive in Milan at all. You can see, my friend, how one thing follows from another. I feel honoured by the emotions towards me which you show in your letters."

In this letter (21st March), Zach uses words like marriage and nuptials rather ambiguously. It is possible that he refers to some sort of an association to pursue common political or scientific objectives. On the other hand it is reasonable to assume that the Duchess and Zach might have been thinking of legalising their liaison in the sight of God-almighty. Then it is conceivable that they might have been discussing marriage plans between the three of them. This could explain why the Duchess' letters are full of urgent expressions of her longing to meet Oriani.

❋

On the 26th March 1809 they were still in Pisa, but they have given up hoping for the grand meeting with Reichenbach.

"… Finally, it is my opinion that Reichenbach is not coming. War has already been declared. {288} The lens is not going to be completed, and plans for Reichenbach's trip have 'gone down the drain'. Even so, I shall make my way to Milan, even if I have to borrow the legs of a goat, if only to equip your circle with a big, strong hammer, and by delivering a big blow to your crate, to reinstate your small circles and your theodolite. We shall also try to sort out the problem of the big circle. We shall only do this because the objective was not delivered … Reichenbach has given us a chance to set up the instrument – for which he did <u>not</u> make the objective – better than it could have been done with his participation. …"

Zach did not like to give up his plans, but when he absolutely had to, he was quick to adapt his plans to the altered circumstances. And he was very much looking forward shortly to be visiting the city of 'nightingales' and of 'mascarponi' and 'stracchino'.

Still, Oriani had to wait a few days before the meeting could take place. The Duchess wanted to spend Easter in Leghorn, where there was a Protestant Chapel and a

Pastor from Saxon-Gotha. Zach, being a Catholic, wanted to celebrate in the Cathedral of San Miniato in Florence.

> "After we satisfied the demands of our religion and partook of the Paschal Lamb, we shall be on our way and fly to Brera without delay." {289}

Meanwhile, the Rosini Edition of the Solar Tables was published in Rome. It gave Zach great satisfaction to learn, that The Tables, although they were only two francs to produce, were approved of by Oriani himself. Mr. Rosini had already have sold a few advance copies. Rosini wished to bring out a set of Lunar Tables, arranged on the same lines. Zach gave the matter some thought, and found a simple but individualistic way to present them. He planned the Lunar Tables as a volume on a grander scale, including the necessary appendices (parallax data, latitudes, diameters, etc.). He hoped that it would be easier to handle then the 'Broda Lungo' of the Bureau des Longitude.

Following his 'managerial' bent, he spared no time and effort to persuade Rosini to publish Carlini's Solar and Lunar Tables, of which he had a high opinion. He felt that they would sell very well in Italy. He would have also liked to order a number of copies to be sold in more northerly lands.

For a long time Zach felt a self-assumed obligation to determine the angle of the Ecliptical plane and the Earth's equator, with an accuracy greater than hitherto obtained. For this sort of work the solstices are the most favourable times, but unfortunately, he was prevented from completing the necessary observation by his present peripatetic way of life and by unsuitable weather conditions. Although he planned to include in his tables to be published, some corrections to augment his previous data, but he did not succeed in establish he true reasons for the existing anomalies. He had also failed to grasp the rules, which explained the very necessity of these corrections.

❋

In his letter dated from 26th of March 1809, Zach again enclosed a jocular 'Jaco' letter :

> "My Dear Friend and Patron.
> I cannot express the joy I felt in my little heart, when I have received my gay Oriani's gay little hen as a present from my kind and gracious mistress.
> I am growing wings to match hers, and learning the ways of flying creatures. I have already made some attempts to fly to you through the window, to bring to you my Mistress' kind regards, but she always manages to catch my spurs and holds me back. I am in despair, because I must tell you that my Lady does not want to travel to the country, but wants to spend Easter in Leghorn and dip her fishes in salt water. I, who have already done this, would only be an impediment to her, like the poor rats in the cathedral, which are keeping the priests amused in their confessionals all the world over. When my Mistress returns, I shall be bad and misbehave, and clip the nails of the great Baron, who always makes fun of me, who is nothing but a parrot, filling his spiritual father's mind with drolleries. In my opinion you should not be told of this, be you a Bishop or a miller. Until then I must greet you with a quick 'Eureka', with jaws dropped and tail wagging.
> Your loving and faithful friend
>
> Jaco Perique." {290}

As indicated by a letter of 12th April 1809, the trip to Milan was still being postponed. The weather is unseasonally cold. Spring should have been there long time ago.

"Here all work is buried under the snow, which covers everything to the height of chimney tops. The Duchess, who sends you greetings from the land of ice, is suffering very badly from the winter's hardships. She is vomiting and coughing a lot, and keeps herself to her corner by the fireplace. She will just have to put up with it in Florence, just as she would have to in Milan or on the top of Mount Blanc. It is impossible to tell when shall we be allowed to start on our long awaited journey to Milan."

The Duchess wished to re-rent their lodgings of last year with the help of Oriani, but Zach wanted to stay at a different place. Last year's place had only one window, opening to a smelly barnyard, where cooking smells from the kitchen mingled with the stench of manure from the stables. {291}

Consequently, in Milan they dared not stay at their previous place, though they had often done it in other towns.

They wanted to reach Milan from Florence via Bologna and Mantua. Their plan was : To beard their dear friend in Brera on Friday, the 21st of April.

The existence of such a plan is verified by the quoted invoice, without indicating of its timing. The only thing that is certain is, that on the relevant day they were still in the city :

"I, the undersigned, hereby certify that on this date 273 Louis d'or, that is 6448 franks and 26 centimes was received from the Abbot de Cesaris, representing the value of a tripod supported repeating circle, made by Reichenbach of Munich, to be handed to the bearer against his countersigning of this invoice
Dated in Milan, 6th July, 1809

Francis, Baron de Zach"

❋

On the 9th October 1809 Zach and the Duchess were in Turin, getting ready to depart again for Milan. This letter is worth quoting from, as it is full of interesting episodes. The tone of the letter is uncharacteristically light-hearted. In Turin they were surrounded by gay companions. They were Zach's kinsmen, in whose company the Duchess felt at her ease.

"What the Devil are we still in Turin for? Turin and Turin again! There are many reasons for our not having reached Milan as yet!

1) Half of the town's inhabitants are my kinfolk. Cousins, nieces, aunts and uncles. For me the most engaging one is one of the cousins, a young widow of 28, the Marchesa Graven. She became my favourite. She is the sister of my cousin's husband, the Count Faverze. His other sister is married to he Marquis Fonteni. I am the one who holds them all together like a big family and keeps them entertained, connecting them with the social world of Piedmont and Savoy.
   I am also keeping in touch with the good Orillon, the brave Bayenod and also with the Knight without fear and reproach, the Jesuit ecclesiastic Dechales. I have found this last acquaintance rather wearing, but I took my revenge on the secular mathematicians. These hordes of my kinsmen have won the Duchess' heart, who took a shine to my cousins, who are all very charming, though occasionally prone to indulge in silly talk.
2) The other reason for the delay is the conveyance itself. You know that Mr. Dalmacia is among saddlers what Newton is among scientists. He builds coaches for all Europe, from Lisbon to St. Petersburg. He also gives a one-year guarantee. We did not want to miss the chance of acquiring such a vehicle,

surpassing even our Berlin coach both in the city and on the open road. It has cost a mere 250 Louis, but we only had to pay 98 gold pieces now, the rest on completion. It only needs a few minor alterations.

3) The third reason is that we have suffered a robbery in the Hotel London.

This is the story : I was in the middle of my preparations to serve the wishes of the Marchesa. On the day when I was expecting her, I found that my large diamond and my golden cross were missing from their box, which I kept in my wardrobe, under lock and key.

I talked to the servant I suspected, telling him that if he returned the goods, I shall let him go, otherwise I shall hand him over to the French soldiers, in which case he will be shot. Next day I promised a reward of fifty Louis to the honest finder. Then I found the missing jewellery in my pocket. I have kept my silence ever since.

You may rest assured, my dear friend, that among the cares of looking after my cousins and the efforts of acquiring the perfect coach (let alone the 'robbery'), I have never neglected to practice astronomy.

The Academy is on vacation. The season of travelling and harvesting is on us. I was visited by Mr. Duchaile from Paris, By Mr. Vassalti from London, Mr. Labbe from Calais, the land of his deceased cousin, and by a Mr. Borromée from Milan. Mr. Napione and Mr. Saluzzo are fifteen km. from Turin.

Count Balbi, Ambassador from the Sardian king, present president of the Academy, and Rector of the University is also in town. I am in haste to get hold of the keys to the Academy. I am expecting my friends there, together with the man who is at present in charge of the observatory by day and also during the night. In the observatory I have unearthed a dreadful piece of ironmongery, the sector of Beccaria, together with his repeating circle, which was attached to its spirit level by Fortin. This instrument, standing on iron legs of 18" is, unfortunately rather obsolete and in our own days it can only be of interest to specialists. It was never even touched by Duchelle. It is a veritable, sacred relic, a witness of the past.

I should like to take a closer look at it. Today I am to meet Prof. Michelotti, Mr. Balbi and Mr. Bidoni. Reichenbach is very different from Fortin. It is easy to see why the Piedmontese, living under French occupation, have to look abroad for their salvation. In addition, the Observatory is also equipped with a pendulum, built by Manlin and installed by Berthoud. It is quite new, but it has already been commissioned. I tell you why Mr. Duchaile never made any observations with these circles with diameters exceeding 8". He wants to go to Paris and working with Bouvard, he wants to be a front-runner among astronomers. Mr. Duchaile studied at the École Polytechnique that is where he started his long career. He arrived to Turin with General Menou and became one of his assistants in one of the offices. From here he ascended to the director's post at the observatory. Now he is keeping himself busy in his present place of residence, the local observatory in the town of Montpellier.

If somebody, who does not happen to be the Rector of the University, were to compare his data with those of Beccaria, he would find a difference of 12". They should be obliterated, similarly to Liesganig's.

General Balbi inherited Beccaria's papers. The Abbot Catuso was Mr. Vassalti's disciple and is now his successor to the Chair of Experimental Physics. He is a good, though rather indifferent scientist, who likes peace and quiet. He has not yet been fired by Balbi, and he hopes that it will remain so. The Abbot Catuso is a man who likes the truth and not afraid to spell it out. Beccaria's personality must

be explored before judging its worth. This monk had high ambitions. He was envious and knew nothing about electricity. He was tutor to the Duchess of Piedmont, and as such, he was held in high esteem by the king himself. Ministers stood in awe of him, he was jealous of the young La Grange, who was oppressed and persecuted by him." {292}

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It will be never known, whether Zach and the Duchess have managed to see their friend in Milan before they departed for France. One thing is certain: their letter to Milan, dated on the 9th November 1809, was posted from Avignon. The subject of this letter was the detailed criticism of Beccaria's work done in connection with the determination of the geographical co-ordinates of Turin. Zach had serious reservations about the quality of this work.

"While I am trying to find out what is new in Paris, the poor Flaugergues is in the darkest Egypt. Nobody seems to know anything since the death of the 'Grand Old Man' (Lalande). Astronomy is totally neglected and forgotten. Letters are not answered, not even urgent ones. Everything is at an end. Amen, Amen dico vobis.
… In a few days we are going to Marseilles, to set up house in a pretty meadow near the city. We shall lead the life of hermits, renouncing the perversities of everyday life, devoting ourselves only to matters we deem conducive to our salvation. St. Sirius be with us, our address remains the same : Nicolaus Councler banquier, consul Federation Helvetique, Marseilles, Rue de Rome No. 50.
Thousand greetings to the good Sardian from the Duchess and from poor Jaco of the most beautiful fur and plumage." {293}

Heavenly Years in Marseilles

We can find a detailed description of their 'hermitage' in Zach's letter to Oriani, dated on the 13th of December 1809.

"We live in the countryside, twenty minutes from the city, in a virtual Paradise. A beautiful house, with a wonderful line of poplars, cypresses, small bushes of evergreens and lakes, and blessed with a perfect view of sea and shore from a terrace ornamented with sixty pots of flowers, a case full of partridges, another case full of books and yet another one for fieldfare and yellow-hammers.
This beautiful estate used to belong to a rich wholesale-merchant. Nobody but he has ever lived here, which he did until his death about two months ago. This might have struck him as unpleasant, but not us, who were thus enabled to move into the best living accommodation around Marseilles. At present the house needs a few repairs, but the present owner – a niece, I am told – is willing to satisfy our requirements regarding furniture, wallpapers, etc. At our request she is going to re-upholster the beds and the soft furniture in silk, and also to change the kitchen pots. For the bedding itself and the silverware we are going to use some gifts given to us by my cousin, who lives in Chambery. We are renting this house, containing ten rooms, one dining room, two sitting rooms, one billiards-room and cellars and a coaching shed. The rent is only 1500 francs for a year. At present we are staying in a hotel, but I hope not for longer than until Christmas. I should also like to build a pleasant little observatory. I also have plans to complete my solstitial observations, but do so in the Maritime Observatory, as it is much more suitable for my purpose. I shall start working in our country home by next January at the latest. This will be the second winter

solstice that I shall study in Marseilles. I have no doubt that I shall obtain the same value for the declination as I did last year, and the measured distance will also replicate last summer's results. I paid a visit to Thulis, the establishment's director, but found him in a very bad shape. The poor man is quite dull in his head and practically incoherent in his speech. I took hours for the poor man to recognise me, and I could hardly understand his speech. For the present he is holed up in his own home, but I doubt that he will survive the winter.

I have found two letters on the subject of the 15" circles, which were apparently dispatched from Genoa. They will come into the possession of Mr. Auisson, who will take over the Observatory of Toulouse, as you have – no doubt – been already informed. In his letter he told me that he intends to install these instruments during the Easter vacation, and that he intends to do the job himself. Before he does so, I should like to show him my instrument and compare it with his. I shall also check up on the possible damage the sea-voyage may have caused the instrument. I will also want to look into the matter of the permanent difference, which you have also had occasion to notice in Milan between your circles and mine. …

We must arrange somehow, that I could assist you when you make your first observations with these circles. Then after the 1810 solstice, we could travel together to Munich. Reichenbach's gift for instrument making is extraordinary, and I have no doubts about his instruments being the best I can ever lay my hands on. My only regret is that for the present I cannot see you enjoying the benefits of this unique gift. … (…)

In Paris the instruments made by Reichenbach are not fully appreciated. Mr. Reboul, the director of the Lycée in Marseilles, told me on his return to Paris, that there are doubts concerning the quality of his work. Count Bardi, who is not envious enough not to see a future for Reichenbach, asserts in his letter from Paris, that »in the opinion of the Parisian scientists, especially Biot and Arago, Fortin (the man who defined the Meridian with his Formentera) is to be regarded as the foremost authority on repeating circles.« I had an opportunity to spend some time with him in Turin.

Mr. Reboul also told me that Astronomy is not going from strength to strength in Paris. The Bureau of Longitude de is up to its neck in debt, the Great Senator is running his office like a fiefdom, and he is behaving like a tyrant. Delambre is working on a Handbook of several volumes, which is to be published by the Imperial Press (offshoot of Mme. Courcier's shop. Work is already in progress on the 1811 and 1812 editions. … (…)

The Duchess sends you a thousand greetings and wishes happiness and good fortune to Senator Oriani and Counsellor of the Italian Kingdom (Bravo, Pagliaccio!). My cousin, also called Jaco, who is an impertinent young lassie, joins me in sending her best wishes. The old uncle, in spite of his big fat belly, awaits you with open arms in his villa either in Thocéan or in Romain, ready to embrace his eminent senator either now or any other time." {294}

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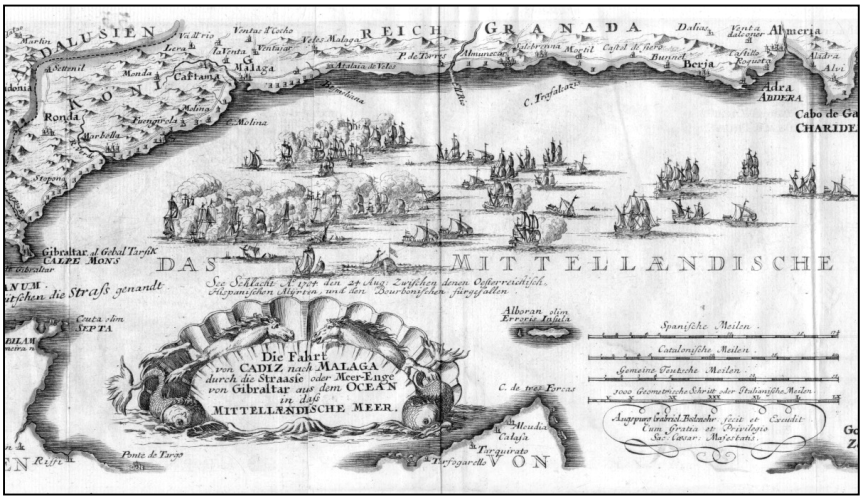
In one of the later letters, written to his friend Reboul, Professor of Physics in Montpellier, dated on the 20th March 1813, we find some interesting details of their everyday life in the villa near Marseille. {295} The main subject of the letter was the nomination of Pons, one of the scientists at the Marseille Observatory, to the post of its Deputy Director.



Although Zach was enjoying good relations with Pons, he was upset about having the former caretaker, who was a 'comet-chaser' unacquainted with the mathematical tools of the trade, appointed to the Deputy Directorship of this prestigious institute.

> "But joking apart, My Dear Friend, what do you think of this tomfoolery… I could accept this farce being played by the Bureau of Latitudes, But the Bureau of Longitudes, an establishment founded by the one and indivisible Republic!
> The most annoying aspect of this is, Sir, that I am the one who is victimised. Who can I now entrust with my shopping, with arranging the delivery of coal and firewood who will move my flowerpots, and fetch my boots from the cobbler and my washing from the laundry? You must know, that it was Pons – known as Ponsillon behind his back in the Mill Hill district – who used to do my shopping and trim my lapdog. I can assure you, that as far as expert trimming of dogs is concerned in a most artistic fashion, you just cannot beat my Ponsillon. Passage of time will deprive me of these little pleasures, as I do not think that an Officer of the State will find it convenient to move my pots, trim my dog and carry my washing and my boots in need of repair. It is a pity, for he was an honest fellow

of jolly disposition, and he was familiar with my little ways. I could trust him with all my worldly goods, and with grabbing the best poultry and sausages when the coach arrived from Lyons. Who is going to shop for me now, and procure best vittles the market can offer. I am in despair. I am also embarrassed about a point in etiquette. Until now, when Ponsillon made his deliveries to my house, he used to eat in our servants hall, and be happy to be seated at the table there. Now, as he is the Deputy Director, I am reluctant to seat him at the same table, but, having no table of my own, I can not invite him to mine either. As you know, I eat at the Duchess' table, where, due to her prejudices, only old noblemen are welcome, whose age at least matches the age of the Duchess' prejudices. …"

These were not the only problems generated by the appointment of Ponsillon a Deputy Director

"My secretary, a pupil of mine, with whom you are also acquainted, who received his classical education from me, who can speak Greek, Latin, German, French, Italian and English, who is versed in all branches of mathematics and the higher level of analysis, who knows all the numerical methods of astronomical calculation without exception, who is sufficiently versed in the subject to complete the orbital calculations of any comets, in four hours, who has acquired a miraculous skill in the techniques of observation, this young man, whom I hold in higher esteem than Burckhardt, as the latter shows no aptitude towards the practical work of observations, and has, as yet, not given any proofs of having any, hitherto undisclosed talent in this direction. Now, this excellent young man has as yet no titles whatsoever, not even a caretaker's job in an observatory, no membership in any Academy, no assistant lectureship in an office of latitude or longitude. He has no official titles, emoluments or wages. His only income is the small monthly retainer he receives from me. This young man is very much »put-out« by having the office cleaner of the Imperial Observatory promoted over his head, so he can not even sit at the same table with him. But there are still worse things to come.

This unfortunate appointment has made my life more difficult where budgets are concerned. Until now I could let the above mentioned Jean Louis receive a few Louis d'or out of my own purse, if he made a discovery of a new comet, without pushing myself to the brink of financial ruin. Now, I expect director Pons will be to shy to receive my »buona mancia«, he is not going to approach me 'on the double', with his cap off, but will find all this below his deputy-directorial dignity. Until now he used to walk down here to see me every day, now I presume I shall have to send a carriage and four, if I want to see him at all. I have no vehicle of my own; I use a rented conveyance, which costs me eighteen Francs every time. So, if, as it was hitherto my practice during the past three years, I were to see him everyday, this would cost me Fr.657 in a year (Fr.6588 in leap years)"

From the above details it is possible to reconstruct the couple's everyday life, their ways of buying their groceries, how they have seen to having their laundry done and keeping their footwear in good repair. Reading it today, it is rather odd to see how full the allegedly republican Duchess was with the prejudices of their time.

The ironic tone of the letter should not mislead us. Zach and Pons were in reality close friends and Pons was a permanent and loyal assistant of Zach in his scientific work.

Later on Zach has left 'no stone upturned' to have Pons appointed as Director to the observatory of Lucca, which was later to be founded by Zach.

The general tone of the letter suggests a feeling of financial security and general contentment.

Zach could not perceive that Napoleon's throne was getting shakier day by day, and that their good days were not likely to last another year.

Their visitors shared this sense of well-being. Zach's home in Marseille was visited in 1810 by Lindenau's friend Gabelenz. He wrote to his wife :

> "The hospitality of the Duchess and Zach was excellent. We had feasted on a meal of thirty-two courses. After a long absence from my home, my sketchy knowledge of historical events was brought up to date."

Two years later, in 1812, Lindenau himself paid them a visit. He also found the prevailing circumstances congenial.

The secretary referred to in the letter was Carl Friedrich Werner (cca. 1782 - 1824). His name is first mentioned in 1803 in the *MC*. He was working with Zach since he was thirteen, and his work was found satisfactory. 1813 was the last year when his name was mentioned by Zach, referring to the computational work Werner has carried out for publication in the 1817 volume of the *Nautische Tafeln*. Zach wrote about him on the 10th march 1824, in his letter to his friend, the consul of Switzerland :

> "Since Werner left me to 'take up his horns', I am having to do without a secretary."

Zach had made a significant contribution to French science during the past decade. His first observations were published in Lyon. When he revisited the observatory in Lyons in 1811, he has found it completely changed.

After 1810 Zach has not spent his time in the South of France in idleness, although this time he could not rely on the helping hands of his old friends. Saint Jacques Sylvabelle, with whom he corresponded during his London years, has died in 1801. Thulis, whom he met in 1786, while accompanying Ernst II, and with whom he also maintained a correspondence, was severely ill and remained so until his death in 1810. Consequently he needed to make some new contacts.

One of these was Reboul, Professor of Physics in Montpellier, the addressee of the previously quoted letter. After 1810 he was to help Zach with his geographic surveys. When Lindenau visited Marseille in 1812, he helped Zach in the examination of the results of Cassini and Lacaille.

Zach compiled the results of his labours in the South of France and had them published under the title : 'Attraction'. {296} Lindenau, in Vol. I of his *Zeitschrift für Astronomie* gave a long and favourable review of this work, which was said to contain a rich store of useful data and to sum up the result of Zach's processing of the data he obtained by working for several years on the geodetic survey of Marseilles and its environment. {297} In his measurement of high precision the difference between the results obtained by trigonometry and by astronomical methods, was less than two seconds, which was attributed to the effect of the attraction of Mount Minet. This assumption was later to prove very influential in the practice of determination of geographical positions.

Even François Arago was satisfied with this piece of work, even though he was later to sling a fair amount of mud in Zach's direction.

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Bernard Lindenau made every effort to carry on with the work of his master. The *MC* was regularly published even in Zach's absence. In 1808 Lindenau was officially installed as Director of the Seeberg Observatory. In 1810 he published his 'Tables of Venus', followed next year with a 'Tables of Mars'. For the latter work, he was awarded the 'Lalande Prize' by he Paris Academy.

In 1812 August, Duke of Gotha, gave his permission to have the damaged observatory renovated.

In October 1813, in the 'Battle of Nations' near Leipzig, Napoleon was gravely defeated. On the 31st March 1814, Lindenau travelled to Paris, in the company of August, Grand Duke of Weimar. In Paris, on the 28th May, he suffered serious wounds in a duel. Zach immediately rushed to his friend's side, and procured the services of an excellent surgeon from Lyons. Lindenau was in a critical condition, but he recovered and returned home in August 1814. In 1815 the *MC* closed down. As its successor, Lindenau and Bohnenberger (also Zach's erstwhile pupil), established a new periodical under the title of *Zeitschrift für Astronomie (ZfA)*. In their introduction the new editors pledged themselves to remain true to Zach's legacy. Between 1815-1818 they published six volumes. It was closed down only when, in 1818, Zach started a new periodical in Genoa under the title : *Correspondance Astronomique*.

Lindenau finished with Astronomy and devoted himself henceforth to politics. After 1820 he remained in Gotha as a minister of the Saxon state. Until the death of the Duke Friedrich, he was the 'de facto' ruler of the state.

In July 1813, a few months before the Battle of Leipzig and the fall of Napoleon he still felt safe in the South of France. In his second letter to Reboul (13th July 1813) he wrote jocularly about the disturbances that were 'allegedly' spreading all over the country.

> "You will remember the stone bridge across the river Jarret, which you also know very well, near to the village of Mr. Mendret, where we occasionally stayed and enjoyed the rural tranquillity during our pleasant walks. It just happens that this bridge was the battleground, the scene of a horrible slaughter. Overcome by curiosity, I wanted to see he appalling details with my own eyes. So I made my approach the next day from the direction of the town. I proceeded slowly and cautiously and reached as far as Rome Street without mishap. Then I noticed two mounted men running towards me. My luck was in, there was a cobbler's shop around the corner, where I found refuge hiding under a heap of old boots awaiting repair. I suffered no harm apart from a good scare. After the event my rescuer the cobbler related that the horsemen were but two officials, trying to get to their place of work. Here are the authentic details of the heroic action :
> The forward patrol consisted of a solitary peasant, carrying a rifle. Another peasant carrying a wine-cask represented the troops. The rear as brought up by another peasant with a pitchfork. Their conspiracy was directed against the local customs house. Its aim was to smuggle the wine-cask into the city. A soap-boiler, a good Frenchman and good citizen, brimming with civic virtue, informed the authorities of this conspiracy, reporting the imminent arrival of nine thousand armed peasants bent on sacking the town. …
> … Yesterday I heard that there is something afoot also in your part of he country. As I have told you all the details of our military activities, I think justice demands that you reciprocate in kind." {298}

Reading between the lines of this jocular letter, it can be seen that law and order has ceased to exist, at least in the South of France. Zach would have liked to establish themselves in safety, but after the Battle of Leipzig the likelihood of achieving this dwindled to practically nil.

Zach and the Duchess found themselves in a precarious position. They were hoping to find refuge in their favourite city, Genoa. The Sardian Kingdom was restored to independence under Vittorio Emmanuele I.

In November 1814 Zach was still writing to Oriani from Marseilles, but his next letter in December informed Oriani of their arrival at Genoa. They had every intention of settling there, but their plans were changed, because of a letter from the King of Naples, the brother in law of Napoleon, offering him a commission to establish an observatory in Naples under very favourable conditions.

Books written about the history of the observatory in Naples all acknowledge Zach's contribution to its establishment.

This 'meritorious commission' has proved a dangerous adventure for Zach.

Zach and the Duchess Try to Start a New Life in Naples {299}

After his ordeal in Russia Napoleon could never re-establish his dominant position in Europe. His opponents cherished the same hopes. In the 'Battle of Nations' the French Army was mortally wounded.

After saying his tender 'Farewell' to his wife, Marie Louise, the Emperor fled from Paris on the 29th March 1814. Two days later the city came under the occupation of the King of Prussia, Friedrich Wilhelm and the Tsar of Russia. On the 12th April Napoleon attempted to kill himself without success. During the same month peace was declared in Fontainebleu. The French state was obliged to pay substantial damages and the Emperor was exiled to the island of Elba. He remained there until the February of 1815, and then he returned to France for one hundred days. The Emperor lost the decisive battle at Waterloo in 1815. In the same year Austria, Prussia and Russia ratified the so-called 'Holy Alliance'. According to the decisions arrived at the Congress of Vienna, the unity of the state and the church was restored, Austria regained her lost territories, Prussia was allowed to annex some new lands, and the Bourbons were restored to the thrones of Sicily and Naples. Joachim Murat, who returned to the Emperor's side during the hundred days, was executed. Genoa came under the Sardinian Kingdom ruled by Vittorio Emmanuele I. who, in 1821, renounced his throne in favour of his younger brother, Carlo Felix.

In 1819 the Karlsbad Conference of the Holy Alliance brought forth a resolution about banning all revolutionary ideas through all the lands of Europe. The order of Jesuits was reinstated. Italian Jews were again confined in ghettos.

In 1821 Napoleon died in exile on the Island of St. Helena, a victim of poisoning. After his death, his memory grew into a legend. After his execution, the same thing happened to Joachim Murat, King of Naples. After the return of the Bourbons, only his popular reforms were retained the people's memory.

This was the historical background against which Zach's journey to Naples, in search of security and a chance to do some useful work must be viewed. For the Duchess the pleasant climate of Naples was the main attraction.

Murat started to build his observatory in 1813, at a place called Mirandois, near Capo di Monte.

In February 1815, when Zach arrived in Naples, the foundations and the superstructure of the building were more or less finished. Zachari was in overall charge of the building, the same man who was also instrumental in issuing Zach's invitation to Naples. The builder was Stefano Gasse, who must have seen Zach's 'Solar Tables', as the building now taking shape was showing striking similarities to the Seeberg Observatory.

In December 1814 Zach and the Duchess were still in Genoa. Here they met Reichenbach, who was going to supply the instruments for the new observatory. It was the wish of King Joachim that Zach was to come to Naples, and take responsibility for the

remaining stages of the building. To this end he dispatched two naval vessels to serve as their transportation. A Corvette was sent to transport the personnel, and a 'Polacca' to bring the instruments and their other luggage. The expedition left Genoa on the 2nd January 1815. Under normal conditions the trip should have taken about 4-5 days, but Zach's party was not so lucky. On the second night out they were hit by a storm and had to seek shelter in St. Florent Harbour on the Island of Corsica. They had to stay there for seven days, while their ship's damaged bow – section was repaired. During their stay Zach came to possess some interesting data about Napoleon's life from a relative of General Paoli, the freedom fighter. During the night of their departure they sailed into a hurricane and drifted towards the northern shores of the island of Elba. The ship's captain knew that Murat wanted to avoid even the appearance of being in contact with the Emperor, so dared not make a landing there. But the shortage of victuals and the demoralisation of the crew compelled the master to think of dropping anchor. The first to heave to were the barges. They were about one km. offshore. One of Napoleon's vessels was also wrecked, a fate shared with many that night. During the night of the 15th they had to cope with another storm. Zach had thought, that the reason for their many inconveniences could be attributed not only to the weather, but also to the inadequate training of the crew. Not a single reliable nautical calendar or nautical tables aid was to be found on either ship.

The ship on which they travelled carried twenty-four guns. The only aid to navigation was a 6" mirror sextant, which was given to the captain as a present by a British sailor. The *Nautical Almanac*, the *Connaisance des Temps*, and even the *Mailänder Ephemeriden* were completely unknown to the captain. On one occasion he entered the 'travellers' cabin to ask Zach for information about the exact time of the beginning of the next phase of the moon. Zach consulted the relevant pages of the 'Mailander Ephemerides' and produced the requested information to the nearest minute. From the captain's contribution to the conversation, Zach soon found out that the concept of tidal cycles was completely unknown to him. In Leghorn, Zach and Reichenbach used the time of enforced idleness to assemble their instruments.

Immediately after this they were hit by another problem. They had lost sight of the 'Polacca' while rounding the Island of Elba. Should she have been sunk or destroyed, the whole purpose of their journey would have been destroyed with her.

Later on information was brought to them about the landing of the Polacca, so they could finish their journey and disembark in Naples.

Zach was impelled by his experiences during their voyage to write an article to the *Zeitschrift für Astronomie* about the scientific problems of ships navigation.

He thought it to be a mistake to think, though for a time he himself shared this delusion, that by the early years of the XIXth century, ships' navigation had ascended to the level of exact science. It is true that one could learn about its theory and practice from many books, but these books were not to be found where they were most needed, that is, on board ships. This ignorance was characteristic of the mariners sailing the European seas. Their tools and tables of navigation, a sundial and a compass were no improvement on those used by C. Columbus and A. Vespucci. Other tools, such as ephemerides, tables of Astronomy and Navigation, calendars, etc. were not unknown, but regarded as things you could do without. In England, France and Spain numerous books were available on the subject of navigation, but in Italy nobody had bothered about publishing anything on this subject.

Many problems were caused by the mariners' neglect of calculating such things as geographical longitudes and latitudes, essential for setting the course of the ship in the right direction. {300} In Naples Zach's first important task was the installation of the new instruments in the new observatory. At this time he was regarded as one of the best

experts of instruments. The following instruments were expected from Reichenbach's workshop in Munich :

⇒ One 6′ passage instrument
⇒ One 3′ Meridian Circle
⇒ One 3′ Equatorial telescope
⇒ One 8′ Parallactic Telescope

After the 31st March 1815, when he learnt, that Napoleon had left the Island of Elba and Murat threw in his lot again with his former Emperor. On the 14th April he had already arrived in Ferrara. On the 23rd May 1815 the Bourbons have returned to Naples. In spite of these events, Zach and his Duchess remained in Naples for another few months. They wanted to make the best use of their remaining time.

Zach, while being able to watch from his hotel room the unfolding events and occasional street battles with their concomitant outbreaks of anarchy, was still able to carry on with his work at the observatory near Mergolina in relative peace and quiet.

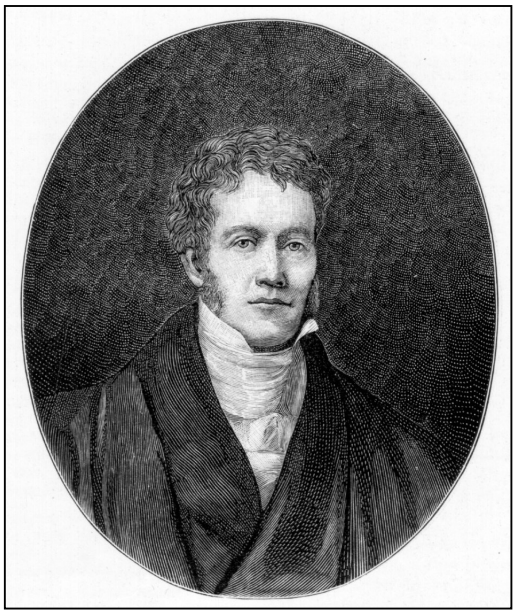
In Naples there was no tradition of practical Astronomy, which is surprising in view of the climatic conditions suitable for practical observations.

Zach reported his work done in this town in the June 1819 volume of the *Correspondance Astronomique*. In his article he quoted several cases in support of his observation, that there is little correlation between the excellence of results achieved and the excellence of the instruments used.

> "The great Kepler died in penury, while he had to make his observations on one of the bridges of Prague. Herschel found Uranus in a hovel, while Olbers found the small planets from an attic-room."

The unpopularity of the practical side of the Astronomer's work did not mean that a few observations were not carried out in the city, but such work as was done was unplanned, uncoordinated, insufficiently instrumented and were connected to special heavenly occurrences, such as solar eclipses, appearance of comets, passages of Venus, etc.

As far as we know, the first observations were made in 1738, by the Jesuit Nicholas Gian-Priamo in the Order's Collegium. The next important year was 1782 in the history of Neapolitan astronomy. In this year a substantial sum of money was donated for the financing of Astronomical research. The money was spent on buying an asimuthal circle from Sissons of London. Using this instrument the astronomer M. Rizzi-Zannoni determined Naples geographical longitude in St. Elmo's Fort. His result was : 40° 50′ 13″.


Sir John Herschel

In 1803 a new Maritime Observatory was opened near the Royal Palace, for which they have procured numerous valuable instruments from England.

Concerning the theoretical aspect of Astronomy the situation was entirely different. In his article previously referred to Zach mentions a great number of old books dealing with astronomical subjects which are connected to Naples, and a great part of whose he can even 'track down' in the National

Library of Naples. The first of those was written by Lucas Gauricus, the 'Mathematician Royal'. It was published in Naples, in 1475. The latest thing was yearly edition of 'Astronomical Yearbook', founded by Murat.

Murat's predecessor, Joseph Bonaparte, has also established a small observatory near the former S. Gaudiest Convent. At the time it was the scene of the activities of F. Zuccari and Cappaccini, his assistant. Zach has also made a few observations here, using, among others, his newly acquired Reichenbach instrument. In addition he has a terrace at his disposal, which opened from their residence, the Palace Ross. From this place, also suitable for astronomical observations, Zach could follow the day-by-day changes in the political situation. All this had taken place in the immediate vicinity of Virgil's Tomb.

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After the Austrian occupation and the Bourbons' return, Zach and Reichenbach were forced to terminate their personal participation in the institute's work, but their written instructions and the guidelines they left behind had a profound influence on the subsequent work of the observatory. Later the Bourbon king appointed Piazzi to direct the Observatory near the Capo di Monte.

In May Zach visited the newly formed Monte Nuovo near Baiae, where he found the lava especially interesting. In May 1815, before their final departure from Naples, Zach performed some azimuthal determinations at the city's several important points. He has made another excursion during the month; he visited Pompeii, the dead city. This was the southernmost point he had ever managed to reach in his life. He was greatly impressed by this visit. He later published his impressions in his new periodical, the *Correspondance Astronomique*, augmented with many interesting historical details.

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As related by Diodorus the Sicilian, Strabo and Vitruvius, the eruption of Vesuvius that obliterated Pompeii and Herculaneum took place in 79 BC. Seneca, who had died in 65 BC also mentioned in one of his books the tragic example of Pompeii and Herculaneum.

Francois Bianchini, the noted Astronomer had already located Pompeii, but the official exploration did not begin until much later, in 1750, under he rule of Charles III, King of Naples.

On arrival to Pompeii, Zach has immediately started on setting up a temporary observatory where he could in/stall the instruments he carried with him (teodolit, achromatic telescope, chronometer, etc.) under the most suitable conditions. In the end he choose the Sanctum of Isis, the oldest temple in Pompeii.

In his choice he was influenced by the fact, that according to the Egyptian practice, it was aligned with the points of the compass on Astronomical principles. Hyginius, an Astronomer of the Augustan age, had already narrated how, on entering the temple through the West portal, he saw the face of the goddess lit up by the rays of the rising sun.

When the French troops moved into Egypt, the astronomers in their train had a chance to check the orientation of Egyptian temples by astronomical methods. These investigations were conducted with exemplary competence by Mr. Nounet.

In August 1815 Zach had a chance to determine the exact co-ordinates of Pompeii. He did this job using the same Reichenbach type repeating circle, which was used by Oriani to solve a similar problem in Rimini.

When Zach tried to measure the Naples – Pompeii distance using data from historical Roman data, he found that the old Roman mile was significantly different from

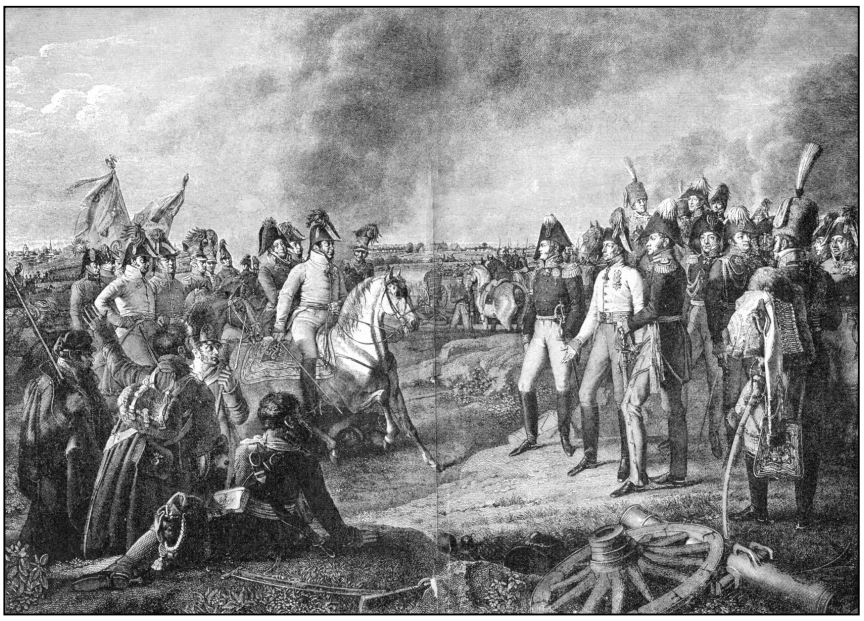
its value in Zach's time. So Zach had made attempt exactly to determine the length of the Roman mile.

✵

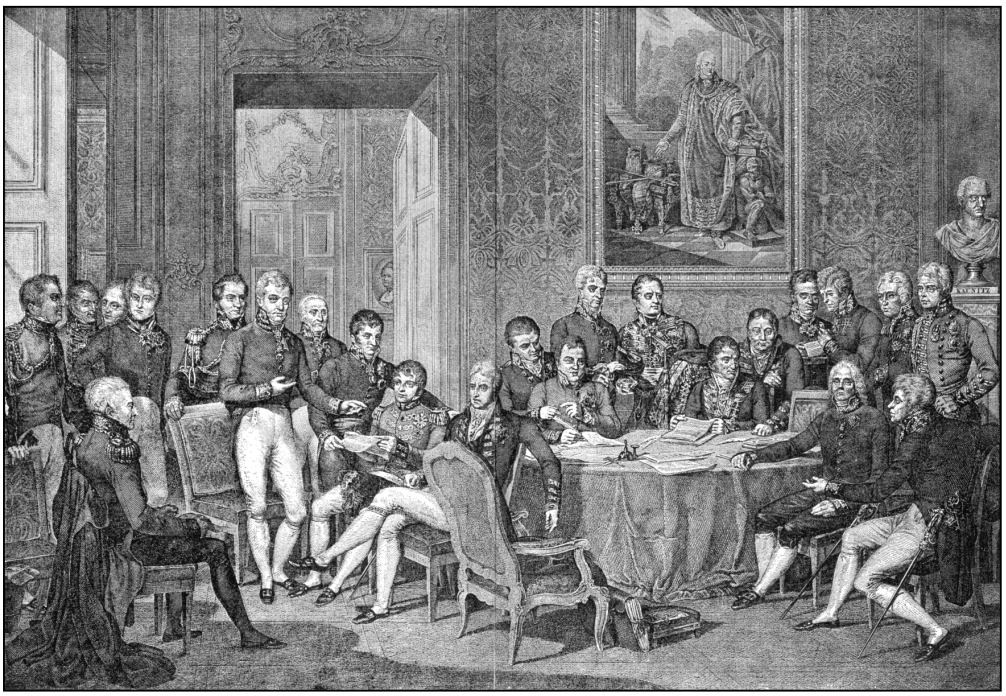
From Pompeii they returned to Naples, from where they continued their journey to Genoa on a Maltese frigate, sailing under the Union Jack. On this ship the only instrument of navigation was an old nautical compass. The ship's Maltese master sailed the Mediterranean using nothing but this ancient instrument. A Genoese ship's master, who suffered a shipwreck in Odessa, also sailed on this ship. He was in no way better supplied with navigational tables than was the Maltese ship's captain.

Zach summed up the times from leaving Marseille to returning to Genoa in this way :

> "The revolutionary upheaval threatening us after Napoleon's fall from power turned us into fugitives. We sailed on a Neapolitan frigate, holding on to our wanderer's staffs, resting in God's hands. We have spent here only eight months in this Babylon, and there was never enough room for us even to build a little shack to find refuge in. The fall of Murat and the new revolutionary changes kept driving us on from one place to another." {302}



The Battle of Nations at Leipzig.



Conference for Peace in Vienna.

PART 5
YEARS OF DECLINE. DRIFTING TOWARDS DEATH

On Freud's Eightieth Birthday

The thorn that once stuck in your foot
has now fallen out.
And now even your death
drops quietly from your heart.

Attila József
(Translated by John Bátki)

1. Between Hope and Despair in Genoa

When Zach and the Duchess arrived in Genoa in August 1816, they were looking forward to years of tranquil security. As so many times before, their hopes were unfulfilled.

In the beginning, the greatest problem was that the Duchess could not come to terms with the climatic conditions prevailing in Northern Italy. In her opinion, there was more wind and rain here than in Switzerland, or even in Eisenberg. Zach wrote a lengthy article in the *Correspondance Astronomique* about the false belief that Italy is the land of sunshine. {303}

The couple's residence was about quarter of an hour's walk away from the town and it was regarded as the comeliest and most commodious building in the whole of Genoa. Zach made proud references to their home, the Durazzo Palace, in many of his letters. They were allowed to live their life in peace there until 1821, the year of Carlos Felix's ascension to the throne. They even built a small observatory in the park. The ordinances of the Holy Alliance, which were formulated in Karlsbad, allowed a few more years of grace to the ageing inhabitants of San Bartolomeo. At first, everything they regarded as important was available to them in this home, which was equally suited to work and their leisure hours. There was no impediment – as yet – to their receiving visits from their friends. Eduard Rüppel, the renowned German botanist and 'globetrotter' spent four months with them in 1820. His purpose was to acquire from Zach the knowledge necessary to the determination of the co-ordinates of various geographical locations, and practical skills in practical astronomy, sufficient to navigate a ship on the sea. In Rüppel's letters sent to his home, it is possible to find many interesting data concerning Zach, whom he called his 'master' and 'benefactor'. {304} The beginning of Zach's friendship with Captain W. H. Smyth can be also dated from this time. This seafarer, who was later raised to admiral's rank, and remained a regular contributor to the *Correspondance Astronomique*, achieved just renown among his contemporaries not only for his excellent seamanship, but also for the solid theoretical foundations, on which the quality of his seamanship rested.

"The Overloaded Donkey"

It was always a burden on Zach's mind that he had to handle all his work on Astronomy practically single-handed. For example, he had to edit his journal *Correspondance*

Astronomique, which he founded in 1818, without help of any kind. He wrote in one of his letters to Kaspar Horner :

> "I am like an overburdened donkey. This is why asinine things occasionally slip into my writings."

His scope for action also became curtailed. There were many reasons for this: the failing state of the Duchess' health, the uncertain political outlook and finally his own health problem, the stone growing in his bladder, in the beginning causing him limited discomfort only, which later escalated to give him spasms of unbearable pain. On the 31st of August 1819, Zach absented himself from Genoa for a few weeks, to take personal charge of the building of a new observatory in Marlin, near Lucca, in response to the request of the Duchess Marie Louise of the House of Bourbon. In his periodical *Correspondance Astronomique*, he published several articles about this new observatory. He also took a hand in solving the problems of leadership, by persuading the Duchess to appoint his old friend Pons for the director's post. {305}

Zach had only one more chance to leave Genoa, in 1820, and even then for only a very short while. On The 7th September 1820, he observed an annular solar eclipse at the Observatory of Bologna. Here he made the acquaintance of Prof. Amici, who returned Zach's visit two years later and gave Zach a Hadley type quadrant, which he made with his own hands. {306}

Unsettled Political Conditions in Genoa

Even though his circumstances were tolerable in 1821, Zach felt rather apprehensive about the future. His own, personal circumstances were only one of his causes for alarm. Being a man of science of enlightened views, he reacted to the realignment of global balance of power with foreknowledge and sensitivity. It was obvious to him that Europe was heading for disaster, because under the dominion of the Holy Alliance the quality of life was bound to become intolerable. From Zach's letter to Horner, dated on the 17th May 1821 :

> "We reached a point of seriously thinking of leaving Genoa … Genoa is full of occupation troops. We can hardly breathe the air, we feel like living in a fortress, or I should rather say, in a camp. We live under a blockade. The 'carbonari' were consumed in the flames old Vulcanus. Nowadays we can only find their ashes, they are as white flowers. Somebody here, in Genoa, preached a sermon from a public pulpit, condemning astronomy. {307} This happened during Lent, on the 11th of March. It was not very effective; it only made the speaker ridiculous. Nothing has changed since the days of Galileo. »Science does not serve religion …« this was preached in one of the important local churches … Oh, Holy Mary!"

In their isolated position, they bitterly felt the need for a friend and confidante. At first, they were making plans to move to Geneva and take up temporary residence there. This was of course unrealistic; they had no earthly hope of obtaining a passport. Their only hope was to invite Horner to stay with them. The Duchess was also looking forward to the reunion, as she had happy memories of the young man that Horner was during the happy old days at Seeberg.

They reassuring answer from Horner arrived in January 1821, promising to pay an extended visit within a short time. Zach replied : {308}

> "You can not imagine the pleasure the promise of your visit brought us and what a joyful occasion it is going to be for us both."

Alas, they were rejoicing too soon.

They were soon to receive a very sad letter from Geneva, dated from the 12th August 1821. It said that Horner's wife was incurably sick, which made it impossible for Horner to leave his family for the time being.

Zach's reply is also full of bad news : {309}

> "The whole of Savoy and the Piedmont is under the Austrian heel. All we hear from them are words of command … We can only hope for a miracle. A French Jesuit posed a question as to whether the Germans do possess a soul at all."

Royal Highnesses Visit Genoa

In his letter, dated on the 13th April 1822, to Horner, expressing his condolences over the death of Horner's wife, Zach provided a list of 'Highnesses', who visited his home during the winter of 1821/2

> "In November 1821 the following members of Royalty came to visit us in Genoa :
> The Dowager Duchess of Saxe-Coburg from Coburg
> The Archduchess Anna Fedorovna and her daughter from Switzerland
> Leopold, at one time first in line for the throne of England and his son from London
> They are all close relatives of my Duchess" {310}

It is strange to think, that while Zach and the Duchess lived in rather reduced circumstances, the Duchess maintained her bonds with men of power and influence, compatible with her social standing. Leopold, who married and survived Charlotte, the daughter of King George IV, were to ascend later to the throne of Belgium.

It could be an edifying subject to study the attitude of Zach towards these eminent personages. On the one hand, they were a continuous source of annoyance for being a hindrance to him in his studies, sometimes for the length of weeks, but he also appreciated their company for the cheer they brought to the lonely life of the Duchess. Many members of this distinguished company, among others the future King of Belgium, regarded the Duchess' Major-domo as their personal friend. Zach was visited in his home in Paris by the future King of Belgium, until his last declining years. Zach wrote to Horner in his previously quoted letter :

> "We said an emotional 'Good-bye' to each other among copious shedding of tears. I cried like an old woman. How inconsistent we men are! Bothersome as these visits were (at least to me) in the beginning, they became just as pleasant, diverting and emotionally charged in the end. We learned to know each other well, and this led to mutual respect. It was a great privilege to get to know my 'colleague', the Grand Duchess's Major-domo. I have found a real friend in him." {311}

❋

Thus, the year 1821 brought Zach another Swiss friend, who 'remained faithful unto death'. They had a very similar background and standing in society. Doctor Rudolf Abraham Schiferli was a constant companion of his Grand Duchess. The Grand Duchess was the divorced wife of Konstanin, Brother of the ruling Tsar. Their liaison was fruitful in producing a little daughter. However, Schiferli was also a family man, having a wife and two sons, who accompanied him to Genoa. Zach developed bonds of cordial friendship not only with the doctor himself, but with his family also. His special favourite

was Moritz, then still a child, whose life was always of special interest for Zach, and who has proved at Zach's deathbed how worthy he was of this friendship.

Abraham Schiferli arrived in Genoa, attached to the Grand Duchess' party, in November 1821, and stayed there until April 1822. Zach has already started to correspond with Schiferli in 1821, when he was still living in Genoa. It is very instructive to compare the letters written to Schiferli and Horner. Horner was the 'beloved disciple'; they had what amounted to an almost paternal relationship. Zach was forever looking forward to their meetings, showing his almost fatherly feelings for the younger man. On his part, Horner remained grateful to the end of his days for the time he was fortunate to spend with his mentor and friend at Seeberg.

The relation of Zach and Schiferli was based on the partnership of two men of equal spiritual and intellectual attainment. The Doctor from Switzerland was attracted by the Jansenist ideas, and his views concerning the world were almost identical to Zach's, who had been steeped in the same spirit during his education among the Piarists. Zach disclosed things about himself, which he would not dream bringing up with others. He wrote about his youth and confessed to the searing pain he felt on losing his friend. Zach felt envious about his friend's family and confessed in many of his letters his regrets of not having been a 'normal' husband and not bringing forth any issue.

The Duchess Charlotte Amalia was also very fond of Schiferli. She had sound, practical reasons for this, as Schiferli, being versed in the science of medicine, was capable of relieving her numerous ailments. Fortunately, he was in a position to leave a successor behind him, when he left Genoa, in the person of Dr. Massara, an Italian physician. He stayed with the couple all the way through their months of mounting difficulties. Zach's first symptoms of a stone in his bladder first appeared while Schieferli was still with them. This time he still succeeded in suppressing the symptoms.

> "My medical condition improved slightly, due to the friendship and skilful treatment received from Schiferli. I have to plan for enduring a lengthy treatment, but for a complete recovery there is no hope." (From a letter to Horner, dated 13th of April, 1822.) {312}

They were granted a few cloudless days.

> "God Be Praised. The beloved patient is free of fever at last. The other bit of good news is that the patient's spirits are on the rise again. Altogether, our Duchess is still very weak; she must be handled with the same care as a newly laid egg. I can just hear her voice, asking me about transmitting her greetings and best wishes to the Grand Duchess, Schiferli and to the whole company. {313}
>
> Please tell my beloved Moritz, that my 'love-letter' and greetings addressed to him will be on the next mail-coach, to squash his belief that I have forgotten him and do not love him any more. I am not the Redeemer, but I do like children as much as he does. There are not many good things in store for me. A world had lost a good husband and a good father in me, but I have only myself to blame." (From a letter to Schiferli, dated on the 4th of May).

His next letter to his Swiss friend, on the 13th of May, strikes a sadder note altogether.

> "The Duchess is in need of constant care and attention. Some good days are followed by some bad ones. Sometimes she has an appetite sometimes she has not. Some nights are good, others are worse. The Duchess suffers it all with the patience of an Angel. Before everything else, I must humbly report that the exquisite volume of Petrarch is now in my clutches, and nobody, let it be the Tsar himself, or a knight or a 'gospodar', or even Podstoy and Utschnitt himself, can

take it away from me. However, the Duchess is also immensely desirous to see the exquisite lines. So, I am forced to lie crosswise on the bed, holding the two weighty volumes in my hands. At first, we feast our eyes on the etchings, and then the Duchess wants to read the poems. This is the time when I let her read on alone and undisturbed, and retire across the hall, to my desk. But then I hear her voice, calling me »come and look at this!« I go and what do I see but my own name on p. 366 of the first volume (in connection with my calculations relating to 'leap years')." {314}

This letter gives us an idea about the everyday life of the exiled couple, compelled to live exclusively on their own intellectual and emotional resources.

Bad News from Gotha

On the 17th of May 1822, Duke August, the son of the Duchess Charlotte Amalia, Ruler of Saxon-Gotha, died at the age of 52, without leaving a male issue. He left behind a single daughter, the Duchess Louise. The sad event was known all over Europe, but it was hidden from the Duchess. Fortunately, she did not read the newspapers. Zach wanted to break the news gently and gradually, after suitable preparation.

Friedrich, the second son was not in the full possession of his faculties and had a weak nervous system. He was also deaf. {315}

Zach sent a letter to Schiferli on the 1st of July, which contained the following lines :

> "Why does Lindenau not write to me? I am beginning to feel that I am nothing but an ox from the Hungarian steppe, or a learned ass from the stables. I have spent thirty-six years of my life in the 'etiquette infested' environment of the royal courts, and still remained an ox or an ass. I have filled the post of 'major-domo' for seventeen years, and you must know what this means. My head is full of thoughts of evil foreboding; I do not know why Lindenau does not write. I am out of breath, I can write no more … I see images of Ossian and Hamlet and colours worthy of Macbeth." {316}

Zach's forebodings were more than justified. Mayhem ruled in Gotha, while the courts of Dresden, Berlin and Weimar recognised the feeble-minded Friedrich as the rightful ruler of Gotha. It cannot be surprising that Zach was deeply disturbed by these events. {317}

Their whole life was robbed of its secure foundations. The future consequences of these events were completely unpredictable. They could put their trust in the wisdom of Lindenau, who, as the representative of the Duke of Saxony, stayed at the court until the death of Duke Friedrich. He was the only person they could trust. At the Ducal court of Gotha there were many people of power and influence, who could not come to terms with the 'irregular' relation of the Duchess and Zach. There were attempts to persuade the Duchess to replace Zach as her Major-domo by a younger and 'more suitable' candidate, but she 'dug her heels in', she did not want to see new faces around her. {318}

The Gradually Deteriorating Situation in Genoa

The city's banking system collapsed, the banks went bankrupt. The Police-Minister of Naples, Canosa, had to remain in the city for several weeks. The wife of General Dison, a notorious personality, became an everyday visitor in the Durazzo Palace, and acted as an informer for the police. The Palace ceased to be homely and welcoming to Zach and the Duchess.

The health of Zach was deteriorating, together with the Duchess'. In addition, he was tormented by an undisclosed crisis in his emotional life. He was an ageing scientist, not given to introspection, or to coping with emotional problems. He confessed it only to Schiferli, in a letter in February 1822, that he had to part with a person who was very dear to him. It is not known who this person might have been, only that the ending of their relationship came as a very great shock in Zach's life, using up a great deal of his emotional resources.

> "It was a terrible reckoning, which I have anticipated with dread for fourteen days. What will my young and upright Swiss friend say and what will he think of an old and heedless cockerel, who had lost his head so suddenly and so recklessly?" {320}

Horner's Visit

It came as a relief for both of them to learn, that Kaspar Horner was about to pay them a visit in the August of 1822.

On the 11th of May Zach was still doubtful of ever seeing his friend again. But the long awaited event finally did come to pass. In July 1822, Horner arrived in Genoa.

They had not met for twenty-five years. It was a long time to make up for. They kept talking to each other from early morning to the late evening. Ten days later, he gave the following account to Schiferli about Horner's visit : {321}

> "Now, after getting over the first ecstatic days of our reunion, we are as Castor and Pollux, working together. We observe, we calculate, we study. We are at our meditations in the morning, at midday, sitting at the luncheon table, at our punch-break and while fermenting our beer. All seven ships of the Dutch Navy are represented in our discussions … We are at sea every day, even though we fail to sail round the world …" {322}

Zach had always maintained a strong interest in seafaring, particularly in providing mariners with reliable charts and other aids to navigation. Horner himself was also busy with the compilation of a similar set of tabulated data. Zach, as he explained in his articles relating to maritime subjects – as published in the *CA* – was aiming to introduce revolutionary changes in the theory and practice of the science of navigation.

Horner also enjoyed his stay in Genoa. In his letter, addressed to his brother on the 31st of July 1822, he wrote :

> "I am leading here an extremely simple life. If the swallows do not let me sleep, I get up early. I busy myself with writing or with my computation until 8^{00} AM. Then I have my breakfast in the company of the Duchess and Zach. At 9^{00} AM I spend a little time in my room, before going out to see the towns, the buildings and the people. During my walk I work up a good sweat, to eat some fresh almonds, peaches, pears and a little bread with some wine. Then I change my clothes and settle down to work again until about 5^{00} PM. Then we seat ourselves at the table and have our dinner. We do not get up from the table until 7^{00} AM. Later we drink coffee, followed by lemonade and cold punch. About 9^{00} or 9^{30} PM, we go to bed. I enjoy the predictability of this uneventful life, it does me good. I feel very contented here." {323}

It was unfortunate that the recently widowed Horner had left his children in the care of his own trusted servants instead of his relatives, so that he had to cut short his visit after eight weeks, thereby greatly disappointing Zach and the Duchess.

In October, Horner's family obligations forced him to return to his home. Zach took the parting rather hard. The two months they could spend together was not enough to make up for twenty-five years of separation. Zach's affection and respect for his one time pupil had deepened during his stay and this did not make saying 'good-by' any easier. Zach was left on his own again to cope as he could with his manifold undertakings.

The Duchess, tormented by her rheumatic pains, kept hankering after more southerly climates. Even in times relatively free of external disturbances, this alone was sufficient to demoralise Zach. He was more and more depressed by the restlessness of the Duchess, and by her inability to settle down anywhere permanently. He did not relish the thought of becoming a 'bird of passage', going north for the summers and South for the winters. {324}

The Congress of Verona

After the Congress of Verona in September, which was honoured by the participation of the Tsar Alexander I in person, the couple's position became increasingly difficult. Immediately after the congress, Zach could only write a short letter of a few words to Schiferli on the 9th September 1822.

> "I am completely at a loss. I can not exchange words with anybody, either in word or script." {325}

In December, he was in a position to tell Horner about some of the details of this fateful meeting.

> "You must forgive me, my dear friend, for not answering letters any sooner. The World is turned upside down since the Congress of Verona. {326}
> I have no news about the state of Astronomy, except that the astronomers of the Roman Catholic faith are being expelled from their observatories, to be replaced by Jesuits. This has happened in Rome to Calandrelli, Conti and Ricchebach. The same thing happened in Milan. Mosotti, fortunately, is in London." {327}

Regarding the last sentence, it must be emphasised that Zach remained a devoted Catholic through all his life, although he had shown great tolerance towards his Protestant colleagues. In one of his letters to Schiferli he wrote :

> "Just between the two of us, I am and going to remain a 'dyed-in-the -wool' Catholic. I am just a simple Hungarian who is incapable of changing his religion." {328}

In another letter, describing the miserable plight of Protestants, he wrote :

> "Ave Maria Gratia Plena. As a faithful Catholic, what could I do?" {329}

Censorship grew stricter day by day. The Director of Post was invited to Verona, where he had to remain for six weeks, to learn all the new rules and regulations. Since the Congress of Verona Zach's difficulties with the local censors sharply increased. Consequently, Zach's nervous system deteriorated to the point, where he became incapable to correspond with his friends at all for four months.

Genoa Is Stricken by a Natural Catastrophe {330}

In October 1822, an unnaturally violent thunderstorm struck at the already sorely tried of Genoa, aggravating the situation already precarious on account of political strife. On the 25th the city was hit by a horrifying storm, accompanied by an unprecedented amount of rain. The onslaught lasted twelve hours without letup. Zach and the Duchess could watch

the flood destroying two bridges on the nearby river. Multedo prophesied the End of the World. The authorities, both civil and military, fell for this, but the general population had shown more common sense.

A Problem Concerning Horner

Added to the hostility of his general environment, Zach had to face a problem of personal nature. He has published an article in the *Correspondance Astronomique*, written by his loyal friend, Horner. Unfortunately this article contained an error, thus giving a – this time justified – cause for his critiques to find fault in his journal. However, as he prized loyalty to his friends above anything else, he drew his friend's attention to the error in the most considerate and tactful manner. He wrote in his letter on the 12th March 1822 :

> "All your calculations published in the *CA* on Rüppel's observations are faulty … The fault lies in your exchanging a '+' sign to a '-' at one place … I think that your mind must have been momentarily distracted by thinking of your dear companion, your beloved wife." {331}

Deteriorating Conditions in Genoa

From 1823, onwards Zach started to restrict and neglect his correspondence with his friends and colleagues.

The reason for this can be found in the unceasing build-up of pressure affecting Zach. The letter he sent to Schieferli on the 19th of March is full of complaints :

> "Please accept my short greetings as the expression of my gratitude for your twelve page long letter, which is charming, pleasant and full of wit. But what else can you expect from the sender of the answer, who is himself nothing but a little man, worn out, parched of spirit, sad and simple of mind.
> Please let me tell you just one story, which will in turn tell you all.
> One of your compatriots, Dr. Brunner from Bern, came for a short visit to Genoa. I think you might even know him personally. One evening a short while ago this compatriot of yours was having his supper in a local restaurant, minding his own business. Suddenly a Commandant of police appeared, in the company of four of his underlings, intent on searching his person and his papers. Dr. Brunner protested, saying that he was not a criminal or an undesirable alien and refused to hand over his passport and letters of introduction. The protest was ignored, and the search was carried out without mercy, and without result … When Dr. Brunner brought his complaint to the Supreme Police Authority of the Kingdom of Sardinia, he had no satisfactory redress. He was only told that the policemen »were only doing their duty«.
> Dr. Brunner had enough of this and left Genoa for Naples." {332}

Meanwhile, because of some misunderstanding, Schiferli appears to have fallen out with his friend Zach. We learn about this from Zach's letter to M. Schläpfer, the Swiss consul, written on the 10th March 1824 :

> "My Journal, the *Correspondance Astronomique* is still going strong and found to be still good value. Only the printing arrangements are subject to change in every seven or eight months. At present the man in charge of the printing shop is a police informer. … I should like to keep sending copies of my Journal to Mr. Schiferli. The financial arrangements have already been made.
> Mr. Schiferli believes that he has offended me. This is not so, it was I who offended him." {333}

Zach was asking Consul Schläpfer to intercede on his behalf and help to restore the old friendship between himself and Schiferli.

❋

The general situation did not appear any rosier in the other parts of the world. The destructive influence of the Holy Alliance had spread beyond the continent. Zach corresponded with Bailey, the then Vice President of the London Astronomical Society. Based on the information thus obtained, he gave the following description of the plight of Astronomy in Britain :

> "His every utterance speaks of misery. He attacked Pond, Brinkley, South and Young. Captain Kater's pendulum-laboratory has also ceased to exist since Troughton gave up his work there. Nowadays nobody produces instruments comparable to Reichenbach's. There are hardly any astronomical instruments left in Cambridge or at the Cape … In short, Astronomy is dead in England. The great 'meridian circle' at Greenwich is a faulty instrument … Their observations are just fabrications. The Royal Society is riven by internal discord … The members are dissatisfied with their president, who used to be an Apothecarian's apprentice. He is not even an academician … The rich Lords do everything in their power to make the scientific life shallow and stagnant."

He closed his letter with the statement :

> "The Jesuits are fully entrenched here, and it is us who will be turfed out of here eventually." {334}

In September 1823, Lindenau paid the couple a short visit. He also had some official business to transact. This was also the time when the Duchess drew up her second 'Last Will and Testament". This was necessitated equally by the situation changed by the death of the Duke August, and by the deteriorating medical condition of the Duchess.

In the April of 1824, a very noteworthy visitor knocked on their door. It was the astronomer Sir John Herschel, the son of Sir William Herschel. {335} This visit was as significant for Zach as Baily's letter. It was a sign, that in England at least, he was still regarded as a force to 'reckon' with.

The letter to Schiferli, sent on the 15th May 1824, is characteristic of their situation.

> "What more can I say? I feel as though I was shut up in the clink and I am lacking the temerity to try to break my bonds. Today I have been just slinking about, like a cat round the boiling kettle; I would hate to have my lips scalded. I should learn not to talk politics with an aristocrat from Bern.
> The Police are taking an interest in my correspondence, so, I expect, I am also a potential candidate for a 'black hole'." {336}

Even under such trying circumstances, Zach had the inner strength to feel concerned for others and lend a helping hand. He learned in December 1824 that the observatory of Lucca was about to be closed down. Zach felt anxious for the future of Pons and his family, who left his job in Marseilles for the sake of going to Lucca.

Finally, due to Zach's intercession, Pons was admitted to the service of the Grand Duke of Tuscany, and was to receive an adequate pension for the rest of his life. Zach's comment :

> "This job was rather heavy on the purse, but at least I have had my way in the end." {337}

Even in the years preceding 1826, Zach was beset with many difficulties. They did not know it for sure, but must have had an inkling, that the worst was yet to come.

He wrote to Schiferli on the 20th September 1826 :

> "During the eleven years I have spent in Genoa, not a single Genoese person came to visit me in my house, excepting my banker. The Genoese were : two medical practitioners, one watchmaker and a printshop owner, The Abbot Degola and his brother, a merchant, Mr. Quartara, our banker. I do not frequent theatres or coffee-houses and do not go to supper-parties, lunches or balls." {338}

In view of the fact that the personal attacks on Zach were usually in connection with articles published in the *Correspondance Astronomique*, I deem it relevant to our subject to mention a few details about the journal.

New Journal in 1818 under the Title : 'Correspondance Astronomique, géographique, hydrographique et statistique' (CA)

At the launching of the new Journal, Bessel greeted the editor in the following way :

> "I hope that this new enterprise of yours will bring to you as much praise and glory as did the *Monatliche Correspondenz*." {339}

In the beginning all was well, as under the rule of Vittorio Emmanuele I, that is from 1815 to 1821, the regime in Genoa behaved in a more acceptable manner, than later under Karl Felix. The King of Sardinia wanted to preserve the appearance of his country's independence, and he also desired to deserve his subjects' loyalty. He was also quite tolerant even with aliens living in his country and took care to allow them to lead a reasonably untroubled life. During his rule, Zach did not have to fight with the censor for every edition of his Journal, which, in later years proved a serious waste of his time and a drain on his overworked nerves.

In the beginning, Zach still could publish articles from authors he knew and respected. He published papers by Gauss, Bessel, Encke, Lindenau, Struwe, Olbers, Schubert, Kruesenstern, Bowditch, Sir John Herschel, Don Bauza, Valz, Flaugergues, Nell del Bréaute, Puissant, Plana, Carlini, Santini, Mosotti, Cacciatore, Ciccolini, Littrow, Fallon, Horner, and Degola etc.

Even at the launching of his Journal, Zach had to overcome various obstacles, even though political conditions were not as adverse as they had later become. He had to work on his own, lacking even editorial assistance. Consequently, he could not give the same attention, even to his own papers, which he used to lavish on his publications in the *MC*. He was also burdened by the necessity to attend to the Duchess' medical and spiritual needs, in addition of looking after his own precarious health. I have already discussed these problems in some detail.

Unfortunately, ingratitude is very much part of human nature. Many people could not forgive Zach for the benefits they have received at his hands. The old scientist, living at first in the state of insecurity and later in total hopelessness, was called to account for every real or imaginary failure or misjudgement his enemies cared to accuse him of.

> "Benzenberg was angry with Zach, because the method he proposed for the determination of the Geographical longitude by studying meteorites, was not appreciated in the *CA* as highly as the author expected. Bürg blamed Zach for doubting his claims concerning his observation of a comet. Schubert complained about Zach having reviewed one of his books not according to its author's wishes. Zach also left a letter from Fuchs allegedly unanswered. Bode objected to

> Zach criticising in the *MC* one of the remarks he made in his 'Jahrbuch'. Rüdiger felt badly about Zach abbreviating one of his articles …" {340}

Littrow wrote to Horner in 1822 :

> "I feel sorry for this good man, this noble stag, hunted by so many ignoble hounds. Now, at the end of a life full of achievement, he should be allowed to take things easy and relax among his friends. Instead, he must live his life persecuted by inferior creatures. His attackers are the recipients of his past largesse, many even owe their present careers to him and his help." {341}

❋

Before giving the details of the two scandalous events touching on the *CA* (Arago's libellous article in the journal '*Annales* …' and the so called 'Pasquich affair'), I should like to introduce the Journal itself.

The *CA* was published in Genoa from 1818 until 1826. Fourteen volumes were printed altogether. It can be seen from all that I have written before, that the importance and quality of this publication can in no way stand comparison with the old MC. In 1800 Zach stood at the apex of his career, he was financially secure and had all the editorial assistance he needed. It is no wonder, that in those circumstances Zach could build up a publication, whose effect was almost revolutionary. Ernest II did everything in his power to give it a secure background of social acceptance. The later 'grand old men' of science, Gauss, Olbers, Bessel and others were still young and for them the *MC* represented practically the only chance to see their name in print. For this reason they all left Zach's efforts to co-ordinate their activities unchallenged, at least in the beginning. The co-ordinating role of the *MC* and its editor in the field of small planets was also acknowledged. The editor was bound to most of the contributors by ties of friendship, which is reflected in the general tone of the Journal. Another outside factor contributing to the successful operation was the relatively efficient postal service, making the quick flow of information possible. The sparkling wit and healthy self-confidence of Zach also had an equally invigorating effect on the contributors and the 'lay' members of his entourage.

On the other hand, the fact that the new journal was not quite up to the standards of its predecessor is not quite sufficient to explain its relative lack of success. Many potential readers or other potentially interested parties were discouraged by the often well meant criticism levelled against it in other publications, from exploring it for the good things it may contain and utilising the valuable data to be found therein.

The volumes of *CA* are an invaluable source of information for those interested in Zach's biography. The details of the 'Naples adventure' are described, besides the results of his observations made in Genoa and a full description of his experimental methods. At the same time, the Journal contained much new material, thereto unpublished.

From these data, the full range of Zach's interest could be established.

The primary concern of these articles is the determination of geographical co-ordinates of various locations, and the introduction and description of new instruments and computational method. Another important field of enquiry concerns refining and improving the methods of ship's navigation on the open seas. Examples of his work of a more theoretical nature are his calculations to determine the orbits of planets or the exact shape of earth, or the accurate determination of the obliquity of the Ecliptic.

He did not live near the centres of Astronomy any more, so it took more time for new data to reach him, than at the Seeberg, in his heydays. Under the circumstances, it does not seem unnatural, that he rekindled his long existing interest in the historical roots of his field, and started to devote his time to books on the history of astronomy. For example, he studied the explorations of Columbus in the light of newly discovered

documents in the Royal Library in Paris (France). He also investigated the history of Pompeii and Herculaneum, the mythology of the Middle Ages, the French opposition to the Newtonian ideas and the history of the Bonaparte family, just to mention a few topics, randomly chosen. {342} In the writings of Zach, historians may still find many things of interest, which have not yet been evaluated, so they are still potentially valuable as source material for today's scholars. Being surrounded by the present day armoury of data acquisition, it is hard to imagine the almost insurmountable difficulties Zach must have faced in the work of assembling his data.

Naturally, the *CA* was also rich in articles on the history of astronomy. The histories of individual observatories, the biographies of old astronomers, the publication of, hitherto unreported, observations on the Transit of Venus in 1761, the reassessment of old observations on various comets were constantly recurring subjects of Zach's articles.

It was Zach's habit to preface his articles with interesting introductions, explaining their historical background. He was in the habit of comparing new discoveries with work performed on the same subject, but some time ago. He did not shrink from pouring scorn on old work proven careless or lacking in accuracy. He liked to challenge the established opinion, and prove their unreliability by quoting his own observations and deductions. The *CA* also published papers on topics of contemporary interest, such as discoveries of new comets, stellar occultations, eclipses etc.). The Journal regularly published Ephemerides of individual planets. He printed news items about astronomers receiving honours, or about the opening of new observatories.

His correspondents were not all astronomers. The names of famous travellers, high-ranking mariners, botanists, philosophers and other scholars could be often found on the pages of the Journal.

I cannot omit Zach's articles about the Jesuits, which were the source of much trouble for our old scholar. I do not want to go into the details of individual articles, but I should like briefly to explain Zach's basic attitudes towards the Order.

First, it is obvious from all that was previously written, that Zach was a faithful son of the Roman Catholic Church.

Zach spent his formative years among the deeply religious, but at the same time highly cultivated members of the Piarist Order. In these formative years of his, the relations between the Jesuits and the Piarists were anything but cordial. The Piarists, who regarded it as one of their tasks to spread the correct use of the Hungarian language countrywide, succeeded in squeezing the Jesuits out of the country's education system. The Jesuit Order was even officially disbanded in 1773. This, of course, did not mean that they had lost all the old influence, which was solidly based on their system of contacts, which they did not neglect to build up and solidify during their years of previous ascendancy.

When Zach made his way to Lemberg (Lvov), he was disappointed in the credibility of the results produced by the scientists of the Jesuit order. He was a young man, so he did not care to hide his opinions under a bushel. This attitude of Zach turned his chief, Liesganig into a lifelong enemy. As it happened, Zach was never quite safe from Liesganig or his secret agents, not even in Seeberg.

On the other hand, it must be said that Zach had never had a cross word about the Hungarian Jesuits or Fr. Maximilian Hell and Franz Taucher. We may find the reason in the fact, that in Hungary the Jesuits blended in with the other holy orders and spent their days doing useful work of good quality, as teachers and scientists at the University of Pest.

In the assessment of the anti-Jesuit articles published in the *CA*, the Spirit of the age must be taken into account. The birth of the Holy Alliance was intimately involved with the restoration of the Jesuit Order. The Jesuits fought against the 'heretic' Protestants, but

they did not hide the animosity and contempt they felt towards the lower clergy of their own faith and towards the lower social orders. Observing the persecution of the Catholic astronomers at the Jesuits' hands especially upset Zach. Another, not negligible, factor contributing to Zach's reservations was the fear for his physical safety, although, and this is characteristic of the man, he has let his fear prevent him from writing what he felt to be true.

In summation, in my opinion Zach would have saved himself a considerable amount of trouble, if he had not started up his Journal again. Even so, the paper was useful to him on the long run, as it was his only chance to break out of his isolation and remain in contact with at least a few of his fellow astronomers.

As far as posterity is concerned, scientists should learn to respect Zach's prodigious efforts, and enjoy the pleasure of finding unexpected treasures of buried information buried among the pages of the *CA*.

An Attack on Zach by Arago, the Parisian Astronomer

It is not in my purview to examine this malevolent piece of writing from the scientific point of view. It would be pointless to do so, as Zach himself refrained from such self-justification. I intend to present a few quotations here, just to show the quality of the paper's general tone, betraying some hidden thoughts and ill will undisguised.

> "For the last three years the Baron Zach has seen fit to publish a new scientific journal under the title of *Correspondance Astronomique*. I do not know of any benefits science may have derived from this publication, but I know that it did nothing but harm to the editor's reputation. {343} (…)
>
> Attacking useful work, done by prominent personalities, is an everyday occurrence. This attitude induces derision, but does not lead to the love of truth. Until now, I refused to stoop to answer Zach's libellous attacks. I was convinced that such 'mudslinging' can only do harm to its author. In this, I was mistaken. {344} (…)
>
> An ardent reader of the *CA* told me, that it was impossible not to believe the man, who had once been the director of the Observatory of Gotha and had compiled many useful tables and had also had the honour of being elected to the membership of many learned societies. The man continued by saying that it might be possible to convince the public, that Zach had relinquished the last traces of good manners, but it would be impossible even to dent the credibility he enjoyed among his fellow astronomers. This opinion I found hard to take, but I am not discouraged. {345} (…)
>
> M. Zach is a very learned man – or so it is said – who can converse in many foreign tongues. He is well versed in the use of 'reflective sextants', and has great skill in the use of the repeating circles. His acquaintance with the use of other instruments (such as the 'meridian telescope') is not so thorough. This can be deduced from the quality of his published results. The reason is probably to be found in the superficial character of his knowledge of mathematics, which can be observed in every page he wrote. My saying, that, as far as spherical geometry is concerned, he is completely ignorant may surprise some people. Later I am going to prove this assertion. In this paper, I shall be well satisfied if I can show that Zach has no idea even of the elements of 'celestial mechanics'. M. Zach's attacks on his enemies are often couched in rather nebulous phraseology, from which even the elements of truthfulness are usually missing."

This last assertion of Arago is obviously very far from the truth. If Zach had opposed somebody's opinions, he invariably did so in a scientific paper, well supported by quoting the relevant facts and calculations. It must be admitted, that spicy remarks had often added colour to his style, but it was never possible to find an untruth, or even a misrepresentation of facts in them.

Here is yet another example of Arago's debating style :

> "The Highly Esteemed Baron might realise, should he choose to pay heed to the preceding remarks, that we are not interested in his threats. I should consider myself honoured, if I would be chosen as the target of his attacks." {346}

This makes it obvious that he has been spoiling for a fight, and only masquerading as a seeker for the clarification of the truth.

Arago also accused Zach of plagiarism, when he was supposed to be using Delambre's results to bolster the compilation of his Solar Tables. In this calumny, he tried to use a letter from Zach, written to Lalande, in which he was asking Lalande to send him Delambre's Solar Tables, because he wanted to check his own results against Delambre's. To look at other people's results, in order to verify the accuracy (or otherwise) of one's own work before publication, could by no stretch of the imagination be regarded as plagiarism. The charge of plagiarism could only be supported by the detailed comparison of the two sets of results. After this is done, the difference between the papers immediately becomes obvious. Discussing Arago's accusations, Kaspar Horner wrote :

> "I have spent two whole years of my life living with Zach. From the first moment of our acquaintance to the last, I knew him for a man of the utmost probity, a straight man of goodwill and noble ideas. Nothing can be further from his character than seeking fame under false pretences. During his whole life, search for truth and justice was the mainspring of his every action." {347}

We should heed the words of a true and faithful disciple.

The Bitter Business of the 'Pasquich Affair' {348}

In the IXth Volume of the *CA*, a letter was published, in which Daniel Kmeth, a Piarist monk teaching in the town of Kassa[7], formerly an astronomer working at the observatory of Buda, had accused his former director, John Pasquich, of knowingly falsifying the results obtained from his observations made on the passage of comets.

If we want to understand this scandal and all its complications, and clearly to see the personal motivation of the participants, we must retrace our steps and go back in time a few decades.

Minor Differences of Opinion between Zach and Pasquich at Seeberg

Zach could probably never admit it even to himself, but he was probably a little jealous of his 'lily-livered' colleague at the Observatory of Buda, whose constant 'moaning and groaning' secured for him a preferential treatment from the Duchess. She often allowed Pasquich to accompany her on the long walks she frequently took, trying to calm him by pouring the healing balm of her sympathy upon his restless soul. Zach, who, ever since his nonage, had only himself to sort out his problems, was rather upset by this 'soft' behaviour. He had a very high opinion most of his fellow astronomers, keeping busy with making their observations competently, concentrating on the job at hand, but it is doubtful if he ever included Pasquich in this select company. On the other hand, it would

[7] Now known as 'Kosiçe', in Slovakia

be a mistake to assume that their relation was openly antagonistic. Otherwise, he would not have invited Pasquich to stay with him at Seeberg for eighteen months. We may safely assume, that he enjoyed the company of someone, who was intellectually his equal, with whom he could discuss scientific problems and who also had a sufficient grasp of mathematics to help him with his calculations.

❋

At the time of Pasquich's visit Zach was at the zenith of his career. He was receiving medals in a seemingly unending succession, including a diamond studded cross, which he received from the King of Prussia. Ernest II, the Duke, died in April 1804. This event completely changed Zach's present position and future prospects. As a 'Minister' under the Duchess, he could not carry on with the life-style, to which he was accustomed. Without giving up his scientific plans, he was faced with the problem of creating the material conditions for their realisation.

❋

At the same time, Pasquich's life took a turn for the better. He had a chance to give some talks on astronomy to the Court Ladies, which made him known in the highest social circles. So, he became accepted in the personal retinue of the Emperor's younger brother, the Archduke Joseph, Regent[8] of Hungary.

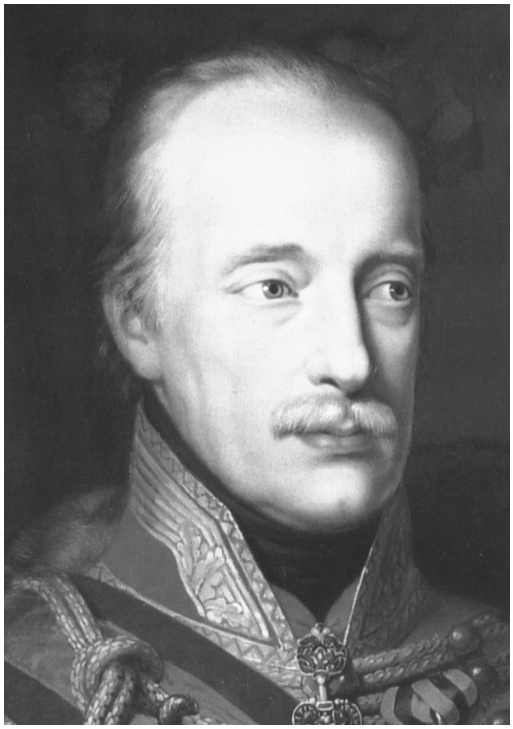
In 1806, Pasquich had obtained the Nádor's commission to build a new Astronomical Observatory on top of St. Gellért's Hill in Buda, to be equipped with instruments to be built by Reichenbach of Munich.

A few weeks after his enforced departure from Seeberg, Zach visited the laboratory of Reichenbach in Munich, where he had a look at the design of the instruments, intended for the new Observatory of Buda. It was no secret, that their design was based on designs made at Seeberg.

At the time of being appointed Regent of Hungary, Joseph did not like Hungary or the Hungarians very much, but later in his reign he established cordial relations with the best representatives of the just emerging Hungarian middle class. He realised that by erecting a new building on St. Gellért's Hill, in the twin cities of Pest-Buda, which could stand comparison with everything Europe could produce, he would increase his own popularity among the local population.

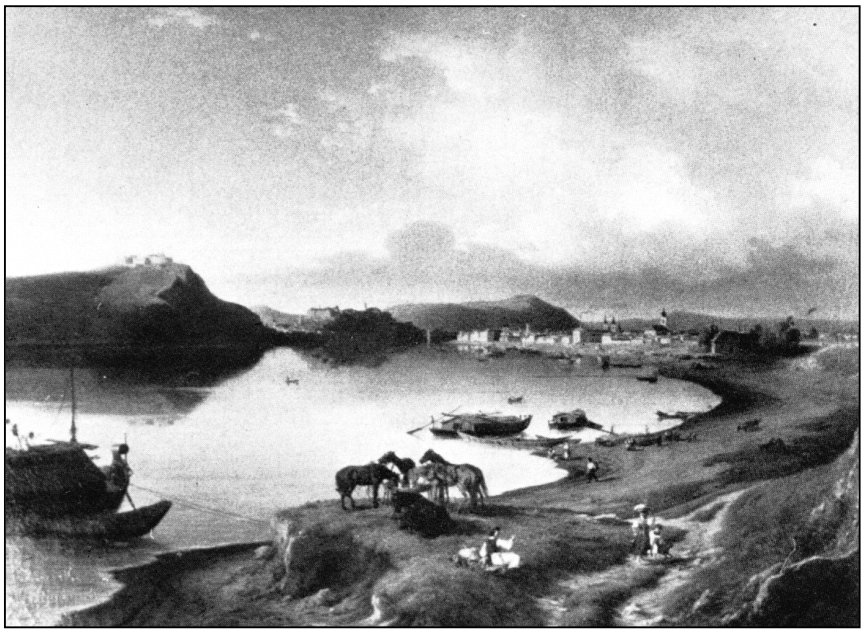
This shows, that at the time when Zach had to struggle to keep his standing in the scientific community, richly deserved by his past achievements, Pasquich was just about to make the first steps on the road leading to real scientific achievement.

It is an interesting fact, that Napoleon's promises were never able to make him accepted by the Hungarians. This was the probable reason for Hungary to be treated by the Holy Alliance more lightly than the other states of Europe.



Archduke Anton Joseph

[8] The official title of the Regent of Hungary was 'Nádor'.



Panorama of Pest-Buda with the St. Gellért's Hill (at left).

Consequently, it was counted as a great honour, when the three rulers of the Holy Alliance States decided to grace the opening ceremony of the St. Gellért's Hill Observatory, in 1815, with their presence. The time was short, so the groundwork for the opening ceremony was completed in haste. On the long term, this decision became the root cause of many headaches and troubles. In its unfinished state the new, beautiful building was unfit for the housing of the delicate instruments, which started to deteriorate rapidly due to rusting.

Pasquich's Difficulties in His New Observatory

Pasquich, who was aware of his uncertain medical condition, was looking for a companion to assist with the new, beautiful observatory, equipped with Reichenbach's precious instruments, who, in the 'fullness of time', could take over as director. His first choice was Encke, the most promising pupil of Gauss. Gauss and Pasquich exchanged many letters over this matter. The plan came to nothing, as the Imperial Court in Vienna objected to the appointment of a Protestant, even though they have never openly advised Pasquich of their objection.

Pasquich, feeling a pressing need for a companion to share his burden, made a fateful decision. He decided to invite Joseph Littrow, an astronomer working in Kazan, to join him in Buda. The Viennese Court also concurred.

Littrow has received Pasquich's letter in the very same hour, when he had to witness the destruction of his personal dwelling and his observatory by the ravages of fire. He accepted and sent a letter to Buda, to express his feelings on the 25th November 1815 :

> "I could not believe my eyes when I recognised your signature. I was longing to write to you from this wilderness … Your observatory is among Europe's most beautiful and best equipped observatories." {349}

To understand better what is to follow, it is necessary at this stage to introduce a new participant. He was Daniel Kmeth, a monk of the Piarist Order. He was working in the Observatory of Buda (which was originally housed in the 'Castle District' of Buda). Kmeth studied and, after leaving St. Gellért's Hill, taught mathematics in the Higher

Education Establishment at Kassa. He was an industrious observer; the single printed volume of observation records coming from St. Gellért's Hill was his work. He had also published several articles on popular astronomy in the Hungarian language. Kmeth, although at first he was careful to hide his feelings, was angry with Pasquich, for bypassing him and appointing someone else to the job and position he felt ought to be his.

Littrow was looking forward to his coming to Buda with pleasant anticipation. He wrote Pasquich a letter in November 1815, promising everlasting friendship. A few years later, in April 1822, Pasquich, in a letter to Schumacher in April 1822, gave this account of Littrow's arrival to Buda :

> "Littrow arrived from Kazan in July 1816. Here, his emoluments included a service flat with heating costs included and two-thousand pieces of good coin, while I was earning about one and half thousand a year. He was cordially accepted in every society, including the Nádor's. Alas, his lack of respect for my person became evident during the first days, after his discovery that I had no intention of handing him the directorship right away. As to the real reason for his antipathy, I could not find the reason for it, until I read it in the 1819 vol. of the Berliner Jahrbuch, where a letter from Littrow to Bode was published. Here I read :
> »I received a letter from Prof. Pasquich not so long ago, in which he stated, that because of his advanced years and his uncertain health, he wanted to discontinue his work in astronomy and that he wanted me to succeed him as director.«" {350}

The two astronomers from St. Gellért's Hill continued to war with each other, resorting to official petitions and propaganda leaflets. This unseemly struggle brought glory neither to 'one of the most beautiful observatories of Europe', nor to any of the participants.

Kmeth had an understanding with Littrow straight from the beginning. Littrow had found a reliable assistant for his scientific observations and a reliable and eager servant of his ambitions in the spiritually flawed monk.

In 1820, Littrow was appointed as director to the Observatory of Vienna. In his next letter to Schumacher, Pasquich gave voice to his hopes and desires :

> "I should like to forget all that took place. The only satisfaction I crave is an acknowledgement, that the treatment I received was by me unmerited." {351}

The poor old man was mercifully oblivious to the fact that the worst was yet to come.

The Pasquich Affair

The comet, that was to bring so many trials and tribulations into the life of the St. Gellért Observatory, made its appearance in the early months of 1821.

Pasquich has made his observations on this comet in February and March 1821, and sent his results to the newly published *Astronomische Nachrichten (AN)*. They were published in the journal's first volume in 1823. {352}

Daniel Kmeth was dismissed from the St. Gellért Observatory because of his intrigues. He also made observations of the same comet, but his results were very different from those of his erstwhile director. In his own mind he became convinced, that Pasquich, who was not an obsessive observer, could not collect his results without using other observers' data for his paper published in the *AN*. On this basis, he levelled the accusation of forgery against Pasquich, and published them in the 9th (1823) Volume of the *Tudományos Gyüjtemény* ('Scientific Collection'). In the same year, Kmeth also sent his

calumny to the *CA*. Apart from its content; the style of this letter was also rather alarming. In his paper, Kmeth has referred to Littrow's article in the *CA* (Vol.7), {353} describing the neglected state of the instruments at the St. Gellért Observatory. According to his opinion, they were in a condition decrepit enough to make it impossible to obtain accurate reading with them. In Kmeth's opinion Pasquich's results 'looked too good', that is they agreed very well with others', such as Bessel, etc., so they must have been forgeries. In both of his articles, Kmeth found great joy in making public the 'originally' observed data of Pasquich, which he sought and, fortunately, managed to discover. According – again – to Kmeth's calculations, these data yielded results quite different from those published in the *AN*.

We can only wonder what could have made Zach to publish such a filthy piece of work. In my opinion, his decisive motive was neither jealousy or ill will, but a sort of 'righteous indignation'. Why could he not settle down and enjoy his good fortune on the top of St. Gellért's Hill? Zach had a high opinion of Littrow, and trusted both his competence and his integrity. Kmeth, had been dismissed by Pasquich, and this counted in his favour, as did his being a Piarist monk. Zach also knew Pasquich as an at best indifferent observer.

It is instructive to observe how a man, by nature fair and intelligent, can be misled by his uncontrolled emotions. Zach was acquainted with Pasquich closely enough to know, that for this man, although of sensitive nerves and given to feel sorry for himself, his integrity and self-esteem were of the utmost importance and his character was really incompatible with committing forgery.

The most eminent German astronomers have drawn a 'line of battle' on Pasquich's behalf. The *Ehrenrettung Pasquich* saw print in the 3rd (1825) Volume of the *AN*. Schumacher, Bessel, Olbers and Encke all made their contributions. They were unified and summed up by Gauss, who had reached the conclusion, that if the data discovered by Kmeth were subjected to the correct mathematical analysis, the results were identical with those published by Pasquich in the *AN*. {354} Thus, poor misguided Kmeth was digging his own grave with the raw data he so 'fortunately' unearthed. This time we do not mean it metaphorically. In less than a year after the publication of the '*Ehrenrettung*', he closed his eyes forever in Kassa, on the 20th June 1825.

Gauss had also given Littrow his deserved rebuff. He demonstrated that for somebody who knows his way about astronomical calculations, it is possible to get correct results even from data obtained with less than perfect instruments.

The 'Ehrenrettung' also contains a sort of self-justification from Littrow :

> "It came to my knowledge, that there were many, who have raised their voices against the article published by Kmeth. I feel that I need to clarify the role I have played in this affair.
> When I saw in print the neat observations coming from Buda, I have received a letter from Kmeth, stating that at the time of the comet's appearance the Equatorial plane was not rectified. From this fact it follows, that without this needed correction it would not have been possible to see a single star.
> »I knew Kmeth as an honest man, possessor of the best certificates … It is possible that, like many other men, I may have been misled by my prejudices. I feel the greatest sorrow about the pain and hurt I inflicted on a man, who did not deserve such treatment.«" {355}

The final word in this affair was said by Gauss, prompted by Olbers :

> "As one of the astronomers, I feel responsible and deeply angered, about this irresponsible, baseless, dishonourable and shameful calumny." (Olbers) {356}

> "Hitherto I have dealt with matters of science only, but how can I separate them from matters of honour and justice. In this respect I am in complete agreement with my excellent colleague, Olbers." (Gauss) {357}

In 1824 Peter-Paul Tittel, an admirer both of Pasquich and of Littrow, was appointed as Director to the observatory on St. Gellért's Hill {358}. As the Imperial Court in Vienna has forgotten to pay Pasquich a pension, he had to work for another year, which he did, enjoying the friendliest working relations with Tittel. In 1826, Pasquich left for Vienna, where he died in 1829. {359}

The tragic persecution of Zach and the Duchess really started in Genoa, in July 1826.

2. Deportation and the Death of the Duchess

Beginning with June 1825 the lives of Zach and the Duchess were torn to pieces by a succession of disasters in the once beloved but by now accursed Genoa. This time of persecution and molestation proved to be a time of beauty and heroism for the unfortunate couple. They survived the horrors and survived the tribulations by equally sharing in each other's pain and suffering. Even in his condition, weakened by sickness, Zach managed to hold his own during the struggles of everyday life. The Duchess, though seriously ill, succeeded in keeping both their spirits up. Both of them displayed a hard core of inner strength. The couple, surrounded by a few faithful old retainers, lived as an extended family, whose source of inner warmth was the radiant spirit of the Duchess. All that came to an end with her death.

Zach reported the event to Schiferli :

> "She is no more. Nothing is left for me on this Earth. What can I do with my endless sorrow and limitless misery? They will never cease to torment me and the others. I should like to tell you in the fewest possible words, keeping it as short as possible, that my only, irreplaceable and unforgettable benefactor left these mortal coils on the 25th April. She went from us in a manner as calm and tranquil as possible." {360}

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From the summer of 1826 onward the health of the Duchess took a turn for the worse. Although she retained her indomitable spirit to the end, and her mind stayed as fresh as ever, her physical deterioration prevented her even to get from her bed to her table unaided.

However, trouble, when it comes, never comes alone. Until now Zach's bladder-stones occurred infrequently, but now they started forming, one after the other, almost without letup, causing him constant, almost unbearable pain. The attending doctors supplemented their various and painful, but mostly ineffective treatments with an equally ineffective but strict diet.

However, these troubles were only the beginning.

On the 17th August 1826, Schiferli received a letter of strange content, written by Ciccolini in his own hand. It was a detailed account of the events in the Durazzo Palace, taking place on the 30th of July

On this day the Zachs' home was invaded by policemen, who informed the couple, who were both bed-bound with illness, of the deportation order issued in Karl Felix I 's name, according to which they had to leave the territory of the Sardinian State within five days. In their opinion, the Sardinian King's father confessor, who was himself a member of the Jesuit Order, must have drawn the strings in this outrage. In their despair, Zach has tried to contact Count Waldburg-Truchsess, the Prussian Ambassador, and asked for his help.

Zach was to be examined on the following points :

1. Zach was a member of the 'Illuminati', for which fact he was under the sentence of death in Bavaria.
2. Zach maintains that Christ's death was not accompanied by a solar eclipse.
3. Zach has written immoral and anti-religious articles against the institution of Monarchy.

4. He ignored the censors' comments.
5. He expressed his joy over the Congress of Panama, and held his resolutions acceptable for Europe.
6. He made attacks on religion and exposed sacred objects to ridicule.
7. He called the Pope's Bull 'Coena Domini' a 'horrible bull'.
8. He wrote a book against the Jesuits.
9. Participated in the assassination of the Tsar Alexander. {361}

The first charge, the basic reason for Zach's deportation, was the most dangerous of all. It asserted that Zach was a member of the 'Order of the Illuminati'. This order was banned in Bavaria by the then reigning Karl Theodore, in 1784. It was led by Adam Weisshaupt (1748-1830). During his exile, Ernest II allowed Weisshaupt to settle in Gotha and even provided him with a small pension. Zach was acquainted with Weisshaupt and introduced one of his books on geography in the *MC*. On the other hand, Zach was never a 'card carrying member' of the order. The factual base of the charge was most probably the fact, that in Bavaria there was a Franz Xaver Zak (1755-1843), who was really Weisshaupt's right hand man. It was probably a case of mistaken identity. Our Zach did not even know of his (almost) namesake's existence.

Concerning he second charge, Zach never actually denied the events accompanying the Crucifixion. He only pointed out the proven fact, that a 'full-moon' and a solar eclipse can not happen at the same time.

The third charge is a completely unfounded accusation. Zach himself many times asserted his faith in the Roman Catholic Church. To publish opinions contrary to the Church's teaching would have been impossible anyway, because they could not get past the official censor's vigilance.

The fourth charge is equally unfounded. Even though it 'went against the grain', Zach always submitted a copy of his journal to the censor before publication. The fact of this submission is certified in each volume.

To form a valid opinion about the fifth charge, it is necessary to read the article published on page 558 of the 13th number of the *CA* (1825). It was true that Zach was in sympathy with the aims and purposes of the 'New Spaniards' movement.

The sixth charge is also pure libel. Zach never exposed truly sacred matters to ridicule. He reserved his scorn for those ecclesiastical persons, who abused their power and scientific authority.

The seventh charge was true. Of the Bull 'Coena Domini' Zach really had a poor opinion. He thought it was concocted by the vassals of the Pope, with too much thought given to matters of this world.

The eighth charge was also based on a lie. Zach had never written a book about the SJ, he reserved his critical remarks to scientific errors committed by individual members of the order.

The ninth charge is also untrue. Although Zach was an elected member of the St. Petersburg Academy, he had never set foot in Russia. He never visited Russia, and he maintained distant, but good relations with the Tsar. {362}

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In spite of the fact, that in his memorandum submitted to the king Zach effectively rebutted all these charges, various calumnies were circulated for a long time about his person in ecclesiastical circles.

In his letter written to Schiferli on the 24th August 1826, Zach gave a heartbreaking account of the happenings in the Palace Durazzo :

"Here nothing has changed. Never better, only worse. The Duchess is sick, taking her rest on the settee. She is ailing in her body and in her soul. Her suffering is beyond words. I am also confined to my bed, my stones causing me pains beyond belief. I am sure you know about the stones in my bladder. Our incredible story is getting more and more incomprehensible with every passing day. It is absurd enough to be ridiculous. Until now, we used to have a yearly visit from our Roman friend Ciccolini, a Knight of Malta, who used always to stay with us during his visits. A few days after his arrival the Superintendent of police had arrived escorted by one of his underlings. He forced his way into our house, which was also the home of an ailing Duchess, and instructed Ciccolini to leave our home immediately. He had twenty-four hours to comply. {363}

Total chaos reigns in our house. We are under a curfew. Policemen are walking in and out during the whole day. Our retainers are completely at a loss. Samuel, who is from Switzerland, wanted to flee our home immediately, his sister, who is a Lady in Waiting to the Duchess, is delirious, calling on Death to succour her. A Genoese lady who was working for us, had a shock, she had to be sent to the hospital, where she died three days later. Words cannot describe our misery … The document, which the King of Prussia sent us, I forwarded by Ciccolini's hand. Perhaps now you can begin to comprehend our situation.

We had to alter our travel arrangements. It is not safe for us any more to remain on Italian soil. We should like to travel home via Switzerland … We are only waiting for new passports from Count Truchsess, and for the end of the present heat-wave, so that I could be capable of travelling again. When this happens, we shall be on our way to Bern as soon as possible. Nobody can long for saying 'good-bye' to this barbarous and 'cannibal infested' land more than I do. I wish I could know that my Duchess is safe in Bern, from where Lindenau can escort her home. I am ready to leave this world behind." {364}

His next letter was written a week later, and its general tone is a true witness to the state of mind of its author :

"Friend of Friends! My friend in misery! My friend in my need!"

In spite of interventions by the English and the Prussian ambassadors, their plight appeared to be completely hopeless. Ciccolini even tried to get the Holy See interested in Zach's problem, but without success. Zach could not leave his bed for weeks and the Duchess herself was incapable of movement. She earned Zach's abiding respect by the spiritual fortitude she has displayed during this ordeal.

While still confined to his bed and planning their escape from Genoa, Zach had learned with sorrow and anguish, that the general situation in France was not much better. The books of Voltaire and Rousseau were publicly burned in the streets. Pascal's books also shared this fate, not for their revolutionary teachings, but because the Jansenist opinions expressed therein were not to the Jesuits' liking.

Thanks to the stress induced by their situation, the Duchess had suffered a minor stroke, while Zach was still confined to his bed. Added to all this there was an epidemic of fever and diarrhea spreading in Northern Italy. One of Zach's doctors fell victim to this disease. The eighteen-year-old daughter of their solitary benefactor, Count Truchsess, had also contracted the disease.

Some good news had arrived from Gotha. Lindenau had been fortunate enough to survive an operation and Zach's only hopes rode on Lindenau's arrival. There were rumours to the effect that the Duke of Coburg, the husband of Louise, the Duchess' granddaughter, was to ascend to the throne of Gotha. This was good news for Zach and the Duchess. Lindenau informed Zach by letter, that the Duke of Coburg and Count

Winzingerode have pledged themselves to do everything in their power to help the stranded couple, and to clear Zach from the charges still standing against him.

An official letter was sent from Gotha on 28 August 1826 to the Genoese authorities. In the letter, it was clearly stated that Zach has never had anything to do with the Order of Illuminati, and that he never had any connections with its leader, Weisshaupt. The letter also denied that Zach was ever deported from Germany, thus proving the falsity of the relevant accusations. Weisshaupt was living in Gotha, respected by everybody, and without ever giving the authorities any reason to question his conduct. To quote from the document itself :

> "Franz Xaver von Zach has lived in Gotha for many years. During this time, he earned himself the respect of everybody in court circles, by his impeccable conduct and by the firmness and righteousness of his character. During the time he resided in Gotha, he never had to face charges or accusations of any kind whatsoever." {365}

Meanwhile Zach had to realise, that regardless of how much they wanted to depart from Italy, they had to stay for another year for the sake of their health. Unfortunately, by this time a sizeable part of their luggage had been already forwarded to Bern and Hamburg.

By this time, Count Truchsess received from Gotha the papers verifying Zach's innocence. The Count himself produced a memorandum on Zach's behalf, and suggested that the Duchess should make a new approach to the king, who has already rejected a petition submitted on Zach's behalf.

In the aforementioned letter, Count Truchsess enumerated the famous people enjoying great respect, who were known to be Zach's patrons and well-wishers. They included the Tsar, Alexander, the King of Prussia, the King of Bavaria, and Maria Louise, Duchess of Lucca. The Duke of Coburg wrote to the King of Sardinia and to Metternich.

Count Truchsess sent his memorandum to many other rulers and heads of state.

Lindenau visited the couple in Genoa. This time both of them redrafted their wills. The Duchess dated hers on the 26th November 1826. She nominated her granddaughter, the Duchess Louise as her principal heir. She was once married to Ernest I, Duke of Coburg, who was also acting as ruler of Gotha since the death of the Duke Friedrich in 1825. The Duchess has left her personal effects and her books to Zach. She has also left some legacies to her faithful servants. It became clear in due course, although it was not explicitly stated in the will, that she also intended to secure a regular income for Zach for his old age. In due course, this pension had to be provided by the Duchess Louise.

Zach has left everything he had to Lindenau, except one hundred gold pieces, which he left to his favourite niece. Later he raised this sum to three hundred gold pieces.

Zach has heard from Lindenau about a doctor, living in Paris, who reputedly had good results in treating stones of the bladder. At a great cost of effort and money to his friends and himself, Dr. Civiale paid him a visit in Genoa on the 24th of February. His examination proved very painful to his patient.

The Parisian doctor stayed in Genoa only for three days. In his opinion, Zach had stones in his bladder. They were not excessive in size, but there were great many of them. The doctor could only undertake the attempt to cure Zach, if he could go to Paris and stay there for several months. Zach, as he did not want to leave the Duchess on her own, and anyway, he was not fit to travel such a long distance, could not do anything else than look forward to the coming of spring and hope for the best.

By the end of 1826, his plans took a final form. The Duchess would go to Bern in company of a doctor, travelling in a coach so adapted, that it allowed the Duchess to travel comfortably in a supine position. In Bern, their ways would part. Zach will

continue his journey to Paris, while Lindenau would come to Bern, from where he could take the Duchess home to Frankfurt or Coburg. They discussed their plans with their friends and agreed on the month of May, as the best time for their departure.

Due to the many aggravations to which she was exposed, the Duchess could not cope with the harshness of winter. Zach's condition did not improve either; he had hardly had the strength to handle his correspondence. Their only and most fervent hope was to leave Genoa behind them, bur their chances of to do so grew worse by every passing day.

Then, after a long illness, but still unexpectedly, the Duchess had left the Land of the Living, "calmly, as an angel and gently, as was always her way".

Zach took his loss very hard. In this morning everything, that was ever important to him, suddenly lost its meaning. {366}

Even if he ever had hankerings after a life free from his 'courtly' obligations, free to devote himself to science, now, after losing his beloved companion, he felt he lost his vocation, and could not see ahead anything but a bleak and forlorn future. Nothing had any meaning any more.

The Duchess was laid to rest in Genoa's cemetery. Zach and the members of the Diplomatic Corps provided escort for her last journey. Later on, her granddaughter, Louise, had a memorial erected in her honour, for which Zach has composed the inscription :

Div. Manibus
Charlottæ Amaliæ
Duci Saxoniæ
Quæ per XXXIV annos
Ernesto secundo
Gothanorum et Altenburgensium Duci
fausto juncta matrimonio
Conjuge morte privata
Ob valetudinis infirmitatem
Patriæ cœlum
Cum mitiore Galliæ et Italiæ sole commutavit.
binis superstes filiis
animi curas et sollicitudines
Constantiæ firmitate
Amicitiæ alloquio
Litterarum solamine
lenivit.
Princeps eximia, Principis eximii conjux
Pietate. Ingenio. Animo
conspicua
Doctrina supra sexum excellens
post annos LXXV peractos
Genoæ d. d. XXV Aprilis anni MDCCCXXVII
Leni morte exstincta
ad Cœli templa unde descenderat
rediit.
Hoc monumentum
pii animi testem
Venerabili aviæ
Sacrum esse voluit
Neptis
Luisa {367}

After the funeral, Lindenau did everything possible to get his old friend out of the town where he had to spend many sad years and acquired so many painful memories. Unfortunately, it was impossible for Zach to travel without constant medical supervision, because of his painful illness. In the end, the search for a suitable doctor ended in failure.

Before his departure, Zach still had a melancholy task to perform. He had to make the arrangements to the final disposal of their erstwhile home. After giving the retainers the legacies willed them by the Duchess, he said an affectionate 'Farewell' to them. He also had to make arrangements about the future of the beloved animals of the Duchess.

He has found it hard to take his loneliness and the uncertainty of his future.

> "I eat no more, I sleep no more, and I live only in my despair" {368}

He had to redefine his future travel plans.

> "Every new day and every new hour confronts me with something unexpected. {369}
> I do not really know why I have to travel to Paris and be operated on by Civiale. I do not know, suddenly I feel uncertain in my resolutions and hesitant in my judgement." {370}

At the same time, Lindenau tried to convince his friend, that after listening to the informed opinions of other doctors, he became more convinces than ever, that Dr. Civiale, he and none else, could really help Zach with his stones.

In the end, the plan was hatched. Count Truchsess would await his friend in Turin, and escort him as far as the foothills of the Alps.

Zach wanted to flee Genoa, but he could not work up a real enthusiasm for the journey itself. He felt that it made no difference to him whether he died miserably in Bern, Gotha or Coburg.

In the end, Zach had finally left Genoa on the 22nd May 1827. It took him three days to reach Turin. During his journey he was in constant pain, he could not have even a moment of sleep. He rested for two days in Turin, and reached Geneva, via Chamberry, on the 30th May. He had to see the manager of his financial affairs.

3. Travelling to Civiale

After his painful journey, when he arrived in Geneva, Zach has found again some congenial friends. The ailing old astronomer was visited in his hotel, on the 1st of June, by the Swiss doctor's elder son, Fritz and his stepson, Eduard, son of Anna Fedorovna.

Fritz gave a detailed account of this meeting in a letter written to his father.

He had found that Zach was very much aged in his body, but his mind remained young, in spite of the melancholy preying on his mind. Zach had to travel to Paris to restore his bodily health, but in his soul, he longed to go to Elfenau, to find peace for his troubled spirit in the company of Schiferli and his family. Fritz wrote to his father : {371}

> "He has told us, that he can forget even his pains in our company. He is full of goodwill. He as good as he is pleasant, and his readiness for good conversation makes him an ever attractive companion." {372}

Zach also spoke with warmth about his encounter with the boys. {373} Fritz would have found it very agreeable if they could give at least temporary home to their friend. He asked his mother to make enquiries about this at the French Ambassador.

In Geneva Zach was visited by many interesting people. He found this very pleasant after Genoa, where, towards the end, he was starved of any company whatsoever. Jean-Alfred Gautier, the Swiss professor Augustin-Pyramus de Condolle and Karl Victor Bonstetten, patricians of Bern were among the callers.

Because of his state of health, Zach could only undertake the journey to Paris if he could find a travelling companion. In this, he was helped by his old pupil, Kaspar Horner, who made his cousin, Johann Jacob Horner, available to look after his old friend on the journey. As it transpired later, this was a very lucky choice. Zach had found willing help in the young Horner, who had also taken him to his heart. In Paris, they have spent several months in perfect amity. The only sorrow the young man caused to Zach was the sorrow of parting in the end.

The young Horner had a well-stocked head, he could speak French, English and Italian, and he had regularly pursued studies of academic subjects.

Zach in the Hands of Civiale

Zach, accompanied by the young Horner, had arrived in Paris on the 15th June 1827. At first, they stayed in a hotel, but this has proved too expensive, so they finally rented a flat near the Tivoli Gardens, which, besides being affordable, had the added advantage of being not far from Civiale and the medicinal baths. Zach needed not only immersion in the water; he had to drink it as well.

Civiale performed his first operation on Zach on the 27th of June. On this occasion the surgeon had removed a single stone, using 'Lithotritie', a special instrument he developed for this kind of work. This operation, the first of many, was not particularly painful. The second operation was done three days later. This time the surgeon had crushed a sizeable stone. This time there was very much pain. Zach had to stay in bed for several days. In spite of this, the third operation took place on the 15th of July. At this stage, Zach was still optimistic. He wrote to Schiferli on the day before the third attempt :

> "Within four weeks Civiale will have removed all my stones. This will be the end of my 'Chronicle of Surgery', which can also be counted as a 'Chronicle of a Miracle'." {374}

Alas, the ceremony of stone-removal became a permanent fixture in Zach' further life. His tenth operation on the 16th of August was so painful, that he became feverish as a consequence, and had to stay in bed for several days. After the twelfth operation, Civiale declared Zach free of stones. He said that he needed to operate again only to get rid of some remaining particles of sand. Zach, not seeing his own future, told Schiferli in one of his letters about an unfortunate priest who had to go through twenty-one similar operations.

Occasionally it has happened that he experienced a certain degree of amelioration in his condition between operations. One day he was so overcome by confidence that he ventured out on a two-hour coach trip to the Bois de Boulogne. It was all right in the beginning, but the state of the roads in Paris was bad enough to turn the end of his excursion into a total disaster. In his letter to Schieferli, dated the 15th September 1827, Zach informed him of his fifteenth operation and had drawn up a sort of balance sheet of the progress of his treatment. He had pains in his bladder for the last fifteen months, but he felt that if he could have started his treatment with Schieferli one year earlier, he might have got away with a few operations at the worst. It is interesting to note, that in spite of the seemingly endless series of painful operations Zach had never lost confidence in the Parisian surgeon, who comforted his patient by telling him that his case was the most intractable one he had hitherto encountered.

And the operations came, one after the other. After the eighteenth one Civiale warned Zach about the impossibility of leaving Paris before the end of October. Zach's discomfort was aggravated by the strict diet, which Civiale prescribed for him. He could eat no meat except fish, and tea, coffee and wine were also forbidden. For a short while the regime was somewhat relaxed, and in a relatively trouble-free period Zach and Civiale drunk a glass of the forbidden wine to each other's health, but this little extravaganza was the exception, that did not turn into a rule.

Towards the end of September Zach had a few pain-free days. Immediately his optimistic nature surfaced again. He wrote to Schiferli in his letter on the 26th September 1827 :

> "By mid-October I shall be free to leave Paris … Since the sixteenth operation I have a new lease of life. I sleep like a mole, from nine o'clock at night until 7 o'clock in the morning … This marvellous surgeon made a masterly job on me. Buffon, the renowned natural historian, had fifty-five stones in his bladder, as was discovered after his death. If Civiale's method had been known at the time, he might not have had to suffer so many operations in his old age and infirm condition … Since I am living in Civiale's »taproom« and with his »jemmy«, He had already healed an American and an Englishman." {375}

Unfortunately, all of Zach's turns for the better were short lived, and on the sixth of October he had to resume his 'monastic' diet, and his pains had also returned. He was bed-bound for another two weeks.

The possibility of leaving Paris was receding further and further into the future. It became painfully obvious to him, that the visit to his friend in Elfenau could not take place earlier than the next spring. It was a pity, because he was full of longing for his friend and his family, believing that living with the Schieferli-s would bring back his peace of mind. He imagined that Frankfurt might, in the end, be chosen as his permanent home, where he could live with Lindenau in a shared house. This scheme would have benefited both, as the old and infirm scientist had become increasingly dependent on the care of his young friend. In Civiale's opinion, it was out of the question for Zach to leave Paris before mid-November. The climatic conditions were dangerous for Zach in both Elfenau and Frankfurt; the surgeon recommended that he should spend the winter in the

South of France. Zach was afraid to do this, because he felt that in Marseilles, he would again become isolated, and in addition to his physical illness, he would become apathetic under the circumstances. His misgivings proved to be justified.

His next letter to Elfenau on the 12th October 1827 struck a more optimistic note. Zach wrote to Schieferli that he was slowly getting better and he could sleep again, but he still had to adhere to his monastic diet. He had no more stones, but clearing out the detritus, left by the old ones had still to be done. Civiale had high hopes for the twenty-first operation. This ought to be really the last one. In the second part of October, he felt as well as could be expected under the circumstances. The pain decreased, he could sleep and he could go out to the street for a few short walks. It was a special treat for him, that on the 22nd of October he could feel strong enough to take part, as a 'corresponding member', in one of the sessions of the 'National Institut' and even remain with them for the following banquet. Because of this meeting, he started to receive visitors and personal invitations again.

Zach's first series of treatments finished on the 25th November. Zach had no more stones, just some residual shards and sand.

> "You see, I am still bound to Paris. I am rid of all my stones. I can walk and ride a horse, and I sleep like a log. All is well for the time being, but I am still exceedingly weak." {376}

Zach wanted to leave South France in the following April. First, he wanted to go to Elfenau, then to Frankfurt. He could even go to Weimar, if he had wanted to. The Duke and the Duchess sent him a thousand greetings through Lindenau, and declared that if Zach should decide to live in their country, they would be very happy with that. However, Zach had enough of life at a Ducal court, and wanted to spend his remaining years in quiet and tranquillity. {377}

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The last letter to Switzerland was sent on the 6th of December. It was sent to inform his friends that he finally obtained his travelling permit, and only the packing had yet to be done. He promised to inform them about his arrival in Lyons. In his letter he also mentioned a Col. Tulla from Karlsruhe, who moved into his Parisian neighbourhood, also waiting to be treated by Civiale. The poor man had two stone of the size of pigeon's eggs. {378}

> "These are my last words sent from this Babylon, from which I hope finally to depart tomorrow. Until now, Civiale's treatment has set me back by sixteen thousand Franks. At the present, my condition is quite satisfactory. Civiale says that living under a warmer climate will do me good. Towards the end of April, I intend to travel to the 'country' through Lyons and Grenoble" {379}

By 'country', he naturally meant the countryside of Switzerland.

Looking back to Zach's Parisian time, he had received relatively meagre attention from his friends, always excepting Civiale, who, besides administering the painful treatments, has proved himself an interesting companion. Occasionally he was surprised by unexpected, but welcome visitors. Such a one was, above all, the brother of Anna Feodorovna, the later King of Belgium, who felt the need to visit his old friend during his short (eight day) visit to Paris, on the 9th of July.

It is in the nature of men of elevated standing, that they not often miss mixing a certain amount of self-interest with the business of their innocent pleasures. He was in need of Zach in a discreet affair connected with the person of the Duke of Gotha.

A book was published in 1823, making public some of the details of the love life of the Duke of Saxe-Coburg, Ernst I, under the title: 'Mémoires d'une jeune greque. Mme Pauline Adélaide Alexandre Panam contre SAS le prince regnant de Saxe Coburg'. In this book, Mme Panam had accused the Duke of being the father of her son, the person who later became known as Count Beaumont. The Duke married Duchess Louise, granddaughter of Charlotte Amalie, in 1817. The Duke has made the acquaintance of the young Greek woman in Paris. Mme Panam's son was more or less of the same age, as the Duke's legitimate children, Ernest and Albert.

Mme Panam, perhaps feeling that the ex-Gratia payments she received from the Duke were insufficient for her needs, decided in 1827 to publish a new broadsheet, disclosing perhaps even more compromising details about the Duke's past.

The present Duke decided to engage Zach to represent his interests in this delicate matter. Later on, he was also given official authority to act on the Duke's behalf. Zach has put himself at the Duke's disposal, out of gratitude for the many favours received by himself and by his Duchess during the dismal months spent stranded in Genoa. Zach had intended to do everything in his power to make himself as useful as possible.

Mme Panam, using stories of unknown provenance, consisting mainly of barefaced lies and distortions, intended to concoct a history of scandal involving all members of the Duke's family, regardless of sex and age. These were to be included in a volume just being printed, with the title of 'Biographie des Contemporaires.' Zach was suspicious, that the 'jeune greque' has in fact already sold her manuscript to the publisher. Zach, with the help of the Abbot Gregoire, had managed to put a stop to the printing of this unworthy document.

Zach was also conscious of another impending publishing event of the same kind. It was to be printed under the editorship of a Mlle Le Normand, and its subject was to be a collection of anecdotes, concerning the English branch of the house Saxe-Coburg. It was to bear the title: 'Anecdotes Historique et politique, secrets en inedites sur Caroline-Amelie-Elisabeth de Brunswick, Reine d'Angleterre, et sur Princess Charlotte d'Angleterre epouse de prince Saxe-Coburg'. This script dealt mainly with the wife and mother in law Prince Leopold. Zach was very interested to find out who this Mlle Le Normand might be and how she may have collected her material. After lengthy research, he became convinced that she could not be any other than the famous fortune-teller of the Empress Josephine, Napoleon's wife. This woman had already written and published the biographies of many celebrities of the age. Of one thing Zach was pretty convinced, that is, that Mlle Le Normand was not the author's real name. {380}

In the context of the same case, Zach was entrusted with another, but even more delicate commission. He received plenipotentiary powers from the court to arrange the transfer of the eight-year-old boy from the care of his mother to live in the Duke's Court.

It was a sign of respect, but at the same time an additional burden, that his help was asked for by both sides in the case of the "jeune grecque". His advice was solicited by a M. Billecocq, a lawyer of high repute, working for Mme Panam. Zach's problems had increased since he had to part with the young Horner at the request of the young man's parents. Now he had to do all his own paperwork and correspondence. He coped with this kind of work, usually on his sofa, lying on his back.

Prince Leopold was happy to meet Lindenau, who played an important political role in Gotha, in the little flat in Paris, near the Tivoli. This time Lindenau spent three weeks in Paris, visiting his old friend.

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About the further life of Count Beaumont, the officially interested parties to the case, that is Zach, the lawyer Billecocq and the merchant Sterzer, all agreed, that without

his mother's consent there was no way the boy could go to Germany, and until his coming of age there was nothing further to do.

Duke Leopold, who had paid two visits to Zach while in Paris, afterwards took the trouble to enquire after Zach's health in every letter he had sent to Sterzer on official matters

The Panam case quietened down after a while, in Zach's opinion because the woman could not get money to pay for a second printing. He had even had hopes that the whole business will eventually felt into a slumber.

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The matter of the will of the late Duchess Charlotte Amalia was a constantly recurring topic in Zach's correspondence with Elfenau. Schiferli, who was presumably informed about the secret marriage of Zach and the late Duchess, was of the opinion, that she should have named Zach as her principal legatee.

Schiferli did not understand why the late Duchess failed to provide for the future of her Major-domo.

The Duchess only left to Zach her books and some personal property of little intrinsic value. Zach did not even know until meeting the Duchess' granddaughter a year later, that he was also left a regular yearly pension, paid to Zach by Princess Louise, the granddaughter.

In fact, Zach had never felt that he was in any way 'short-changed'. In his later letters he only referred to the emotional void in his life left by the Duchess' death. The 11th of September was always a special day of sorrow for him, being the Duchess' birthday, the celebration of which used always to be a heart-felt occasion.

According to Zach, the Duchess had only very limited funds of her own. Besides, she had no reason whatsoever to exclude her granddaughter, blood of her own blood. Louise's legacy was not the Duchess' private fortune, which she could not have legally left to the Master of her Court.

Zach in Marseille

As it could have been foreseen, Zach arrived in Marseilles in a very poor condition. It was a city, where he spent some good time with his Duchess, when both of them were in their prime. Now he had found that his friends of the old days were dead, infirm or left the town. This was the reason why he needed several months to collect the strength to write to his friend in Elfenau on the 14th February 1828. In his letter he gave a detailed description of his journey. He left on the 8th December in a reasonably good condition, which remained the same until his arrival in Lyons on the 13th December. Here he rested for two days and continued with the cure prescribed by Civiale. The rest of the journey was much less agreeable, and he arrived in Marseille on the 20th December in great pain and distress. All the symptoms of the Bladder stones were back, in addition to new complaints of racking coughs and a running nose. He spent his nights without sleep, and his appetite was also gone. It was incredibly distressing to see this town again, once beloved but now disfigured by change. He could not take food for days on end.

He became completely apathetic, having lost interest in everything. He had lost interest in science, in books and in the events in the big world. He became dead even for the beauties of nature.

What kind of a place was Marseille in the time of Zach's arrival? Conversation was confined to bankruptcies and percentages. Public hostelries served unhealthy food, badly prepared. The usurers and the men on the make ruled the town.

The improvement in his condition, expected and predicted by Civiale, did not materialise. He arrived in December in a bad condition, and now he was getting even worse. Also, his faith in Civiale and his cure was also badly shaken. There were many surgeons abroad, who disagreed with and fought against Civiale's methods. There were also many, Count Truchsess and Schiferli among them, who simply thought him to be a 'charlatan'.

Zach was lucky to find another doctor in Marseille, just when he was on the point of giving up hope. Dr. Roux, the first secretary of the local Academy invited Zach to one of their sessions. After he meeting, their conversation drifted on to the subject of Dr. Civiale. Dr. Roux was a practising surgeon, so he was well acquainted with Civiale and his book on treating stones, the 'Lythotritie'. After a thorough discussion with Zach, he stated that the pain had nothing to do with the stones, but had been caused by an inflammation of the kidneys. {381}

There was another cause of Zach's temporary loss of faith in Civiale. It was a sad case, in which he was himself a close spectator.

> "I do not remember writing to you about Col. Tulla. He was another patient of Civiale in Paris. We were living as neighbours in Tivoli. He was an intelligent man, expert in rivers and the economy of water utilisation. I came to like the old man, who was in fact younger than I was, and his initial condition was also better. He was operated on several times, when I was still in Paris. Now, I have been informed by Civiale in a letter on the 4th of April, that Tulla has died on the 11th of March. {382}
>
> The death of Col. Tulla seems to make the prospect of my early crossing the river Styx more likely." {383}

In spite of it all, Zach's relations with Civiale remained good. The doctor even asked his permission to write up his case history in one of his professional publications.

By the end of March, the full and well-known set of symptoms of the stones returned. He decided to return to Paris. He was lucky, as Dr. Roux proved himself not only a good friend, but a good doctor too. He stated that Zach's stones had been all successfully removed and now he did not suffer from anything more than an inflammation of the kidneys. He suggested a treatment and carried it out. Thanks to his ministrations, Zach's condition took an apparently lasting turn for the better. {384}

Even though his physical condition has left much to be desired, the main source of his distress remained loneliness. He suffered more from it than from all of his other complaints put together. He was lost without his friends, and he raised this complaint in all of his letters in one form or another.

> "You wrote to me that »It is not good for you to be alone among strangers. You must return to your friend and you will be well again.« These words had struck at my heart. I could almost see you, standing there and saying it to me. Your words are the words of truth, but how could I reach my friends in these circumstances? {385} (…)
>
> My only conso/lation on this miserable earth is the presence of my friends, among whose you are most emphatically counted, who mean the whole world for me. {386} (…)
>
> There exist a few people in this world, who do only good and agreeable things. You belong among those few. When I retire to my bed at nights, I wish never to see the morning again. When I see the morning light again, and take again notice of this world's shortcomings, I think of my friends who still exist for me, and in this thought, I find my consolation. …

> I have no wife and children, I have just lost my best friend and benefactress, and so what is there to tie me to this unknowable and unrecognisable world? Only friends such as you, Lindenau and Truchsess. … {387} (…)
> I have turned into a slow snail long ago, but now I am losing my patience and am turning into a venomous snake. But the thread that ties me to you and Elfenau is a mooring rope, not likely to break until the ship herself goes down." {388}

His reasons were probably real to some extent, but it was mainly due to the state of his nerves, that he had a strong feeling of being politically persecuted in Marseilles. He wrote thus to Schieferli on the 14th April 1828 :

> "I always get depressed when I think of the events in Genoa and am forced in my memory to relive the short periods of happiness of my life as consolation. I was born full of doubts, like Rousseau. For a long time I was held to be a criminal and a treacherous alien, and these charges were still not officially removed. Perhaps I am on the Sardinian King's 'death-list'. What am I to do with enemies so implacable? Gregoire has few defenders at his back, but I have none. Sometimes I think of some new attempt on my part may make things even worse. I wonder if they would leave me in peace in Bern. My friends are not strong enough to fight such invisible and ghostly enemies. One of my friends from Turin informed me, that he would have liked to share a serious secret with me, but he dared not to write to my present address. He asks me for a 'safe' address." {389}

Zach was very lonely in Marseille. Due to his physical and spiritual state, he was very dependent on his servants. He had two cooks in his employment. {390}

One of them is described in detail in one of his letters sent to Schieferli. Christian Tanner of Bern entered Zach's service in June 1827, when he was thirty-seven year old. He could not speak a word of German. Zach described him as very polite in his manner, 'faithful and noble as gold'. In Paris, he assisted Civiale with the painful treatments. Civiale was so satisfied with his skilful ways, that he did not use any other assistant when treating Zach. Tanner was a 'master of all trades', he had only one fault. He could not bear to have anybody come near his master, except himself. On such occasions, he was insolent and rude and had to be handled like an Easter egg. He always accompanied Zach on his travels, because, among his other skills, he was an expert handler of horses. {391}

Spring had finally arrived and with it came the renewal of Zach's 'travel fever'.

By now, he had really nothing more to do in Marseilles. He was also upset, because Lindenau could not spend Easter with him, even though he promised to do so, as he had to be in Frankfurt by the 1st of May and attend the first session of the newly established German League.

His urge to go was so overwhelming, that it made him forget his well founded fear of travelling, although he should have been aware by now, that for him, travelling always brought about a deterioration in his health and physical condition.

At the beginning of April, he was happy and confident enough to notify his friends :

> "You can be sure that my treatment will be finished within a month. In the beginning of May I intend to 'take to the open road again' and slowly, like Scarab beetle, I shall sneak into Bern. You will find me a worn-down and unneeded stick of old furniture, more fit for the storage shed than for an elegant study-room." {392}

A few days later, on 29th April, Zach had written again to Schiferli in Elfenau :

> "Doctor Roux thinks that I am now fit for travel. I am awaiting your answer : Can I come immediately, before the expected heat wave reaches Marseille?" {393}

Doctor Roux had really consented to let Zach travel, but reluctantly, as he had thought that Zach would have benefited from a few more days of rest. The doctor had set some strict rules for Zach, before permitting him to leave Marseille. For example, he was allowed to spend only a few hours in the coach every day, and he also had to take a few days of complete rest from time to time.

Zach has replanned his itinerary, now he wanted to go to Switzerland straight away, without first going to Hyères or Toulon, as he previously intended. This time they were to travel through Grenoble instead of Lyons, because this route promised to be more pleasant, and they could make their journey two stages shorter. There was only one problem; they had to go through Chambery, which was Savoyard territory.

> "And because the state of war exists between me and the King of Savoy, and we still have not made peace between us, I can not be sure that I shall not be arrested and imprisoned in the moment I cross their borders. If you do not see me any more, you will know what happened to me and where to look for me, for example behind bars, kept as a hostage." {394}

There were eleven stations between Chambery and Geneva. Had he been a Swiss subject, he would have had no need to be worried. He wrote to his Swiss friend in the following vein:

> "I should be very proud to be a free and 'bona fide' citizen of Switzerland, prouder than to sink to the level of a French nobleman. At present, the first option appears unrealistic. I am a Catholic, but I do things my own way. How, then, could I celebrate there the 'Day of Reformation'? You must understand that a true Catholic can never become a Swiss citizen, because, under the name of 'God', we should worship two different beings and this is not possible." {395}

Zach's travels ended the same miserable way as all of his previous journeys did. He was healthy in the beginning, but was sick at every stations of the journey. He was a broken man, when he reached his journey's end.

He had arrived in Grenoble on the 9th May 1828, feeling more dead than alive. The rest of the journey proved even more difficult. The first stage to Aix was a mere two stops and to Avignon, ten stops. So far, his condition was more or less satisfactory, although he was forced to stay in Avignon from the 3rd of May to the 5th. He had to visit the medicinal baths and take a variety of pills. They had left Avignon on the 6th of May, at 7 PM. and arrived in Orange at 10 PM. They had managed to pass four coach-stops, when he started to feel deadly sick again, between Pallud and Donzere. He had to leave the coach temporarily and try to find relief sitting on a stone by the roadside. He had a bad fit of vomiting and had to be lifted back to the coach, without regaining his full consciousness. By 1 PM, they had arrived at Montelimar, where he had to be put to bed. He slept for eleven hours without interruption. He took some weak lemon tea. This and the long sleep did him good. He arrived in Grenoble at 5 PM, practically in a state of collapse. Moreover, he still had some hard travelling before him, from Chambery to Geneva.

He had arrived in Geneva on the 12th of May. On the 13th he wrote to Elfenau :

> "Te Deum Laudamus … All the good spirits praise the Lord … Perhaps now things will take a turn for the better. I shall say 'Hosanna' in Bern, on the 15th."

Finally, after so many of his plans ending in failure, he could enclose his friend in his arms within two days, and that will be the end of his solitude.

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Perusing Zach's letters of this period written to Kaspar Horner and Rudolf Abraham Schiferli, it must be noticed with a certain amount of sadness, that he lost his previous 'broadness of outlook' and his interests now centred on complaints about his physical condition. On the other hand, he still retained some interest in matters of philosophy and theology, and this can be still discerned in his letters. He discussed some religious questions in his letters, reaffirming his commitment to the Church of Rome. He held it against his co-religionists, if they let themselves be converted to the Protestant faith, usually for material gain. Although he sent his friend a two-volume edition of the 'Koran', he seriously cautioned him about falling under the influence of Islam.

In parallel with his loss of interest in the matters of world events, his empathy increased and he begun to show a growing sensitivity to the problems of humanity. The lives of his young friends remained in the centre of his interest. He was always glad to spend his time in their company. This, sometimes, could even make him forget about his physical condition.

4. In Elfenau, Where Zach Always Wanted to Be

Since 1826, Zach's life became a series of failures. Alas, Elfenau, the latest target of his wishful thinking, ended up as another disappointment. The company of friends, so much longed for, could not give him permanent relief, only some temporary betterment of his condition. He suffered most gravely in his spirit, but this was only a spiritual reflection of his bodily condition. The tender loving care of the Schieferli family could suppress the symptoms of his ailments for a time, and for a short while longer Zach could still retain his illusions about getting better and regain his old, 'bouncy' personality. But when he saw, that even the company of pleasant and caring friends could not keep him permanently out of his sickbed, he finally had lost all his faith in his recovery and his hope of ever leading a full life again. He did not believe any more in the existence of any earthly place, where he could find healing for his body and for his spirit. It was a consequence of this 'vexation of the spirit', that his misanthropy grew stronger than ever. He had even sunk so deep, that he threatened his loving friends with committing suicide. He had upset even Schiferli, his devoted friend, by writing him long 'Jeremiads' of complaints in return for the love and care he had received from his friend's family. It is a matter to wonder on, whether Zach had remembered how put out he was over the similar 'deluge of complaints' he had received from Pasquich, his compatriot, at Seeberg.

The other two members of the Schiferli family, Moritz and his mother, unlike their father, surrounded the 'Dear Baron' (as Mrs. Schiferli used to refer to Zach in the letters written to her husband) with their love and compassion. They could find pleasure in his company, even though they were full of sympathy over his plight.

Zach had arrived in Elfenau on the 15th May 1828, accompanied by Moritz Schiferli. This Ducal estate was situated in the close vicinity of Bern, surrounded by picturesque landscape. The planner and owner of the newly built palace was the Archduchess Anna Feodorovna. Schiferli, the Master of her Court, was also given his residence here.

Zach's favourite of long standing, Moritz, the twenty-year-old medical student joined Zach's coach in Gümmen (fifteen km. from Bern). On arrival at Elfenau Zach could meet again his friend, Abraham Schieferli, with whom he could maintain contact only by letters for many long years. Mrs. Schiferli was also overjoyed on meeting again her husband's friend, whom she had held in affection and respect for such a long time.

At first, everything went well. The details were described in Zach's letter to Civiale on the 10th June 1828. He informed his doctor, that here, in Elfenau, he regained his strength and weight, he had a huge appetite, he slept like a log and he could take a ride without being in fear for his health and of pain. He had experienced only a slight problem with passing water. He was keeping himself to the prescribed diet, that is he drank plenty of milk, rich in whey, and ate dairy products, fish, a little bit of white meat and lots of vegetables. He drank no wine, but indulged himself with coffee and tee with lots of whipped cream, according to local custom. He also ate various fruits, strawberries, pineapples, melons and grapes, which were all produced in the estate's glasshouses. {396}

Abraham Schiferli left Elfenau as part of his Duchess' retinue. From this time, inconstant contact was maintained between the home and the 'pater families' by mail.

At first, these letters carried only good tidings. In her letter of 20th June Frau Schiferli was happy to inform her spouse, that

Castle in Elfenau (Photo by Peter Brosche)

> "The Baron is feeling on top of the world, he is getting younger and more handsome, he is docile as a lamb, and getting merrier and more talkative as the days pass by. Moritz follows him like a shadow." {397}

Moritz gave the following account to his father :

> "Our dear Baron is very well. At his request, I go with him everywhere, to the Library and to the 'Cabinet of Natural Sciences' also. Here Zach made the acquaintance of the youthful Professor Studer, with whom he managed to make good friends and have some good conversations … Our plan for today is to visit the Observatory with Professor Trechsel. Zach is completely ignorant about this, but wants to see it just for honour's sake. Yesterday he went for a coach-ride with mother. I think it did both of them good … He is also frequently visited by Dr. Brunner, who is also acting as his procurer of books." {398}

On the 24th June Moritz had informed his father, that her mother and Zach had travelled to Oberried, to visit Frau Anna Charlotte Fischer and that he intended to spend a few days there.

Unfortunately, it was pouring with rain all the time, and this did not do Zach any good at all. He consulted Dr. Lutz of Bern, who advised Zach, that after the summer heat abated, he should not remain in Switzerland any longer. He prescribed plenty of rest and put him again on a very strict diet. To be witness to Zach's despair made everybody very sad.

Until then Zach had derived great pleasure from going for short walks with Frau Schiferli, and occasionally even dared to take a chance on going to a coach-drive together. Now this all had to come to an end, Zach was forbidden even to leave his bed.

It was with great sadness, that Moritz informed his father of all this.

> "This poor weather is bad for us all, and doubly so on account of the poor Baron, who can not cope with our climate, and is talking of suicide. He is telling us that one of these days we will find him in the garden, hanging from a tree. He says that he had already bought the rope." {399}
>
> After the 5th of July, his condition saw an improvement, for a short spell, but as the weather deteriorated again, so did his health. Elfenau was struck by several bad thunderstorms, during one of which an old oak tree was torn up by the roots.

Reading Zach's letter to Horner, sent on the 10th of July, we can see that even in the midst of such suffering he did not sink in his own misery, but maintained an interest in the new developments in astronomy.

> "The Duchess and Schieferli have gone away on the 17th of June, and I was nominated in their absence to look after the estate in the capacity of a Vice-regent. During this time, I had suffered all kinds of mishaps. The Kingdom had passed through dangerous days.
> I do not know if you know, but Guepratte published new Tables in Brest, with the purpose of establishing once and for all the really accurate 'virtual lunar distances'. He had published them in an unassuming little brochure, under the title 'Nouvelles additions aux problémes d'astronomie nautique et de navigation, Brest, 1827'. I have a certain feeling that the author is not quite too satisfied with his method. This can be seen in his letter written to me on the 28th April 1828 … Among others of my friends, he is also trying to persuade me to start publishing again the *Correspondance Astronomique (CA)*. The last one to write me on this subject was Nell de Breauté, who wrote from Vichy. He is taking the waters there, to recover from her serious illness of the last year. Old, ailing and alone I would not feel capable of handling such a task. You should undertake the task, then I could be your 'factotum'. Or, perhaps, the *Astr. Nachrichten* of Schumacher may in itself be sufficient. I have also heard that Gruithuisen has also published a new journal in Munich, titled *Analekten für Erd und Himmelskunde*. These are published in German, people abroad cannot read them, and they rather neglect Hydrography and Navigation. Lastly, I have read the notice in the *Allgemeine Zeitung*, that 'Oltman's Connaisance des temps pour 1829 a l'usage des marins. A Chez Cotta Tubique' has appeared. What can it mean? Could it be a reprint of the Parisian, or is he really talking about new calculations? However, we shall have a better chance to talk these matters over in Zurich in person.
> In my opinion, the people of Bern are not much interested in science. I have knowledge of only two men of science of any account. One is Prof. Brunner, an outstanding chemist, the other is Professor Stuber, a disciple of Gauss, who has to concern himself with mineralogy, for reasons of trying to make ends meet. The rest are mediocrities, or worse.
> Valz, a rich landowner in Nîmes, is a very pleasant man. He stated rather emphatically that he came to Marseilles last year just to meet me. When I had returned to Switzerland last time, he surprised me by coming to Avignon to meet me again. He had travelled with me to Orange, where he introduced me to a very interesting man. He was Gasparin, who was mentioned in Napoleon's will in such a remarkable fashion. The day spent in his company was a very pleasant gift to me.
> Gasparin is a committed Huguenot, with huge estates and forty thousand Francs in the bank. He takes an interest in science, especially in agriculture, mineralogy, geology and archaeology. He produced a number of good studies, which are now deposited in Library of Geneva." {400}

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The letter, which so upset Schiferli by its 'Jeremiads', was written from Elfenau, on the 26th July 1828. It contains some heartbreaking lines :

> "I have received your letter from Gotha, dated of the 13th July, lying in my sickbed. I am a victim of a very complex ailment, which is both mental and

physical. First, the chronic catarrh of my bladder has returned. This was followed by melancholy, misanthropy and deep depression. Doctors say: 'healthy mind in a healthy body'. If it is true, so is it converse. If the soul gets sick, the body will follow. Well, my dear friend, this is happening in my case. Because my afflicted soul, I appear to have nothing to look forward to, but never ending hopelessness. It is even possible, that one of these days I shall be seen as a pendulum, suspended from one of the beautiful elder-trees of Elfenau.

I begin my letter by informing you that your letter has found me in bed. This is not because I am so near to death, but on the orders of Dr. Lutz, who forbade me to leave my bed on account of the cold weather. It is true; on the 19th July we all almost froze to death. There were cold, rain, stormy winds, thunder and lightning. The storm even uprooted a splendid oak-tree in Elfenau. We have been waiting for the Sun, as the Jews for the Messiah.

If you want to imagine my present condition, you should read Segur's Memoires (Vol. 3): 'Die Schilderung and Schicksale eines Spanischen Gasandtenin St. Petersburg'. This poor man was first made depressed, then melancholic and finally crazy by the Russian weather." {401}

By the end of July, the weather had cleared up, and Zach's condition also improved somewhat.

Frau Schiferli, who was herself not free from ailments, wanted to visit a spa and receive a long awaited course of treatment. Now, as she could verify the improvement in their friend's condition, She left him in the care of Moritz and departed on the 26th July 1828 for Argau.

She wrote to her husband one day before her departure. In the letter, she spoke about Zach with enthusiasm and approval.

> "I am more impressed every day with the many-faceted richness of Zach's inner spirit. Even now, confined to his room and tormented in his body, he could still retain the felicity of his spirit. For Moritz he is a treasure, he is greatly enriched by the daily contact with this extraordinary man. I can see his knowledge increasing with every day he spends in his company. It is of special value for Moritz to see Zach in the company of his uncle, Dr. Samuel Wyss. It is a pleasure to see them discussing problems as they crop up, with commitment and vehemence."

Moritz, in his postscript to his mother's letter, added to these words of praise : "It is not easy to find a patient as docile and obedient as Zach." {402}

Zach's letter to Horner sent on the 30th of July is full again with news from the world of science.

> "Should Old Man Pons be taken by death, all comets would die with him. Such a 'handicraft' is not practised in France any more. The Observatory of Paris is deserted; Arago never sets foot in it. Bouvard has trouble with his eyes; he has grown old, fat and deaf. Gambey, the mechanic has lost his interest and joy in his work, the poor devil.
>
> Last winter I saw Gambey's Passage instrument exhibited in a scientific exhibition. It was set up in such a manner that it was impossible to go near and examine it in more detail." {403}

We are also informed in this letter that Zach was visited in Elfenau by his old travelling companion, Jacob Horner. The visit gave him a great pleasure.

Zach had left Elfenau for good on the 5th August.

He met Frau Schiferli in Argau, who was still staying at the spa, taking the cure. In her letter of the 6th August, she told her husband about this meeting :

> "The dear Baron had interrupted his journey, just to meet me. I was overjoyed beyond measure to see this likeable and highly respected friend again." {404}

Zach had spent a full fortnight with Kaspar Horner. Having finished their cure, Frau Schiferli and her sister Sophie Mousson visited Zach in Zurich on the 16th August.

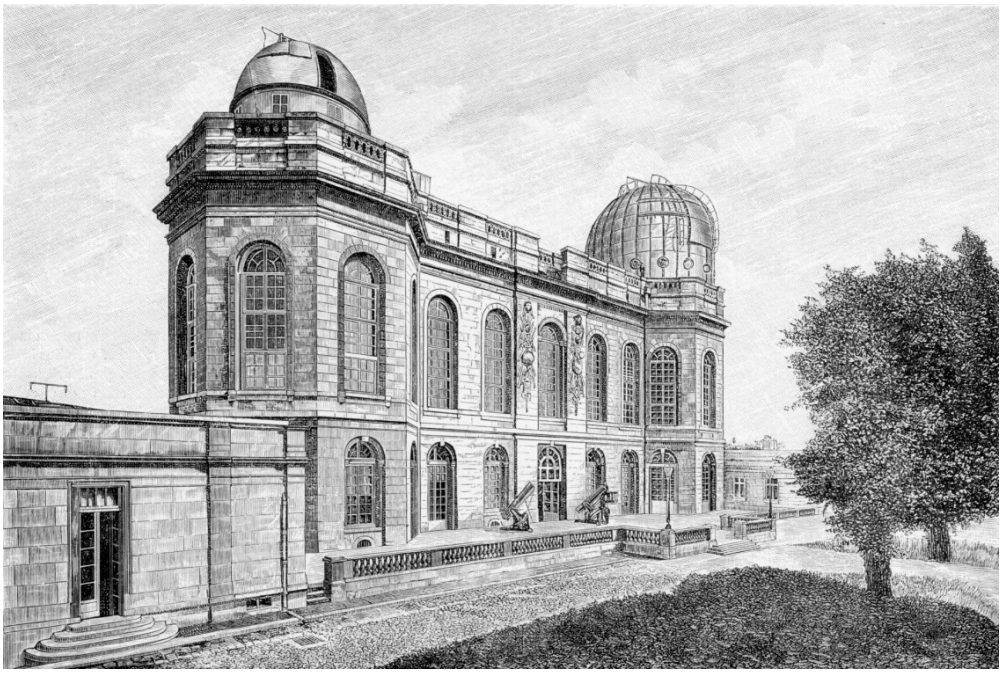
> "I have spent the greater part of my morning with our friend, Zach. I have found him overcome with suffering. He felt his situation was hopeless, but I think we could cheer him up just a little with our conversation. On his way to Frankfurt, he intends to spend a day in Heidelberg, just to meet with our Fritz." {405}

According to the two women, Zach was looked after very well in Horner's home. He was on his way to Frankfurt, not only for reasons of sentiment, but he had also to pay an urgent visit to Lindenau to sort out his finances.

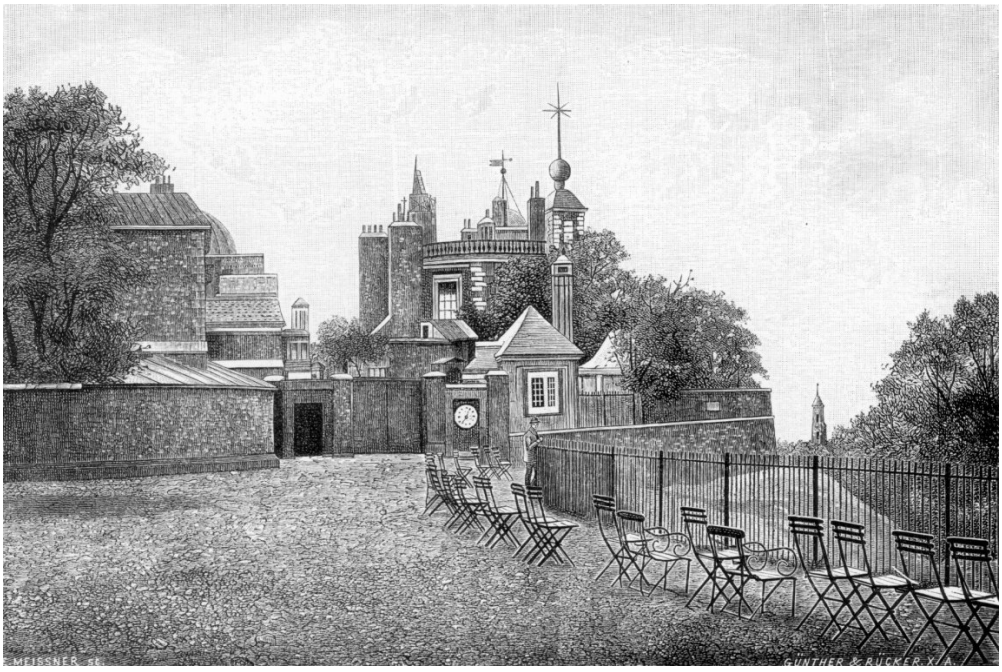
Zach continued his journey to Frankfurt on the 18th August. This time the weather was clement, and this may be the reason that his friend Fritz had found him in tolerable condition.

The correspondence with Schiferli was interrupted for a while. Then it was resumed on the 19th November, in the form of a desperate letter from Frankfurt, sent, presumably, as a reply to Schiferli's angry letter :

> "For the sake of God, how could you send me such a horrible letter, which made me completely unhappy on the 8th of this month? I think that my misery could not be increased beyond the state, when I took your letter full of misunderstood in my hands. You assume, and also say, that I was dissatisfied with the care that I have received at Elfenau. Also, that I wanted to break off any existing contact between us. What a baseless suspicion, just for my neglecting to write to you for a short while? It would have been more natural for you to think me dead, or had a stroke, or had been murdered, they would all have been more natural than your assumption, which are contrary to my whole nature. …
>
> Since you had occasion to examine my ailments, and the locality of my pains, they have escalated to a degree, that both the Sommerings, Father and son, assume that my bladder-stones have re-grown. I have informed Civiale by letter, and he is of the same opinion. He wanted to come to Frankfurt and operate immediately. Unfortunately, I had to decline, for here I am incapable of getting my hands on the necessary funds. I must get to Paris immediately, before my stones proliferate too much. If Lindenau had not had to leave Frankfurt for his station in Brussels, I would have been in Paris four weeks ago. I am expecting him at any moment, and when he comes, I shall have to decide on having another turn of wintering in Paris. Meanwhile, my pains are growing, and I must hurry and travel, while I am in a fit state to do it. …
>
> My only excuse is that I have written this letter in three days. If you are still capable of taking an interest in my sufferings, you must be informed about the date of my departure for Paris. I shall write you a longer letter on arrival, though I think that the road I am taking is taking me straight to the Pére la Chaise.
>
> Now, even you must realise that you have added the finishing touches to my sufferings, with your letter and with your unfounded assumptions. May God forgive you.
>
> In spite of all this, I remain, as always, your faithful, grateful and humble servant :
>
> Zach" {406}



The Paris Observatory.



The Royal Greenwich Observatory.

5. Suffering Gravely, Supported by Friends, His Mind at Peace

It is hard to find an explanation for the miracle of Zach's last three years. Although his medical condition did not show much improvement, the old Zach, with his strength, humour, acute powers of observation end interest in scientific matters, seems to reappear in his late letters. Consequently, he again turned into somebody interesting and stimulating to be with. During his stay in Paris, even in those troubled time, he was seldom without visitors, seeking his company.

This change was probably caused by his parting with two false illusions. One must have been the hope in his eventual recovery and belief in ever being able to live without pain. The other was the belief, that the company and support of his friends, in Frankfurt or Elfenau, can ever turn him into a healthy, contented man again.

In one of his letters, Abraham Schiferli also made the point that Zach's letters ceased to be 'Jeremiads' full of complaints. In his letter of the 17th December 1829 Zach made a slightly offended remark :

> "I do not know what gave you the idea, that I am satisfied with my medical condition." {407}

We learn from the same letter, sent from Frankfurt, that Zach arrived in Paris in a condition racked by pains.

> "I am in haste to inform you, as soon as I can, of my arrival in Paris. On this journey my suffering was unbearable, worse than during the last occasion. The pain was worst not during the travelling itself, but rather what was meant to be my nightly rest. I spent my nights without sleep, tormented by acute pains. … I have arrived in Paris on the 7th of December. Civiale gave me five days to recuperate from the vicissitudes of the journey, and then he started on the preliminary treatment using baths and similar methods. On the 13th he examined me using a special probe, but he did not find any stones, only some insignificant pieces of debris, not enough to account for my condition. In spite of this, my bladder is sick, very sick. The inflammation of my bladder reached the chronic state; it cannot now be cured in less than five or six month's time. Every hour I can spend free of pains is a net gain for me." {408}

His accounts of his illness became short and factual, sometime even humorous, but they were purged of all traces of misanthropy.

Apparently, Zach has regained his spiritual equilibrium.

I should like to use a few excerpts from his letters, to shed some light on the progress of his sickness between 1829 and 1832. He wrote to Schiferli on the 14th of March to Horner :

> "I have surrendered myself to my sufferings. It would be a fitting idea to rename St. Lazaire St., the street where I live, as the 'Street of Job'. I am not afraid of death and do not dread it, my only wish is, that if I be condemned to life, to spend the remainder of my life with as little pain as possible." {409}
>
> "I want to start my letter by telling you that I am getting better from day to day. I receive an injection from Civiale every day. The doctors in Marseilles, Bern and Frankfurt made me to take a lot of useless concoctions. My Civiale is entirely

different. If he is near, apothecaries starve. He treats diseases of the bladder not by medicines, bur by mechanical procedures." {410}

"My Dear Friend, this winter was better than the previous one … My condition was generally improving, except for a short relapse in the early months of winter." {411}

"You may look upon me as a living factory of stones, which, I am afraid, is more efficient than most similar workshops in Manchester, Sheffield or Liverpool." {412}

"I wish young Moritz would write his Dissertation on Civiale's »Lythotritie« …" {413}

Zach was very pleased by the news that his beloved young Moritz was going to write his Doctoral dissertation on his ailment and Civiale's method of treating it. He had two reasons for being pleased with these news. Firstly, he remained a firm believer in Civiale and his methods, secondly, because this way he could spend more time in the company of his long time favourite.

From his letter to Abraham Schiferli, on the 14th December 1831 :

"What a delightful surprise it was for me to have Dr. Moritz Schieferli paying me a visit … The young Doctor ought to be more sparing with his time and should not waste it on dull and profitless visits." {414}

In spite of the pleasure the young man's visit caused Zach, he did not want selfishly to waste his young friend's time and distract him from his studies.

Three brief report of Zach's health, sent to Elfenau during the last three years :

"I better say nothing about my health. It keeps going like an old, run down watch." {415}

"I am still among the living, but what a living! Still, I have been saved from the cholera. I have constant pains, and writing is becoming a hardship." {416}

"Perhaps you may have been thinking that I am about to give up the ghost. This time I am the victim of not the bladder infection, nor the cholera, but a very painful rheumatic condition, locally known as lumbago." {417}

Paris in 1829 - 32

In the final years of Zach's life conditions in Paris were very unsettled, he had to survive two revolutions. In 1829, he was still hopeful, that the stupidest, and most violent rule of the last Bourbon king, Charles X will not provoke a new revolution in France. He wrote to Schiferli in December 1829 :

"You posed me the question: »Will revolution come to France once again?« Even if it does, it will be a less violent outbreak. Today Frenchmen remember only two things, the horrors of the last revolution and the bayonets of the English, Russian, Prussian and Austrian armies." {418}

Events had proved Zach wrong. Revolution broke out in July 1830. Charles X had to flee the country in a mail-coach, wearing disguise. He was succeeded on the throne by another member of the house of Bourbon, Louis Philippe, the 'citizen-king'.

"Louis Philippe was sneaky, careful and clever. He was always shaking hands with his new followers, »the brave fighters of liberty«; He was walking the streets, carrying his umbrella, demonstratively playing the role of the simple citizen and National Guardsman. His pear shaped, simple face was meant to be proof, both to the simple people of the streets and the crowned heads of Europe,

that from now on they had nothing to fear of the return of the Bourbons' arrogance, or the Jesuits, or Bonapartist adventures, or any disturbance of the peace of Europe or costly wars. Those with little businesses can sell their wares undisturbed, and those planning big business adventures may surely count on him. After this, he sacked Gen. LaFayette, thus putting an end to the fear of the military or the people of the streets" {419}

It seems that the clever and soberly calculating mind in Louis Philippe. was not up to solving the problem of the corruption of public life and the rule of the rich, wearing the guise of liberty.

"On the 5th of June 1832 barricades were erected again in the streets of Paris.
The workers and the university students knew that the 'expulsion of the Bourbons' two years ago, during the 'glorious days of July', was a sham and did not work out as intended. The people felt betrayed by their leaders, by Gen. LaFayette, the nobleman and by citizen Lafitte, the banker. The rule of the church and the aristocrats turned into the rule of bankers and moneymen. The naked corruption of the bankers was even harder to take than the arrogance of the aristocrats and the Bourbons. Armed uprising appeared to be the only way out. For two days there was fighting on the barricades, which only ended when the rebels were forced to retreat to the Church of St. Merry, where they were massacred to the last man." {420}

Louis Philippe ruled for another sixteen years, until the revolution of 1848.

News from the Life of Science

It is worth thinking of how Zach could learn so much of the world outside, confined as he was in his Parisian home, or, as he was wont to call it, his 'prison'. It is known that he was a subscriber to contemporary journals, but it must be assumed that his main source of information was the circle of his friends and visitors. In 1829, when he resumed his correspondence with Carl Friedrich Gauss of Göttingen, he gave the following account of the scientific life of the French metropolis :

"I can send you no interesting scientific news from Paris, as there is nothing happening in Paris. In the observatory, nobody is bothered to take any observations. Legendre is old and ailing. Fourier is ailing and deaf. Poisson is burned out. Biot has disappeared. Damoiseau lost interest. Our only hope is a twenty-year-old official, Pontecoullant. Only his judgements are worth of consideration. Politics gobble up everything. Everybody is restless and frustrated and seeing only a bleak future ahead. The same mood pervades everything.
Things are declining in England too. The scandal is caused by stopping the publication of the 'Nautical Almanac' and the closing down of the 'Office of Longitude'. The stories circulating about the research on 'pendulum clocks' are probably known to you. At present Airy and Lubbock are the only two notable practitioners of Geodesy. Ivory is regarded as half crazy. I am certain you have read Airy's paper 'On Laplace's Investigation of the Attraction of the Spheroid Differing Little from a Sphere', and Lubbock's 'On the Determination of the Orbit of a Comet'. Airy made his observations with a 10' passage instrument, and published them in the Journal of the new observatory. I think we can expect much from this scientist. You can also have access to Bradley's results, because I know they were published by somebody. The accuracy and authenticity of

these measurements was contested by M. Sabine. I am sure you are bound to have more of these baseless accusations." {421}

Zach's letters to his friend, Horner, are also full of news about scientific activities :

"Did you see and observe the comet yet? The corruption and ineptitude of the Parisian astronomers is really wondrous to behold. (This was the second return of Encke's comet, visible in Europe, whose periodicity was established in 1819.) They reported it as their achievement, when they stated that it was nothing but an old and already well known and thoroughly studied nebula in Andromeda. Practical astronomy had ceased to exist in France. Gambart is the only observer left in Marseille. The only trouble with him is that he has a mild case of a degenerative disease, and has not much time left to live. {422} (…)

You have informed me in your letter, that in the forthcoming 'Dictionary of Physics' you were given the task of contributing the definition of »magnetische Inclinatorien und Länge«. Please do not forget duly to emphasise the fact, that the first »Inklinatorien«, and the first »Längen Uhren«, were invented by the French, who are also to be credited with the first accurate determination of the »Lunar Distances«. Should you neglect this, you will be damned and ostracised by them for the rest of your life. Get hold of this year's edition of the yearbook of the 'Office of Longitude'. From this source you will learn the truth: the steam engine and the steamship were not invented by the English or the Americans, but by the French. John Bell is going to publish a reply to this in the near future. …

On the other hand, you may be saved by the Frenchmen's ignorance of foreign languages. Nowadays everything was invented by Frenchmen, railway transport, gaslights and the theory of gravitation. In any moment we shall be informed that printing books is a French invention too. …

What is Encke's comet is doing nowadays? I have not heard of this 'pseudo-comet' lately, which ought to be much better known by now. …

Hereabouts nobody can be bothered to observe it. Plana informed me in his letter, that he is keeping it under observation since the 5th of November. It was very visible on the 23rd December, on account of its nearness to the horizon. …

Alas, suicide is becoming endemic among scientists, even astronomers. Sr. Brambilla in Milan, who made the calculations for the 'Ephemerides', took a dive from the high roof of the Brera observatory, and never rose again. He was the second unfortunate astronomer in Milan. Mosotti, who was forced to flee, wrote to me a few years ago, that he has landed a Professorship in Buenos Aires, where he wants to build an Observatory, of which he would be the director. I have not heard of him ever since. Here, in Paris, the Secretary of the French Academy threw himself in the Seine. He has left some papers behind him, but his body has not been found yet. He has disappeared a fortnight ago, since then his duties are performed on a temporary basis. {423} (…)

In the 1831 volume of the *Conn. de Tems*, where Puissant's paper was published about the Azimuth of the Polaris, another very interesting study can be found by Nicollet, in which he wanted to clarify the scandalous difference of latitude between Mont-Jouy and Barcelona. I intend to contradict this in an anonymous article, establishing the true value of the meridian. …

I should be very happy to receive a paper from you, to compare it with Puissant's. …

… These gentlemen, who are presenting German achievements as their own, constantly use Bessel's calculations concerning corrections to the 'solar orbits', without understanding, let alone acknowledging them. They keep saying that

these were known to and used by them long time hence. And, as far as the aberrations are concerned, these were fist clarified by Delambre.
I only want to remark, that such an explanation, as was provided by Bessel, has never been created before. …
Littrow's position is not much to be preferred to Bessel's. When he has written his gap-filling opus on achromatic lenses, Biot asserted that all that was known to them for a long while. What is more, the French have already reached a better solution using trigonometrical methods. Littrow's work has only scratched the surface." {424}

So Zach had not only read and observed, or used his sharp tongue to chastise the French astronomers for their habit of putting themselves on a pedestal, standing superior to all others. Not planning to go as far as a learned article, he still intended to publish a letter in one of the learned journals, and tried to persuade his Swiss friend also to publish a scientific paper. As the following letter would show, this effort has proved not to have been in vain.

"Many thanks for your valuable contribution. Your recommendation, like Reichenbach's instrument, is universal. Much more valuable than the combined effort of Puissants. Your method necessitates the use of only thirteen logarithms, and it can be used without tables. To evaluate Puissant's, one would need nineteen logarithms, and still recourse should be made to different Tabulations. I shall send your work to Taylor's *Phylosophical Magazine*. You are right when you say that the Frenchmen's »calling« for scientific work is a sham, egotism and nationalism of the most contemptible sort. The Germans are on the right lines, when they try to shake off this tutelage and doing it with confident pride.
The English do not send the products of their intellect to Paris, and make no secret about it. The French send theirs neither to London, even less to Germany.
Here are two facts in support of my statement :
Four days ago, a Major of the Corps of Engineers, name of Müller, paid me a visit. Did he come to get to know me? No. To visit me on my sickbed? No. It was necessity that drove him to me. His field of study is the determination of longitude on the high seas. He asked for guidance from the Office of Longitude, but they were incapable of giving him any assistance.
Another case. A man came to me with a recommendation from the Duke of Cambridge. He has been also recommended by the Duke of Clarence. To my question; why did he not take his invention to the Office of Longitudes, he replied that it was his original intention and this was the reason of his coming to England. Only after arriving to London did he learn that this office was disbanded by Parliament, for the reason that the Nautical Almanac contained too many erroneous data, the use of which led to an unnecessary number of shipwrecks and other disasters.
I have heard frightening stories about scientists and scientific life in England from Major Müller. Pond, the Astronomer Royal, is always dead drunk, lying in his bed. Davy had also taken to drink. Nobody is willing to accept the chairmanship of the Royal Society.
I have heard it a few hours ago that the government had closed down the Milan Observatory and fired all the scientists." {425}

❋

It gave Zach great pleasure, that after so many years and on a very modest scale, he could take part in a 'mini' gathering of international scientists in his home near the Tivoli.

South from London, Moll from Utrecht and Herr Scherer from St. Gallen, they all arrived in the St. Lazaire Street home for a short scientific discussion. In addition to many important subjects, much of the current gossip was brought into the discussion. For example, mention was made of the Office of Longitude in London, which was closed down by an order of Parliament, and his erstwhile Secretary, Thomas Young was hounded to death. Sir Humphrey Davy died of a 'broken heart; over the anger and vexation he was subjected to.

South has heard it with his own ears when the Chancellor of the Exchequer said in public: »I know nothing about science, and the subject of the nation's scientific self-respect leaves me cold …«

Professor Moll, a man of very pleasing manners, was having supper at Bouvard, who was living with Laplace's widow. There was not a single astronomer among the guests. The four astronomers working in the Royal Observatory were looking at each other, as dogs usually look at cats. On French soil, astronomy was defunct. Moreover, the same sort of situation prevailed with the other sciences. Politics and egotism has ruined all."

These extraordinary events were the subject of conversation at Zach's 'mini' meeting. {426}

❋

Zach's letters to Schiferli show, that Zach, besides keeping an eye on the everyday happenings in the world of science, but took the trouble to keep abreast with new ideas in fields such as religion, philosophy and history. He was in the habit of making short summaries of them for his friend Schiferli. For example, they discussed the four-volume work of M. M. Delavaut and Franchet, titled : 'Répertoire alphabetique de la police politique sous le Ministére Déplorable'. One of the points of interest of this opus was that it contained the reports of denunciation, written to the police by informers in the days not very long ago. Another item of interest was the publication of the correspondence of Baron Grimm, a popular figure in the social life of the last century and close friend of the late Ernest II, Duke of Gotha. The publication of M. Diderot's (one of the leading lights of the French Enlightenment) was also a noteworthy occasion.

Zach has especially emphatic in recommending his close friend and faithful visitor the new book of the Abbot Grégoire dealing with religious sects. The enlightened Bishop of Blois was a faithful and consistent fighter for religious reform. In his books, he took a brave stand for the inalienable right of man to liberty. He was the first to write a book about the horrors of slavery. During the revolution, he bravely wore his priest's clothing, in spite of its having been strictly forbidden. He could always reconcile his Catholic faith with his progressive ideas. Nevertheless, he was expelled from the church, and after his death, he was denied a church funeral.

Schiferli, a man deeply steeped in his Protestant Faith, who was as proud of his enlightened humanity as Zach, had often got entangled in religious arguments with his friend, who, on his side, had an equally deep commitment to Roman Catholicism. Schiferli saw the Roman Catholic religion, or even the Roman Catholic faith itself was the main stumbling block on the road to enlightenment. Old Zach had never had any hostile feeling towards other people's beliefs, was far more tolerant in these questions. He closed one of his letters, which he wrote as an answer to Schiferli's inchoate idea of using the conversion of the world's population to the Protestant faith as an instrument of curing it of all its ills, with the wistful sentence :

"I wish for living out the short part of my life still left to me, in holding on to our mutual understanding, harmony, tolerance, friendship and abiding affection." {427}

Visitors in the St. Lazaire Street

From the quoted correspondence it san be seen, how many interesting people visited Zach in his home near the Tivoli Gardens. It is known from Zach's letter to Gauss, that in addition to Mr. South, Chairman of the Royal Astronomical Society, who was a frequent visitor in Zach's home, Mr. Airy, the director of the new observatory built in Cambridge, came to see Zach every time he visited the French capital. Especially welcome guests were the Princess Louise, the late Duchess' granddaughter, and her new husband, Count Pölzig.

He has first met the Princess in Frankfurt, at Lindenau's Place. He also reported the details of this event in a letter to Elfenau. For a time he was acting as the legal guardian of the princess, who has paid Zach a regular annuity on the late Duchess' request, who left part of Prince Friedrich's inheritance to the princess for this purpose.

Formerly Zach had a wrong assessment of the young woman's character. He used to take her for a pleasure-seeking, heedless and extravagant woman, but when he had met her in person, he had found no trace of these adverse characteristics. He had found her a natural, well-mannered, level-headed and honourable young woman, whose attractive speaking style and sound opinions stood out among the other members of her elegant set.

The Princess and her husband had also found Zach sympathetic, and they have invited him to spend some time with them in St Wendel. Zach spent August and September of 1829 there.

Unfortunately, the Princess had to return to Paris in February 1831, to seek a cure for her serious illness. She died there in the August of the same year.

Zach shared some sorrowful thoughts with Lindenau about this sad event :

> "It is a sad turn of fate, that I, who had to bury the grandmother, now had to witness the fading away of her grandchild, the last surviving member of the House of Gotha. This event has reopened many of my old, but only partly healed wounds. When at the turn of the century, I was present to welcome the child and to hold her in my arms; I had never thought that thirty-one years later I should be there to close her eyes in a foreign land, as I had to do for her grandmother." {428}

In the same year, Zach had to part with another of his faithful friends, the Abbot Grégoire. Just one year later, our hero himself had to say his final 'Farewell' to this 'vale of tears'

Epilogue

Unfortunately, we know nothing about Zach's contacts with Hungary. The last item of his estate related to Hungary is a letter written to Károly G. Rumy on the 30th July 1825, in which he had invited the Hungarian scientist to become a co-worker of the *CA*. As the Journal itself ceased publication not much later, this letter had no practical consequence.

It may be of interest to note, that the Abbot Grégoire, who played such an important role in Zach's life, had quite a few Hungarian friends of his own. Of two we know for sure: one was József Podmaniczky, the famous politician, the other the director of the St. Gellért's Hill Observatory, Péter Pál Tittel, the successor of Pasquich. Tittel, even though he was a Roman Catholic priest, had never renounced this friendship, which might have presented him with some unpleasant problems.

Zach was also officially notified about having been accepted in 1832 as a member of the Hungarian Academy of Sciences (named Scientific Association that time). The Association entrusted the Hungarian Ambassador in Paris to deliver the official document of notification to Zach's address. He was living in hope, that his native land would

eventually acknowledge his achievement. Unfortunately we cannot know, whether the long awaited document was or was not delivered in time. {429}

His astronomer friends in England commemorated him with a warmly worded necrology in the journal *Monthly Notices* :

> "It is seldom, that we have to lament a more useful lover of science than Franz Xavier von Zach …
> It is needless to mention, the cause of the Baron's unexpected removal from Genoa in 1826, and the general loss which stopage of his work occasioned : for about this time a painful complaint rendered application to Dr. Civiale, of Paris, so absolutely necessary, he took up his abode in that city. There, even while under repeated suffering surgical operations, his animation never flagged, and to the last his natural exuberance of spirits was ever at hand, to relieve the earnestness of discussion …
> There are few persons of the age who are likely to be more regretted by the numerous friends to whom his talents, vivacity, sociability and agreeable manners, had endeared him." {430}

Here, At Last, I Found My Home

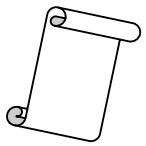
I finally found my home,
the land where my name
is correctly spelled above the grave
where I'm buried–if I'm buried.

***

While I lived, I tried
to stand up against the wirlwind.
The joke is, I harmed less
than I was harmed.

Spring is fine, and so is summer,
but autumn's better and winter's best
for one who finally leaves his hopes
for a family and a home to others.

Attila József
(Translated by John Bátki)



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Biographies

Airy, Sir George Biddel (1801-1892) English astronomer. Appointed in 1835 to the post of Royal Astronomer, becoming Director of Greenwich Observatory. His research was principally in astrometry. His work, spanning several decades, made it possible to establish precise latitudes and longitudes throughout the whole of Great Britain. He thought it an important task for himself to foster an agreement between astronomers concerning a standard first meridian. Thanks to his work, in 1883 the meridian of Greenwich was chosen for this purpose.

Anna Fedorovna, Duchess Juliane (1781-1860) daughter of Prince Franz von Sachsen-Coburg-Saalfeld. Married in 1796 to Prince Konstantin Pavlovich (brother of the Russian Tsar, Alexander I). Divorced in 1820. Her marshal was the Swiss doctor Abraham Rudolf Schiferli, the most important correspondent of Zach. One of the brothers of the duchess, Prince Leopold, later became Leopold I, King of Belgium; the other, Ernst I, Prince of Sachsen-Coburg-Saalfeld, ruled in Gotha from 1825.

Arago, Jean Dominique François (1786-1853) French physicist and astronomer, director of the Paris Observatory. In 1806, he worked with French astronomer Jean Baptiste-Biot (1774-1862) as an employee of the Bureau de Longitudes, where he was carrying out geodesic measurements in order to precisely establish the length of one metre. As a physicist his name is preserved by the so-called Arago experiment, which shows that a magnetised needle placed above a rotating copper disc will itself rotate. In 1830, he was elected as the Secretary of the Academy of Paris. He was made France's Defence Minister in 1848.

Bailly, Jean Sylvain (1736-1793) President of the 'Académie royale des sciences' in Paris. French astronomer, one of the the first authors of serious works on astronomical history. In 1789, he was elected to be President of the French Constitutional Assembly. As one of the victims of Robespierre, he was put to death by guillotine.

Baily, Francis (1774-1844) English astronomer, President of the Royal Astronomical Society. Astronomical geodesy featured as one of his research areas. He published in 1824 a treatise entitled 'On the method of determining the difference of meridians by the culmination of the Moon', which appeared in the second volume of the *Memoirs of the Royal Astronomical Society*.

Bajtay, Antal (1717-1773) Piarist monk, who stayed in Rome during 1739-1745 where he studied philosophy and mathematics. During the years of 1745 and 1746 he made a European scientific tour. In 1759, he was given the task of teaching Hungarian history to Joseph II, then heir to the Habsburg throne. As the Bishop of Transylvania he stayed in Gyulafehérvár (now Alba Iulia, Romania) between 1761 and 1773.

Banks, Joseph (1743-1820) English scientist, president of the Royal Society from 1778 to 1820. His main research area was botanics. Apart from botanics, Banks was also interested in astronomy, he himself carrying out observations. During 1868-71, he was a member of the James Cook-led expedition whose main goal was to observe the transit of Venus on

the Tahiti islands. Banks had a big part to play in the success of these measurements, as he was the one who managed to recuperate the astronomical instruments that had been appropriated by the local indigenous population. Banks followed Cook on other journeys, too. He was with him, for instance, when Cook discovered New Zealand's two islands and Australia's Eastern Coast. Banks also led the first English scientific expedition to Iceland in 1772. As a confidant of King George III of England, he directed the Royal Botanic Gardens in Kew.

Benyák, Bernát (1745-1829) Piarist monk, who in 1767 taught at the Piarist Secondary School in Veszprém, and then between 1774 and 1784 at the Piarist Academy in Pest. The following saying, oft-mentioned in monastic quarters, originated from him: "Be a good philosopher and then you are a good Piarist, since the philosopher is characterised by intelligence, self-discipline, a respect for the law and a sense of duty". Bernát Benyák's remaining lecture notes also reflect the spirit of the Enlightenment.

Bessel, Friedrich Wilhelm (1784-1846) German astronomer and mathematician, who during 1806-1809 worked at Lilienthal (Germany), at Schroeter's observatory. Later he was made director at the Königsberg Observatory. His work, *Fundamenta Astronomiae*, counted as one of the fundamental astronomical handbooks of its time. Bessel was among the first to measure the parallax of a star. His first scientific treatises appeared in Zach's journals.

Billecocq, Jean-Baptiste-Louis-Joseph (1765-1829) famous Parisian lawyer, renowned journalist and translator. Representative lawyer of Mme Panam ("le jeune grecque") and his son.

Bode, Johann Elert (1747-1826) named Director of Berlin Observatory in 1876, and editor of the Astronomisches Jahrbuch. In 1801, he published a catalogue that contained 17000 stars. The name Uranus (for the planet discovered by Herschel) originates from him. During his 1785 stay in London, Franz Xaver von Zach sent his first article to the Bode-edited Jahrbuch. This publication was Zach's most important forum for his scientific results, until the time when he had his own journals.

Bogdanich, Imre Dániel (1762-1802) Hungarian astronomer; a student of János Pasquich at the University of Pest. During 1785-88, he taught at the Academy of Nagyvárad (now Oradea, Romania). Between 1793 and 1795, he worked at Vienna Observatory. In 1795 he got a job as an assistant at the observatory operating at the Buda Castle. In 1798, he was entrusted to carry out astronomical observations on the territory of the Austrian Empire so as to help the creation of Lipszky's Mappa Hungarica… . Zach followed Bogdanovich's travels with an anxious care, since Bogdanovich worked in severe circumstances; he did everything he could to obtain for him the most appropriate instruments. Unfortunately, the gifted astronomer became severely ill, and after a long period of suffering, died on the 31st of January, 1802. His observational results contributed to a large extent to the success of the 'Mappa Hungarica…'.

Bohnenberger, Johann Gottlieb Friedrich (1765-1831) German astronomer. For a time he worked beside Zach at Seeberg. Then, after Zach's failed attempt to obtain for him the directorship of the Bologne Observatory, he ended up working in Vienna, beside Bürg. Later he became Professor of Astronomy at the University of Tübingen. Here he published with his fellow editor Bernhard Lindenau four volumes of the journal *Zeitschrift für Astronomie und Verwandte Wissenschaften* (in 1816/17).

Boscovich, Ruggero Giuseppe (1711-1787) Dalmatian Jesuit physicist, astronomer, the founder of the Milan Observatory. Not only the most consistent defender of Newton's theories, but also a developer and propagator of it. As an astronomer he worked out new methods of calculating the trajectory of comets. These were later displaced by Laplace's theories. Boscovich also carried out astronomical geodesic measurements, which Zach did not think to be precise enough. Boscovich had good relations with the professors of Nagyszombat (now Trnava, Slovakia) Jesuit University; he even visited them. He was also well acquainted with Ferenc Weiss' work and he held it in high esteem.

Bouvard, Alexis (1767-1843) French astronomer who worked at the Parisian Bureau des Longitudes. As an immediate colleague of Laplace he also worked in calculations of celestial mechanics.

Burckhardt, Johann Carl (1773-1825) German astronomer who for a time worked beside Zach at Seeberg. Later he worked in the Observatory of 'Ecole Militaire' in Paris with Lalande, and after its establishment, he also worked in the „Bureau des Longitudes". Afterwards, he became Director of the Observatory of the 'Ecole Militaire'.

Bürg, Johann Tobias (1786-1834) Mathematics Professor at the University of Vienna, and an employee of Vienna Observatory. He visited Zach several times at the Seeberg Observatory, becoming one of Zach's most endeared colleagues in his astronomical work. In 1801 too, they were 'hunting' together for the disappeared asteroid, the Ceres. The main reason why Zach honoured him so much was his competence in theoretical work, and the results which he had attained in the field of celestial mechanics. Regrettably, when the astronomer from Seeberg got into difficult circumstances, this intimate friendship did not stand the test.

Cagnoli, Andrea (1743-1816) Italian astronomer, mathematician, and diplomat. Zach met him for the first time in Paris, 1783, when he was in diplomatic service. From 1798 he worked as a mathematics professor at Modena, Italy. In 1807, he published the booklet 'Catalogue de 501 étoiles'. His work 'Trigonometria piana e spherica' appeared in three editions (Paris, 1786; Bologna 1804; Paris, 1808).

Calandrelli, Giuseppe (1749-1827) Italian astronomer and mathematician; director of the observatory belonging to the Collegium Romanum. His main research area was comets.

Cassini de Thury, Caesar François (1714-1748) French astronomer, Director of Paris Observatory. It was his South France survey measurements whose validity Zach checked, where he took care to repeat the observations in exactly the same locations. Zach also published Cassini's geodesic measurements in a book.

Charles-Félix (1765-1831) Viceroy of Sardinia during 1799-1816. The brother of Victor Emmanuel I, from whom he took over the kingdom 1821. During his rule, he came under the influence of Metternich, and he represented Austria's interests in his country. He was Zach's most dangerous enemy, who had done everything to expel our astronomer from Genoa.

Charlotte Amalie, Duchess (1751-1827) daughter of Duchess Charlotte Amalie (1730-1801) and Duke Anton Ulrich von Sachsen-Meiningen (1687-1763). Married in 1769 to his cousin, the then 29-year-old Ernst II (1745-1804), Duke of Sachsen-Gotha. She bore four children, only two of whom survived childhood : August (1772-1822) and Friedrich (1774-

1825). As a result of these mournful events and the Duchess' own continuing illness, the couple had estranged pretty early on. The Duke always had in his court certain, discreetly hushed away, 'adventures'. Notwithstanding, the couple had several common interests which united them: their respect and love for the sciences and arts, for instance. Both were interested in the theory and practice of astronomy, meaning that Zach found equal pleasure in the friendship of Duke and Duchess. It is absolutely evident from both the Duchess' surviving diaries and Zach's letters that Charlotte Amalie was an intelligent and cultivated woman, who evoked the greatest respect from those around her. Goethe was also among her admirers: the pair had already been acquaintances from the Duchess' childhood in their native Frankfurt.

Ciccolini, Lodovico (1764 – 1854) Maltese knight, director of Bologne Observatory during 1801-1815. He was a frequent visitor of Zach's and the Duchess' Genoese home. He was even present when they received their deportation documents.

Civiale, Jean (1792-1867) noted Parisian surgeon. 1824 was the year in which he first demonstrated his famous method of removing bladder-stones. He even published a book on this subject, entitled 'Sur la lithotritie ou broiement de la pierre dans la vessie' (Paris, 1826). He was the main actor in the last years of Zach's life, someone who was trusted by Zach even in the worst years of his illness.

Conradi, Norbert (1718-1785) Piarist monk. An excellent scholar who was equally proficient in languages as well as the sciences. Editor of the book 'Dissertationes Agonisticae' by the Italian Piarist, Eduard Corsini. He advertised within his order the 'new', natural philosophical and mechanical way of thinking, as opposed to the old qualitative way. The collection of his philosophical writings, 'Sic es conscripsi versus…' survived him in manuscript form. He taught Zach between 1763 and 1772 at Veszprém, and then after 1773 at the Piarist Academy in Pest.

Cörver, János (1715-1773) Piarist monk, who as the head of the Piarist Order in Hungary, did everything to spread the new ideas of the Enlightenment. Studied in Rome in 1740. After his stay in Rome, he embarked on a foreign scientific tour. In 1745 he reached Paris. During his travels he also appeared in Friedrich II (the Great)'s court. He furnished the Piarist Order's house in Pest with a rich library.

Dalberg, Emmerich Joseph Duke (1733-1833) envoy of the Grand Duchy of Baden in France. Entered his French service in 1809. The transaction of the marriage between Napoleon I and Archduchess Maria Louise was his responsibility. In 1815 he took part in the Vienna Congress. During the period of the French Restoration he was a minister wihout portfolio, then France's envoy to Torino.

David, Martin Alois (1757-1836) monk of the Premontre Order who, with the title of 'Royal Astronomer', was the Director of the Observatory of Prague. Later he became director for the scientific society, the 'Königlich böhmischen Gesellschaft der Wissenschaften'. He carried out his astronomical and meteorological observations in Prague for many decades and with great zeal. He met Franz Xaver von Zach in Karlsbad (now Karlovy Vary, Czech Republic) in 1789. He was one of the first correspondents of Zach – they exchanged their observations regularly, informing each other of their newest results and experiences on the field of astronomy. The Seeberg astronomer forwarded David's observations to Bode's Jahrbuch, and when he had his own journal, it was there that he communicated the writings of the astronomer from Prague. Their frequent

correspondence stopped on the death of Zach's patron duke. Later, during 1810-16, Bernhard Lindenau also sent a couple of letters to David in Prague.

Degola, Eustachio (1761-1826) Jansenite philosopher and theologian. Opposed Napoleon's treaty with the Vatican. He lived in several places: England (1802), the Netherlands (1803), Germany (1805); in the last case, he also visited Seeberg with his friend Gregoire, where he became acquainted with Goethe and Zach. From here he returned to Genoa. In 1809-10, on the invitation of Gregoire, he stayed in Paris.

Encke, Johann Franz (1791-1865) German astronomer. Finished his university studies under the hand of Gauss, in Göttingen. His writings already appeared in Zach's journals when he was quite young. During 1813-15, at the time of the Napoleonic wars, he served in the artillery. Johann Pasquich would have liked to see him as a co-director of the Gellérthegy Observatory in Buda, but he did not manage to obtain the necessary permit from the Austrian Empress. From 1813 to 1817, he worked as an astronomer at Seeberg. In 1825, he was named as the Director of the Berlin Observatory. From 1844 to his death, he was the Professor of Astronomy at Berlin University. He nurtured a countless number of renowned astronomers, including the Hungarian astronomer, Miklós Konkoly Thege.

Ernst I (1784-1844) Duke of Sachsen-Coburg-Saalfeld-Gotha, the brother of Archduchess Anna Fedorovna and Leopold I of Belgium. Husband of Duchess Louise, the granddaughter of Duchess Charlotte Amalie. Furthermore, he was the father of Queen Victoria's husband, Prince Consort Albert.

Fekete, Count György (1711-1788) one of the most loyal subjects of Queen Maria Theresia. Appointed in 1748 as 'Personalis', the Queen's personal representative. His merits earned him the title of Baron in 1751 and then that of Count in 1758. In 1768, the Queen made him High Commissioner of Nagyszombat (now Trnva, Slovakia) University. During the time of Joseph II, he resigned from all of his posts, which act regained him the trust of his fellow (Hungarian) countrymen, a trust that he had lost due to his previous extreme loyalty.

Fekete, Count János (1741-1803) Hungarian nobleman, who at the age of 13 became the godfather of Franz Xaver von Zach. There is no evidence that the two ever met afterwards, we can only say that they had often stayed in the same city. Both of them were freemasons, and their way of thinking was very similar. János Fekete also became the follower of the Enlightenment without ever denying his Catholic faith. His role model was Voltaire. It was for him that he wrote his French poems, which were published in 1781. They had a correspondence that stretched several years. At the age of thirteen he became a student at the Teresianum, and later in 1758 at the Viennese Military Academy. As an officer in the Austrian occupying forces, he stayed in Galicia from 1772. In 1778, he took part in the Austrian inheritance wars. At the time of Joseph II, he belonged to the group opposing the empress' rule, together with his friends Baron Miklós Vay and József Podmaniczky. In 1790, at the time when Leopold II was crowned, he became one of the leading figures of the Hungarian national movement. He was a member of the nobility group that transported Hungary's Holy Crown to Buda. He spoke in Hungarian at the country's National Diet, and fought for the usage of Hungarian in military commands (as opposed to German). The collection of Count Fekete's command words are now stored in the Manuscripts' Section of National Széchenyi Library in Budapest. Under Franz I, he retired to his estate at Fót. The Imperial Secret Service followed his every move.

He dedicated his last living years to writing Hungarian poetry. His most loyal visitor, Lajos Schedius, was a correspondent of Zach.

Flamsteed, John (1646-1719) the first Astronomer Royal and founder of Greenwich Observatory. A result of his industrious work was the magnificent stellar map, the 'Atlas Coelestis', which was only published in 1753, after his death. His observations on the Moon provided Newton with great help for developing his theory of gravitation.

Flauguergues, Honoré (1755-1835) amateur astronomer at Viviers, France. A frequent contributor to Zach's journals. The two met in person during the winter of 1804-5, in France.

Gauss, Karl Friedrich (1777-1855) German mathematician and astronomer, who after finishing his studies became the Court Mathematician for the Duke of Braunschweig. In 1807, after the death of the duke, he was made Professor of Mathematics and Observatory Director at the University of Göttingen. In 1814, his 'Theoria motus corporum coelestium' became, in its time, a fundamental work on the movement of planets. The Hungarian astronomer Pál Tittel spent one and a half years (1815-17) as a student of Gauss at Göttingen.

Goethe, Johann Wolfgang (1749-1831) German poet, who had made an acquaintence with Duchess Charlotte in their home town, Frankfurt. Goethe, who in his autobiography speaks of the young Duchess with great appreciation, even visited her at Seeberg. He also knew Zach well. In 1808, on the occasion of the Erfurt meeting, Napoleon had met him on a personal reception. It is likely that Goethe, in his sketch of the astronomer in the 'Wilhelm Meisters Wanderjahre …' was basing the character on Zach.

Grégoire, Henri (1750-1831) cleric, theologian, who after 1789 was elected into the French Constitutional Assembly, as a follower of the Jacobine movement. In 1791, he became the Assembly's President. In the same year, he was appointed Bishop of Blois. Although as an Assembly member he voted for the cessation of the Kingdom and the establishment of the Republic, he opposed the execution of the King. When the revolution turned against the Church, he put on his priestly garments during sittings of the Assembly. He fought for religious freedom, and against the discrimination of Jews. In his writings he demanded the total liberation of slaves. During his life, because of his libertarian views he was the recipient of fervent attacks from the Church, and after his death they denied him a religious service. He was one of the most loyal friends and frequent visitors of Zach in his old age.

Grimm, Frèderic Melchior Baron (1723-1807) German writer, critic, friend of Duke Ernst II of Sachsen-Gotha. The Baron was a well-known member of Marie Thérèse Geoffrin's (1699-1777) salon, which was a meeting place for followers of the Enlightenment. Visitors included the great French philosophers Diderot, d'Alambert and Holbach. The Baron introduced Duke Ernst into this distinguished circle, where he was duly accepted. Baron Grimm also visited his friend at Seeberg.

Hájek von Hájek, Tadeáś (aka Hagecius) (1525-1600) Czech doctor and astronomer, friend of Kepler and Tycho Brahe. The latter he invited to Prague, when he got into difficult circumstances on the Isle of Hven, Denmark. In 1572, Hagecius had – simultaneously with Tycho – observed the supernova that was later named after Tycho.

Hardenberg, Georg Gottlieb Leberecht Freiherr von (?-1822) Chief Equerry to Ernst II, amateur astronomer, who in 1787 accompanied the Duke, Duchess and Zach to Southern France, and who carried out astronomical observations with them. He prepared a small observatory in his own home in Gotha, where he carried out his observations. These were forwarded by Zach to Bode's Jahrbuch's; later he published them in his own journals. They also corresponded.

Harding, Karl Ludwig (1765–1834) German astronomer who, to begin with, worked beside Schroeter at Lilienthal. Here he discovered the asteroid Juno on the first of September, 1804. Harding later became a Professor at the Georgia Augusta University in Göttingen, and became a co-director with Gauss at the observatory.

Harriot, Thomas (1579-1621) English mathematician and astronomer. An Oxford man. In the company of Sir Walter Raleigh, he sailed to Virginia in 1584. A book sprang out of this journey: 'A brief and true Report of the Newfoundland Virginia, of the Commodities there found to be raised. London, 1588'. In the fall of 1784, Zach found his astronomical manuscripts (which had never been published) on the estate of Baron Porchester, a stepson of Count Brühl. They contained old accounts of solar spots and comets, two of which stood out: the comets that had been spotted by Halley and Kepler (the latter in 1618). Zach had extensively analysed these notes and found them quite valuable; consequently, he published a detailed account of Harriot's manuscripts in the *Astronomisches Jahrbuch*'s Supplement I.

Hell, Miksa (1720-1792) Hungarian Jesuit astronomer. Carried out astronomical observations throughout his whole life, starting out at the Jesuit Academy in Kolozsvár (now Cluj-Napoca, Romania). He had also published two mathematics books in this city. In 1756 he became Director of the University of Vienna's Observatory. From this moment on, he had regularly published his almanacs, the *Ephemerides Astronomicae Vindobonensis*. On the request of the Danish ruler Christian VII, Miksa Hell and fellow Jesuit János Sajnovics travelled in the Autumn of 1768 to the island of Vardoe, so as to observe, on the 3rd of June 1769, the transit of Venus over the Sun. His successful results were published in book form in Coppenhagen and Vienna. Hell also carried out longitudinal measurements on the territory of Hungary. Zach only accepted these measurements as reliable.

Herschel, Sir John Frederick Wilhelm (1792-1871) after the death of his father he took on his observatory. From 1834 to 1838, he stayed in Cape Town, where his activities laid the foundation of astronomical work in this city, which work is still significant to this day. It was his discovery that the Magellanic clouds are galaxies. He published a catalogue on binary stars and on the 5079 star-clusters and nebulae that were known at the time. The observations that he had carried out in Cape Town when the comet Halley appeared in 1835 were of great importance. He was among the first astronomers to use photography as a scientific method. In 1848 he was made President of the Royal Society. No doubt it served much to Zach's joy, that in April 1824, in his state of persecution, the young, talented astronomer had visited him in Genoa.

Herschel, Friedrich Wilhelm (1738-1822) outstanding musician who thanks to his talent, moved to England from Germany. Besides this, he was also a keen amateur astronomer and telescope-maker. On the 13th of March 1781, he discovered the planet Uranus. He was a Fellow of the Royal Society, and in 1782 George III made him the King's Astronomer. He had achieved great results on the field of observing binaries, listing stellar nebulae and

the analysis of the Milky Way's structure. He is also the discoverer of the Sun's infrared radiation. Brother to Caroline Herschel (famous for her observations of comets) and the father of the outstanding astronomer, Sir John Herschel.

Herschel, Lucretia Caroline (1750-1848) continous helper to the work of her astronomer brother, Friedrich Wilhelm. The discovery of eight comets are linked to her name.

Horner, Johann Jakob (1804-1886) nephew of Johann Kaspar Horner, from 1829 mathematics professor at the Carolinum, in Zürich. Stayed for a few months with Zach in Paris, 1827.

Horner, Johann Kaspar (1774-1834) Zach's dearest and most loyal pupil. He had done his university studies in Jena and Göttingen. In 1798, he worked beside Zach at Seeberg. Between 1803 and 1806, he partook as an astronomer in Adam Johann Kruesenstern's round-the-world voyage. On this occasion he made countless valuable observations on the Magellanic clouds. Returning from his voyage, he became the Russian Tsar's "Imperial and Royal" astronomer. He returned to Zürich in 1809, so as to become the Mathematics Professor at the 'Collegium Humanitas'. In 1822, after 25 years, he met his mentor again in Genoa. They had corresponded with each other throughout almost their entire lives. Horner's pupil was the Rudolf Wolf to whom we are indebted for Zach's first extensive biography, and the publication of countless letters of Zach.

Hornsby, Thomas (1733-1810) English astronomer, a Fellow of Physics and Astronomy at Oxford University. First publisher of James Bradley's observations, which contributed a great deal to the success Friedrich Bessel's 'Fundementa Astronomiae'. He was also the founder and first director of Oxford University's Observatory. Zach visited Hornsby in Oxford. It was at this time that Zach took such a liking to the observatory, which he later used as a model for his observatory in Seeberg.

Joseph Anthon, Archduke (1776-1847) younger brother of the Austrian Emperor Franz I, who in 1795 became the Palatine of Hungary. His goal was based on sensible compromise: to suit the interests of the Empire, yet preserve and secure the constitutional governance of the country whose welfare he was entrusted with. In 1804, he presented a document to the City of Pest, in which he outlined his plan to rebuild it. To this end a 'Beautifying' Committee was created in 1808. Under its control, Pest had become a modern, classicist city. The Palatine had a big role in the establishment of the St. Gellért's Hill Observatory in Buda, whose first director was a much-loved guest at the Palatinal Court. Pál Tittel, who followed Pasquich in the post of Director, also enjoyed the Palatine's kindness, who himself was an amateur astronomer: in 1820, for instance, he witnessed a Solar eclipse from the St. Gellért's Hill Observatory.

Kmeth, Dániel (1783-1825) Hungarian Piarist monk, astronomer and mathematician. Taught philosophy from 1807 at the Piarist Order's High School ("Gimnázium") in Vác, Hungary. In 1812 he ended up working beside János Pasquich at the Observatory in Buda's Castle Hill. During 1815-23 he worked at the St. Gellért's Hill Observatory in Buda. He was a hard-working observer, and his observations had been published in printed form. In the spirit of his Order, he took it upon himself to write and publish astronomical articles in Hungarian. He wrote a detailed account of the operation and instruments of the Castle Hill Observatory for the journal *Tudományos Gyűjtemény* (meaning "Scientific Collection" in Hungarian). It is unfortunate that his name in posterity survived not due to his scientific achievements, but instead his mournful role in

the so-called 'Pasquich affair'. In 1824/5 he taught mathematics at the Piarist School in Kassa (now Kosice, Slovakia).

Konstantin Pavlovich (1779-1831) Russian Grand Duke, younger brother and general of Russian Tsar Alexander I. In 1796, he married Duchess Juliane Sachsen-Coburg-Saalfeld, who on her marriage adopted the name Anna Fedorovna. They divorced in 1820. In 1822, he surrendered his rights to the throne, after which he lived in Warsaw, with a Polish wife.

Koppi, Károly (1744-1801) Hungarian Piarist monk and historian. During 1771-85, he taught history at the monastic quarters in Nyitra (now in Slovakia), Vác, Kolozsvár (now Cluj, Romania) and Pest. In the midst of this, he stayed in Count János Fekete's Viennese house for a year (in 1774), as a personal teacher and nurturer of his son, Count Ferenc. Between 1786 and 1796, he was History Professor at Pest University; later he was robbed of this title because of his freemasonic links, after the 'Martinovics plot' against the Austrian monarchy (inspired by French Jacobinism) was uncovered.

Köhler, Johann Gottfried (1745-1801) German astronomer, who as a member of the 'Mathematischen Salon' in Dresden, was occupied with astronomical observations and the development of astronomical instruments. His personal relationship with Zach started in the winter of 1785, when Zach stayed for some time in Dresden, in the company of Count Brühl. Köhler's observations appeared in Zach's journals regularly.

La Lande, Joseph Jérôme le François (1732-1807) outstanding French astronomer. In Berlin 1751, as a young, nineteen year-old man, he carried out measurements concerning the establishment of the Moon's parallaxis. From this moment on, he had a good relationship with German astronomers. He got in contact with freemasons in Friedrich II's court in Berlin. Upon returning to Paris, he founded the masonic lodge 'Loge des neuf Soeurs', whose members included such distinguished people as Talleyrand (1754-1838) and Benjamin Franklin (1706-1790). Lalande was, from 1768 right up to his death, Director of the Observatory 'Ecole Militaire' in Paris. Zach – whose interest in astronomy started when he read Lalande's several-volumed book, the 'Astronomie', in his youth – got to know his book's author during his 1783-stay in Paris, when he worked with him in the observatory. It was at this time that their life-long friendship started. Lalande also counted as a much-honoured guest in the circle of Zach's rulers when he visited them in 1798, on the occasion of the Seeberg Astronomical Conference. He was the most assiduous contributor to Zach's journals, who in addition edited the astronomical almanac *Conaissance des Temps* for several years. His regularly-published astronomical biographies did a great deal of service to researchers of astronomical history.

Laplace (La Place), Pierre Simon (1749-1827) French phycisist and astronomer, the first significant figure in the field of "celestial mechanics". During Zach's stay in Paris, the two had close contacts with each other; Zach used his method to calculate the trajectory of the comet that had appeared in 1779. In 1799, for a brief time, he was a minister. From 1803 he was a member of the French Senate. Napoleon was a big admirer of the renowned scientist. During the period of the French Restoration, Louis XVIII bestowed on him the rank of Marquis.

Leopold (1790-1865) Prince of Sachsen-Coburg-Saalfeld, the brother of Anna Fedorovna and Ernst I of Gotha. Married Princess Charlotte (1796-1817), the daughter of English King George IV, in 1816. King of Belgium from 183l. In 1832 he married again, this time

Princesse Louise Marie, the daughter of French King Louis Philippe (the so-called "Hatter King"). He too belonged to the band of loyal visitors when Zach was old and infirm.

Liesganig, Joseph (1719-1799) Jesuit astronomer, who taught mathematics at the Teresianum, Vienna. The coursebook he wrote, entitled 'Tabulae memoriales praecipua aritmeticae … in usum auditorum', was published in this city in 1755. He started his astronomical studies in the Viennese Jesuit Observatory, which was led by Joseph Franz. Maria Theresia, Austrian Empress, comissioned her in 1756 to survey (that is, establish the precise latitude and longitude of more important locations) the length and breadth of the Empire. The results of his work were concluded in "Dimensio graduum meridiani Viennensis et Hungarici', published in Vienna, 1770. Following the dissolution of his Order he became Director of Lemberg (now Lvov, Ukraine) Observatory in 1777, doing surveying in Galicia (now in the Ukraine and Poland). Franz Xaver von Zach worked under him when he worked in this city.

Lindenau, Bernhard August (1779-1854) German diplomat and astronomer, a friend loyal to Zach throughout, his "guardian", as Zach in his last years called him. After the death of Duchess Charlotte Amelie, he did everything in his power to ensure that Zach lived in appropriate conditions. Despite being much engaged, he made the effort of visiting of Zach from time to time. Lindenau read law to start with, but from a young age he was interested in astronomy. As an astronomer, he was the follower of Zach in the directorship of Seeberg Observatory, also taking over from him the editing of the *Monatliche Correspondenz*. In 1816, together with another pupil of Zach by the name of Bohnenberger, he started a new journal entitled *Zeitschrift für Astronomie*. He also had a successful career as a politician. From 1813 he took part in the anti-Napoleonic campaigns as an officer. During the peace talks in Paris, he acted as the Prussian King's adviser. Under the rule of August and Friedrich it was in fact him who, as a minister, governed the state of Gotha. Lindenau was the heir to Zach's material and intellectual legacy; he also took care of Zach's funeral. Zach's epithet also originates from: "Dem Himmels-Kundigen Franz Freiherrn von Zach sein Dankbarer Schüler und Freund Bernhard von Lindenau."

Lipszky, János (1766-1826) officer, cartographer, member of the same regiment – Graeven – that the Kossuth-dubbed "greatest Hungarian", Count István Széchenyi, served in a few decades later. The 'Mappa generalis Regniae Hungariae partiumque adnexarum …' that he edited had much success when it was published in 1806. This was the first Hungarian Atlas that had been drawn with the help of astronomical observations. Lipszky had personally requested from Palatine Joseph of Hungary that Imre Dániel Bogdanich be entrusted with the astronomical observations that were required for the completion of this map. In 1808, the appendix necessary for the usage of the map was also produced. Zach helped Lipszky in all possible ways.

Littrow, Joseph Johann (1781-1840) Austrian astronomer. Named in 1807 Professor of Astronomy at the University of Krakow. In 1810 he moved to Kazan, where he was employed with the same post. During 1816-1819 he worked beside Pasquich as co-Director at St. Gellért's Hill Observatory, Buda. From 1820 he gained the directorship at Vienna Observatory. Here he worked right up to his death. He was a big admirer of Franz Xaver von Zach.

Löwenfels Eduard, von (1808-1892) natural son of Duchess Anna Fedorovna. His father Jule-Gabriel- Emile de Seineux (1738-1834) was the first marshal of the Duchess. Lövenfels

grew up in the Schiferli family, where he treated Abraham Rudolf Schiferli (who became the next marshal) as his own father. Later he lived as a courtly adviser in Coburg.

Louise (1800-1831) German Duchess, daughter of August Duke of Gotha, granddaughter and heir of Duchess Charlotte Amalie, and wife of Ernst I, Duke of Sachsen-Couburg-Saalfeld. She had two sons. In 1826 Louise divorced her first husband and instead chose Baron Hanstein, who later gained the name Count Alexander von Pölzig. During their stay in Paris, Duchess Louise and her new husband often visited Zach in the street of St. Lazare. The Duchess' son was Albert (1819-1861), none other than the husband (and thereby Prince Consort) of Queen Victoria of England (1819-1901). Zach took a liking to the well-educated and attractive Duchess, and mourned her untimely death.

Martinovics, Ignác (1755-1795) Hungarian Franciscan monk and natural philosopher. He read theology and philosophy at the University of Pest. From 1783 to 1791 he was Physics Professor at the University of Lemberg (now Lvov, Ukraine). At this time he published several articles on Physics and Chemistry, as well as a book on Physics called 'Praelectiones physicae experimentalis'. As a layoff agent of the Austrian Empire, Martinovics organised a revolutionary movement in Hungary. After its repression, he and his associates were executed on the 20th of May, 1795.

Maskelyne, Nevil (1732-1811) Astronomer Royal at Greenwich. His catalogue of stars was an indispensable tool for the day-to-day work of contemporary astronomers. Leader of the 1761 expedition to St. Helen's island, whose objective was to observe the Venus transit. Editor of the Nautical Almanac from 1767, which he had founded.

Mayer, Christian (1719-1783) German Jesuit astronomer, Director of Mannheim Observatory. In his book, 'Gründliche Vertheidigung neuer Beobachtungen von Fixstertrabanten : welche zu Mannheim auf der Kurstfürl. Sternwarten endeckt worden sind …', which came out in 1778, he gives a detailed account of his observations on binary stars, providing a theoretical explanation for the phenomena he experienced. Christian Mayer also notified his friend Ferenc Weiss (astronomer at Nagyszombat; now Trnava, Slovakia) of these conceptions.

Mudge, Thomas (1715-1794) famous watch-making Londoner, who constructed the finest chronometers. A protégé of Count Moritz Brühl, for whom he made several valuable chronometers. Retired from business life in 1771. He was among those who had proved the significance of the chronometer invented by Harrison with respect to the safety increase it brought for navigation, doing all he could to develop this invention further.

Murat, Joachim (1767-1815) outstanding military leader. As the son of a pub-owner, he had worked his way up from being an ordinary soldier in the French Revolution to the rank of Marshal. One of the closest friends of Napoleon, whose sister Caroline he married. When in 1808, Joseph Bonaparte (1768-1844) became King of Spain, the Emperor (Napoleon) entrusted him with the Kingdom of Naples. He was the leader of the unsuccessful Russian campaign. On returning from Russia, he briefly made a treaty with Austria, but at the time of the 100 Days' War, he aligned himself with Napoleon again. For this he was captured and executed after the Battle of Waterloo.

Napoleon I, Bonaparte (1769-1821) Corsican with a gentry background. Enlisted to French military school. During the revolution he served in the army. His first distinguished service came in the Italian campaigns. After the fall of Robespierre, he

became one of the three members of the 'Directorium'. In 1804, he crowned himself Emperor. Marengo, Austerlitz and Jena were his successful battles. At one time, the whole of Italy belonged to his rule, as well as numerous small German states, which came to be known as the 'Rhineland Alliance'. It was only with Spain and the English Navy that he could not deal with. In 1812, his troops returned defeated from Russia. Finally, a coalition of Austrian, Prussian and Russian forces won an overwhelming victory against Napoleon at Leipzig, 1813, and on the occupation of Paris in 1814 he was forced to abdicate, whereby he was exiled to the island of Elba. From there he returned in the Spring of 1815 for 100 days, only to be defeated for good at the Battle of Waterloo (June 15, 1815). After being exiled to the island of St. Helen, he was poisoned at the age of 52. In Zach's letters, we can follow how his opinions of Napoleon formed and changed. Initially he saw in him someone who preserved the ideals of the Revolution and suppressed the terror of those who had sidetracked from it. Later, during his stay in Italy, he was pricked by the "invader" attitude of the French troops. However, the reaction caused by the Holy Alliance, which he had to personally experience in the form of persecution, greatly saddened Zach, who earnestly lamented the Emperor's Death.

Olbers, Heinrich Wilhelm Mathias (1758-1840) acquired a medical degree at the University of Göttingen. From here he moved to Bremen, where he practised as a doctor for the rest of his life. It was in this city, on the attic of his own house, that with relatively small instruments, he continued an astronomical work that was rich in success. The discovery of several comets and two asteroids: Pallas (1802) and Vesta (1807) are attributed to him. His book 'Neue Metode für Berechnung der Kometenbahnen' – edited by Zach – provided a new method of calculating the trajectory of a comet. As a close friend of Zach, he regularly published in his journals.

Oriani, Barnaba (1752-1832) Director of the Milanese Brera Observatory, one of the closest friends of Franz Xaver von Zach. In 1786, he carried out geodesic measurements in Lombardy. A decade later Napoleon entrusted him with surveying across the whole of the Italian Kingdom. We find a regular account of his work in Zach's journals. Oriani edited and published the Milanese Astronomical almanacs, which served as a useful tool for practical astronomical work. Beside this he worked on several theoretical projects. His main area was celestical mechanics. He was also a diligent student of the effect of refraction, and the precise determination of the time with the help of the Sun's altitude. Beyond their shared scientific interest, a common set of beliefs also binded them. Both of them managed to reconcile their faith with the ideals of the Enlightenment. They respected – albeit with reservations – Napoleon, for which both of them were made to suffer. Napoleon had named Oriani as a Senator of the Italian Kingdom, later giving him the title of Count.

Pasquich, Johann (1754-1829) Hungarian astronomer, who in 1784 moved to Pest to teach mathematics at the local university. In 1786, he went to work in Buda's Castle Hill Observatory. His first book was published in Leipzig 1789, which was followed by several mathematics textbooks, and a popular astronomy work. He left Hungary in 1797, to which he only returned in 1802. In 1806, he was named Director of the Castle-Hill Observatory. The Gellérthegy Observatory in Buda was built according to his conceptions, and started functioning under his direction. In 1826 he left Hungary again, moving to Vienna, where he later died.

Piazzi, Giuseppe (1746-1826) Italian astronomer. Founder of the Palermo Observatory, whose director he became in 1790. On the first of January 1801, he discovered the first

known asteroid, Ceres. As a result of his diligent observational work, he published a star catalogue in 1814 that contained 7646 stars. At the time of the Bourbon Restauration in 1817, he was entrusted with directorship of Naples Observatory. Zach held Piazzi in high esteem, trusting his expertise. It was partly thanks to this that Zach was the one who rediscovered Piazzi's asteroid. In the January 1810 edition of the *Monatliche Correspondenz*, a detailed study is to be found of the astronomer's activities.

Pictet, Marc August (1752-1825) Swiss astronomer, Physics Professor and Observatory Director at Geneva University. In 1823, together with Kaspar Horner, he organised the meteorological network in Switzerland.

Podmaniczky, József (1756-1823) Hungarian politician and a supporter of the arts. It was in his house that the young Ferenc Liszt first introduced himself to the wider world. He was a student of Göttingen University, and a frequent visitor to England. It is not known precisely when, but we know for certain that by 1880 he was a Fellow of the Royal Society. In London, he became close friends with the President of the Royal Society, Joseph Banks, and with Jesse Ramsden, a master of astronomical instruments. In 1790, he became Governor of Trieste. As a member of Hungary's Governing Council he became the first Intendant of theatres in Pest. After the defeat of Napoleon he led the talks at the Paris Peace Conference (1815-17) as a representative of the Austrian Government. Podmaniczky was in good relations with one of Zach's dearest friends, Henri Gregoire, who counted as an honoured guest at his house. It was the place where Gregoire, the French humanist priest met another Hungarian astronomer Pál Tittel.

Pond, John (1767-1836) named Astronomer Royal and Director of Greenwich Observatory in 1811. In 1833, he published a star catalogue containing 1113 stars, a catalogue that was more precise than anything preceeding it. From 1820, he rebuilt Cape Town Observatory.

Pons, Jean Louis (1761-1831) moved to the Observatory of Marseille in 1801, where he worked as an assistant astronomer for years. In 1813 he was named Assistant Director. He became the Director of Lucca Observatory in 1819 on the recomendation of Zach. In 1825, he took over the direction of Firenze Observatory. The renowned "comet hunter" discovered 27 comets in his lifetime. Zach had already met Pons in 1804/5 when he was staying in France, who remained a keen helper in Zach's astronomical work.

Ramsden, Jesse (1735-1800) optician, mechanic, maker of the best astronomical instruments of his time, whose efforts were rewarded by a Fellowship from the Royal Society. The Hungarian Baron Miklós Vay had spent half a year in his London workshop so that he could pick up the processes for making these instruments. Zach was also in close contact with him, since a proportion of the instruments used at Seeberg had been purchased from Ramsden. Giuseppe Piazzi discovered Ceres on the New Year of 1801 with meridian circles purchased from him.

Reichenbach, Georg (1772-1826) German instrument maker who in 1804, together with Joseph Utschneider and Liebher, created a mechanical and optical plant in Münich. In 1806, Joseph Fraunhofer (1787-1826) also came to work in this workshop. Zach, as he had often stated in his letters, held Reichenbach as a close friend and one of the greatest instrument makers of his age.

Roux, Pierre Martin (1791-1864) French doctor and surgeon who served as a military doctor in Napoleon's army. Later he worked in Marseille. He treated Zach with great love

and understanding, when in the Winter of 1827/28 he stayed in this city in a totally run-down state.

Roy, William (1710-1790) English Marshal, who besides his military work also dealt with surveying. His papers on this topic were published in the Philosophical Transaction, London.

Rumy, Károly György (1780-1847) Hungarian writer and historian. He had achieved great success with the advertisement of Hungarian literature in German. In 1803, the writer visited Zach at his Seeberg Observatory. Rumy's 'news-from-home' accounts can be found in the *Monatliche Correspondenz*. The last letter Zach sent to Hungary was addressed to him, on the 30th of July, 1825.

Rumovsky, Stephan (1734-1809) pupil of Leonhard Euler and Mathematics Professor at St. Petersburg University. He made observations on the 1761 and 1769 Venus transits. Other observations were regularly sent to Zach at Seeberg for publication.

Rümker, Karl Ludwig Christian (1782-1862) naval officer, a good expert in the theoretical problems of navigation. Appointed as leader of the Naval Academy in Hamburg. Zach met him on Malta, in 1816. He published Rümker's writings in his journal, the *Correspondance Astronomique*.

Rüppel, Eduard (1794-1884) German natural philosopher, zoologist, traveller, who donated his rich collection – accumulated during his travels – to the museum of his home town, Frankfurt. He stayed in Genoa for a few months in 1819, and with the guidance of Zach learnt the methods and practice of determing the location of places, which skill he greatly needed as a traveller. He remembered his 'master' with great love for long afterwards.

Saint Jacques de Silvabelle (Sylvabelle) (1722-1801) French astronomer; Director of Marseille Observatory from 1763 to 1781. His astronomical work appeared in Bode's Jahrbuch through Zach's mediaton and translation. Zach met him personally in 1783.

Schedius, Lajos (1768-1847) Hungarian linguist, writer, who taught Aesthetics at the University of Pest. Despite teaching Arts he had a great interest in map-making, he himself publishing a Hungarian Atlas for educational purposes. He corresponded with Zach for several years. He also sent regular accounts to the *Allgemeine Geographische Ephemeriden* and the *Monatliche Correspondenz*. As a curator of the Lutheran Church in Pest, he was the founder of the Lutheran High School in the city. He published a German-language journal under the name of *Zeitschrift für Ungern*, whose goal was to make Hungarian scientific life and culture known abroad. He was a close friend of two other Hungarian astronomers: Johann Pasquich and Pál Tittel.

Schiferli, Friedrich (Fritz) Ludvig, von (1806-1834) the elder son of Abraham Rudolf Schiferli. Finished reading Law in Heidelberg.

Schiferli, Karl Moritz von (1808-1897) younger son of Abrahan Rudolf Schiferli, whose development Zach followed with great love from the very beginning. Moritz acquired his medical degree in 1831 in Heidelberg. He went to Paris in the same year to study Civiale's surgical methods. During his stay in Paris he regularly visited Zach. He even based his doctorate on his treatment and on Civiale's treatment methods.

Schiferli, Rudolf Abraham (1775-1837) Swiss doctor and politican, marshal of Duchess Anna Fedorovna. Read theology and philosophy in Bern. Moved to Jena in 1795 to pursue medical studies. In 1798 he returned to Bern to practise as a doctor. Married to Margaryta Ith (1782-1855) in 1803, who – as we know from Zach's letters – was an outstanding woman, who during Zach's time in Elfenau cared for the old and frail Zach with great love and attention. They had two sons, Friedrich (1806-1834) and Moritz (1808-1897). Zach liked both of them very much, and held them in high regard. Schiferli became the Professor of the newly-formed Bern Medical Faculty in 1805. Three years later, the Duchess built a magnificent castle in the lovely Elfenau, bordering Bern. This is where Schiferli lived with his family, and where he returned with his Duchess if he got bored and homesick of their travels. Schiferli's duties as marshal lasted – with short exceptions – right up to his death, preventing him from practising as a doctor, or living for his scientific 'calling'.

Schröter, Johann Hieronymus (1745-1816) German astronomer who, as a clerk of city of Bremen, erected his own observatory at the nearby Lilienthal. In 1793, he set up a 27-feet mirror telescope there, which at the time was considered a 'giant telescope'. Friedrich Wilhelm Bessel started his astronomical work in this observatory, as did Karl Ludwig Harding. It was in this observatory that the latter discovered an asteroid – later named Juno – on the first of September, 1804. Schroeter's most important work concerned the Moon and the planets. The first astronomical society (the predecessor to the 'Astronomische Gesellschaft') was founded in his observatory, on the 20th of September, 1800.

Sonntag, Anton (?-?) chief surgeon of the Austrian forces in Hungary, who on several occasions visited military institutions in the company of Joseph Zach, the father of Franz Xaver von Zach. Since Joseph's wife was called Sonntag, it is even possible that he and Zach were relations.

Smyth, William Henry (1788-1865) naval officer conversant in natural philosophy. During his stay in Genoa, Zach often visited him in the harbour. His geographical and hydrographical writings appeared in the Correspondance Astronomique. Zach, in his last years, exchanged a few letters with Smyth's wife.

Studer, Bernhard Rudolf (1794-1887) Professor of Mathematics, Physics and Mineralogy at the University of Bern. He studied in Bern, Göttingen, Freiburg and Paris. Zach met him at Elfenau, in 1828.

Taucher, Ferenc (1738-1820) Hungarian Jesuit astronomer. After the Jesuit Order was dissolved and Nagyszombat (now Trnva, Slovakia) Observatory was moved to Buda, he still stayed in Nagyszombat. Only after the death of Ferenc Weiss in 1785 did he move to the observatory in Buda, where he was Director until his retirement in 1806. Leaving Buda, he moved to Pécs (also in Hungary), where he lived as a canon for the rest of his life.

Thulis, Jacques Joseph Claude (1748-1810) French businessman who gave up his trade in 1789 in order to dedicate his time to astronomy at Marseille Observatory, later becoming Director of the institute. His observations appreared in the *Monatliche Correspondenz*. Zach made friends with him in 1787, and their friendship remained deep right to the end.

Tittel, Péter Pál (1784-1831) Hungarian mathematician, astronomer. Appointed as Director of the Observatory of Eger in 1809. After this he went to Vienna to pick up some theoretical and practical knowledge on astronomy. From October 1815 to the Spring of 1817, he studied in Göttingen under Carl Friedrich Gauss. From there he travelled to Paris, and then to London. In 1824, he was made the director at St. Gellért's Hill Observatory in Buda, where for a year, he controlled the observatory together with János Pasquich. From 1828 Tittel took part in the meetings leading up to the creation of the Hungarian Academy of Sciences. In 1830, he was elected as a full member. He died of cholera the following year.

Triesnecker, Franz Paula de (1745-1817) Austrian Jesuit astronomer, Director of Vienna Observatory from 1792 to his death in 1817. Between 1788 and 1805 he edited the Viennese astronomical almanacs ('Ephemerides Windobonense …').

Truchsess von Waldburg, Friedrich Ludwig (1776-1844) Prussian statesman, a member of the Würtenberg Representative House, envoy in Vienna and Paris, one of the politicians who accompanied Napoleon to Elba in 1814. Later he stayed in Torino as the official envoy of the Prussian State. He was Zach's main pillar of support during his ordeals in Genoa, doing everything he could (risking his own international reputation) to defend Zach from the campaign of slander he was facing. He was also the one who acquired a passport for him after the death of the Duchess so that he could leave the Sardinian Kingdom.

Tulla, Johann Gottfried (1770-1828) German engineer and Director of Water Affairs for the Grand Duchy of Baden, who had a big role in regulating the Rhine. In October 1827, he came under the treatment of Civiale. It was during this time that Zach made friends with this fellow sufferer. He died after the fifteenth operation. Our astronomer Zach was much shattered by this mournful event.

Utzschneider, Joseph (1763-1840) associate at Reichenbach's mechanical plant and owner of the glass factory at Benediktbeuren. City Councillor in Munich. During their 1807-stay in München, Zach and the Duchess both became friends with the Utschneider family.

Vay, Baron Miklós (1756-1824) military engineer and politician. Studied at the Leingruben Military Academy in 1776. Named General in 1805 and entrusted by the Hungarian parliament to regulate the river Tisza. Made Fellow of the Royal Society on the 22nd November, 1887. Count Moritz Brühl, Jesse Ramsden and William Roy were among those who recommended him. Vay worked in Ramsden's London workshop for half a year so that he could learn the skills of making some contemporary physical instruments. During his studies he was a great help to Ramsden in the mathematical calculations that were necessary for the production of the instruments. Baron Vay bought a countless number of valuable tools and objects (including a steam engine) to bring back to his native Hungary. "There were few mortals of more noble thinking and sentiment than him; he could not grasp how to do something vile", wrote Kazinczy of him in 'Pályám emlékezete' ("Recollections of my career").

Weishaupt, Anton (1748-1830) Professor of Ecclesiastical Law at Ingolstadt. Founder of the Illuminatus Order, which was later banned by the King of Bayern. In 1785, Ernst II received him to his court in Gotha. He lived here until his death in untroubled circumstances.

Weiss Ferenc (1717-1785) Hungarian astronomer. Founder of Nagyszombat University Observatory (now in Trnava, Slovakia), and editor of the first regular astronomical publication in Hungary, the 'Observationes astronomicae … in observatorio Collegii Academii Jesu Tyrnaviae in Hungaria habitae' (1756-1770). After the dissolution of the Jesuit Order the observatory was moved – together with the whole university – to Buda, so he continued his work in Buda Castle. Weiss managed to tune his observations to the work of his contemporaries by means of his regular correspondence with astronomers of his age (eg. Christian Mayer, Joseph Jerôme Lalande, etc).

Wolf, Rudolf (1816-1893) astronomer, science historian, Mathematics and Physics Professor at Bern University during 1839-1893, and later director at the 'Eidgenössischen Sternwarte in Zürich'. His work as an astronomer concerned Solar spots. His teacher Kaspar Horner drew his attention to the significance of Franz Xaver Zach's work; it was him who initiated Wolf to study his life and scientific activities. In the 1871-74 number of the Astronomische Mitteilungen, Zürich, he published the letters Franz Xaver von Zach wrote to Rudolf Abraham Schiferli and Kaspar Horner, as well as a detailed biography of our astronomer. All further works dealing with Zach are founded on his researches.

Zach, Anton (1747-1826) elder brother of Franz Xaver von Zach. Outstanding military leader. Finished his studies in the Military Engineers Academy in Vienna. Joined the Royal and Imperial Cadets in 1765. Became military adjutant to Baron Gábor Splényi in Galicia, 1774. During 1796-97, with the rank of Marshal, he was named Commander-in-Chief of the Austrian forces fighting in Italy. Awarded the Order of Maria Theresia in 1799. As a great expert in military technology, he wrote a series of books entitled 'Elemente der Manövrir-Kunst', Wien (1812-1830) on the subject. He had a close friendship with his brother Franz, and they had several common fields of interest. For instance, also took part in establishing geograhpical co-ordinates. A part of these measurements appeared in the *Monatliche Correspondenz* (*MC* 7 (1803) 134 p.) was also interested in astronomical problems: a study of cosmogony penned by him also appeared in his younger brother's journal. The good relations between the two brothers were unperturbed even when they sometimes had opposing political views. They even received the title of Baron together, in 1801.

Zach, Joseph (1714-1792) father of Franz Xaver von Zach and Anton Zach. Born in Olmütz, he emigrated to Hungary in 1840. He was first Chief Doctor of city Esztergom, then in 1845 he was appointed to be the Chief Doctor to Pest's Invalids' Hospital as well as to the whole city of Pest. In 1865 he received nobility status from Maria Theresia.

Notices

[1] Detailed description are available about this Hospital in the following books: Schoen, Arnold : A budapesti Központi Városháza, Budapest, 1930; Engländerné Brüll, Klára : Orvosok és kórházak Pest Budán, Budapest, 1930; Schlesinger, Ignác : Medicinische Topographie der Königlichen Freistädte Pesth und Ofen. Pest, 1840; Borsos, Béla – Soder, Alajos : Budapest Építészettörténete. Bpest, 1959.

[2] "In Junio 1754 : Den 16. Dito ist dem wohl edl gebohrenen and hochgelehrten Herr Jospho Zach a(rtium) l(iterarum) et philosophiae nec non saluberrimae medicinae doctori des allhiesigen königlichen Militar Invaliden Haus bestellten physico von seiner Ehefrau Clara ein Söhnlein gebohren worden, und in der heyligen Dauff Joannes Franciscus Xaverius Vitus Fridericus genennet worden, der Tauff wahr illustrissimo dominus Joannes Fekete de Galantha, filius personalis Pestiensis, illustrissima domina Maria Anna de Lavert als Zeugin; baptizavit P. Ludovicus." (Öster. Staatsarchiv, Kriegsarchiv Wien, K.K. Militärmatriken, Archivband 04339 = Militär-Invalidenhaus Pest und Tyrnau, Geburtenbuch 1735-1816. p.143) In : Franz Xaver von Zach und die Gründung der Seeberg-Sternwarte in Gotha 1788. Jahrbuch der Coburger Landesstiftung 1988. pp. 188-189.

[3] Anton Freyherrn von Zach. Elemente der Monövrir-Kunst. 1-3, 1812-1830. Dritter Theil. Nach von ihm hinterlassen Manuscript. Mit Biographie. p. III-VIII.

[4] Zemsky Archiv Opava, pobocka Olomouc. M.5623 p. 142 Date of birth 4. 11. 1714 Place : Olomouc apud B. mariam Virginem in Praeurbio. Name: Carolus Josphus Antonius. Father : Joannes Paulus Zoch, bürgerlicher Caffesieder. Mother Clara. Godparents Praenobiis dominus Josephus Walkowski von Walkenheim, senaor et domina Dorothea Bischoffin Ernbberger Bürgemeisterin.

[5] Budapesti Belvárosi Római katolikus Főplébánia. Keresztelési anyajönyvek, 5.köt. 1747. Jún. 15. Notices : Antonius. Pater : Joseph Zach. Mater : Clara. Godfather : Anton Grassalkovich, Godmother : Baronesse Anna Laffert.

[6] Rómer Flóris : A régi Pest. Budapest 1873 pp. 120-121

[7] Interesting information is avaliable about Pest of XVIII century in the following books : Schmall Lajos : Adalékok Budapest Székesfőváros történetéhez.; Trencsényi Waldapfel Imre : A régi Pest-Buda. Schams Ferenc : Vollständige Beschreibung Pest. Patasich József : Die Bürger Pest. Pest, 1834.

[8] Magyarország Történeti Kronológiája. 1981 p. 574.

[9] Schams Ferenc : Vollständige Beschreibung der Königlichen Freystadt, Pest, 1821. p. 86-90.

[10] Magyar Országos Levéltár. P910. Galánthai Fekete család iratai. II. Gróf Fekete György iratai. 19. cs. Személyes iratok. (private papers) /Nos. 9-10.

[11] Magyar Országos Levéltár. A 57 Magyar Kancelláriai Levéltár. – Libri Regii. 4. Köt. pp. 345-346.

[12] ibidem 60. Köt. pp. 498-503.

[13] "… welchen traurigen und schmerzhaften Verlust ich durch der Tod eines innigstgeliebten Bruder(s) erlitten habe. Hauptman bei Eszterházy, wurde er bei durch den Leib geschossen, lebte noch 2 Tage, und starb unter den heftigsten Schmerzen" Briefe Franz Xaver Freiherrn von Zach … und seiner Nachfolgers Berhhards von Lindenau von 1791-1816 an P. Martin Alois David. Hrsg, von Otto Seydl. Prag, 1938. p. 84

[14] Zach's letter to Oriani (1809. Oct. 9).
[15] Szontágh Dániel : Az iglói és zobori Szontágh család története és oklevelei. Budapest, 1864.
[16] Hadtörténeti Levéltár. General Kommando. 1779/34/6 January 3.
[17] Fővárosi Levéltár. Pest Belvárosi templom születési anyakönyvei. 1770. március 6. Franciscus Xaver. Apa : Anton Sonntag. Anya : Anna Maria. Keresztapa : Ferenc Kauffman.
[18] Fővárosi Levéltár. Pest város jegyzőkönyvei. 1791. szeptember 24. p. 291.
[19] Fővárosi Levéltár. Pest-Belváros. Halotti anyakönyvek. 1792. július 16. Josephus Zach, doctor Medicus ex Moravia originis 78 an.
[20] Magyar Piarista Rendtartomány Központi Levéltára. "Catalogus studiosae iuventutis [Veszprémiensis]" 1748-1801.
[21] Magyar Piarista Rendtartomány Központi Levéltára. A budapesti gimnázium iratai. Anyakönyvek. "Liber iuventutis Scholastici Gymnasii Pestiensis" (1766-1779)
[22] Magyar Piarista Rendtartomány Központi Levéltára. "Catalogus studiosae iuventutis [Veszprémiensis]" 1748-1801. Koppt Károly levelezése.
[23] Gerencsér István : A piaristák és a magyarországi fizika a XVIII. században p.138-155. In : A magyarországi fizika klasszikus századai. Összeállította : Gazda István. Piliscsaba 2000.
[24] ibidem
[25] Wolf, Rudolf : Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. 1873. p. 336.
[26] Magyar Piarista Rendtartomány Központi Levéltára. "Catalogus studiosae iuventutis [Veszprémiensis]" 1748-1801. Koppt Károly levelezése.
[27] Anton Freyherrn von Zach. Eelemente der Manövrir-Kunst 3. 1831. p. III
[28] Magyar Piarista Rendtartomány Központi Levéltára. "Lyber iuventutis Scholastici Gymnasii Pestiensis." 1773.
[29] Rasp, Wilhelm Carl Beiträge zur Geschichte Lemberg. Archiv der österreichischen Geschichte. Bd. 43.
[30] ibidem
[31] *Monatliche Correspondenz*. 1801/ Nov. p. 550.
[32] ibidem p. 552.
[33] ibidem p. 551.
[34] "Als ich im J. 1783 in Genua war". *Monatliche Correspondenz*. 1800/May. p. 510.
[35] *Astronomisches Jahrbuch für 1788*, Berlin, p.148.
[36] Wurzbach, C. von : Biographischen Lexikon der Kaiserthums Österreich. Wien, 1890.
[37] Schreiber, Simon : Die Jesuien des 17. Und 18. Jahrhunderts und ihr Verhältniss zur Astronomie. Münster, 1903.
[38] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 81.
[39] ibidem p. 80.
[40] "… Die hiesige Erzbischof und die Jesuioten meine Verfolger sind …"Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche. P., p. 182.
[41] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 81. *Monatliche Correspondenz* 1801/ Nov. p. 553.
[42] *Astronomisches Jahrbuch für 1788*, Berlin, p. 148.
[43] Wolf, Rudolf : Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. 1873. p. 338.
[44] *Astronomisches Jahrbuch für 1799*, Berlin. p. 122.

[45] ibidem

[46] *Astronomisches Jahrbuch für 1788*, Berlin. p. 151. Wolf, Rudolf : Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. 1873. p. 338.

[47] ibidem

[48] At 4th April 1804 Franz Xaver von Zach was elected Fellow to the Royal Society. Among his bidder were : Nevil Maskelyne, Stephen Lee, Thomas Young, Joseph Banks, Henry Cavendish, Alexander Aubert, William Hyde Wollaston, William Mudge, Henry Englefield, John Hunter, Jose de Mendosa Rios, John Rennel, Joseph Huddart, George Best, Mark Beaufoy, Sir William Herschel. In May 1785 Franz Xaver von Zach made observations together with William Herschel in Dachet-ben. *Astronomisches Jahrbuch für 1788*, Berlin. pp. 215-221.

[49] Gosteli, L., Boschung, U., Brosche, P. (Hrsg.) : Astronom, Weltbürger, Blasenpatient, F.X. v. Zachs Briefe an R.A, v. Schiferli 1821-1832. "Ich bin kein Heyland, aber ich habe die Kinder eben so lieb wie er. An mir ist nicht viel gutes, aber leyder, ein guter Vatter ein guter Eheman ist an mir verlohren gegangen, ni fallor. Ich kann mich irren." Genua, 4. May 1822. p. 122.

[50] Paris, 1783. Aug. 5. British Library, B.M. Add. MS. 8095 p. 236.

[51] *Astronomisches Jahrbuch für 1787,* Berlin p. 251.

[52] 1784. May 3. British Library. Add. MS. BM 8096. pp. 199-200.

[53] *Astronomisches Jahrbuch für 1788,* Berlin. pp. 139-156, 214-220. *1799,* pp. 120-129.

[54] Vargha Domokosné : A Royal Society első három magyar tagjáról. William Herschel magyar barátai. Magyar Tudomány. 1994. 1 sz. pp. 108-114.

[55] Baron Miklos Vay de Vaja (1756-1824) Hungarian nobleman, enngineer Banks avoided using the Baron's name, and marked many of these letters "Secret" or "Private". The Baron arrived at the Soho Square on 20 March in order to gain secret access to Pitt trhough Banks. He sought British support for a plot as he put it to Banks on 28th March 'to take Hungary fully from the House of Austria'. Chambers, Neil : The letters of Sir Josephs Banks London, 2000. p. 123.

[56] *Astronomisches Jahrbuch*, Berlin. Suppl. 1. p. 41.

[57] ibidem pp. 2-26.

[58] ibidem pp. 26-41.

[59] *Astronomisches Jahrbuch für 1787*. Berlin. p. 251.

[60] *Astronomisches Jahrbuch für 1788*. Berlin. pp. 139-156.

[61] ibidem pp. 214-220.

[62] ibidem pp. 214-215.

[63] *Astronomisches Jahrbuch für 1789*. Berlin. p.158., *1791*. p.133, *1794*. p. 197.

[64] *Astronomisches Jahrbuch für 1794*. Berlin. pp. 197-198.

[65] ibidem p. 197.

[66] Franz Xaver von Zach : Hans Moritz Graf von Brühl. Allgemeine Geographische Ephemeriden. Bd. 4. 1799. p. 186

[67] ibidem pp. 184-186

[68] Bereichung der Leipziger Sternwarte durch die Grossmuth des Grafen von Brühl. Aus einen Schreiben des Professor Rüdiger. Monatliche Correspondenz 1803/Febr. p. 168.

[69] ibidem p. 169. G. Piazzi to H.M. von Brühl, Palermo, 18 March 1796. Scottish Record Office, GD 157 3432.

[70] Vargha Domokosné : A Royal Society első három magyar tagjáról. William Herschel magyar barátai. Magyar Tudomány. 1994. 1 sz. pp.108-114

[71] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 81. *Monatliche Correspondenz* 1801/ Febr. pp. 79-81

[72] Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. 1873. pp. 341-342.
[73] Beck, A. : Ernst the zweyte; Herzog zu Sachsen Gotha und Altenburg, als Pfleger und Beschützer der Wissenschaft und Kunst. Gotha : Perthes, 1854.
[74] Brosche, Peter : Der Astronom der Herzogin. Frankrut am Main, 2001. p. 37
[75] Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. 1873. p. 342. *Astronomisches Jahrbuch für 1789*. Berlin. pp. 236-244.
[76] *Astronomisches Jahrbuch für 1796*. Berlin. p. 235.
[77] *Astronomisches Jahrbuch für 1792*. Berlin. p. 166.
[78] *Astronomisches Jahrbuch für 1789*. Berlin. pp. 249-251.
[79] ibidem pp. 249-251.
[80] *Astronomisches Jahrbuch für 1791*. Berlin. pp. 112-148.
[81] ibidem p. 112.
[82] ibidem pp. 114-116.
[83] ibidem pp. 115-116.
[84] ibidem p. 117.
[85] ibidem p. 118.
[86] ibidem pp. 121-122
[87] ibidem p. 123.
[88] ibidem pp. 125-127.
[89] ibidem pp. 125-127.
[90] ibidem p. 128.
[91] ibidem p. 130.
[92] ibidem p. 131.
[93] ibidem p. 132.
[94] ibidem p. 132.
[95] ibidem pp.132-133, 138-147.
[96] ibidem p. 133.
[97] ibidem p. 134..
[98] ibidem p. 148
[99] Historische Studie über Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. p. 345.
[100] *Astronomisches Jahrbuch* für 1795. Berlin. p. 133.
[101] Chronometerbücher von Ernst II., zwei Hefte … Quellen zur Astronomie in der Forschungs- und Landesbibliothek Gotha unter besonderer Berücksichtigung der Gothaer Sternwarte. Zusammengestellt und kommentiert von Oliver Schwarz, Cornelia Hopf, Hans Stein. Gotha 1998. p. 17
[102] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). p. 6. *Astronomisches Jahrbuch für 1793*. Berlin. p. 163.
[103] Wolfschmidt, Gudrun : Gotha – the instrumentation of the observatory. The Message of he Angles – Astrometry from 1798 to 1998. Acta Historica Astronomiae Vol. 3. Verlag Harri Deutsch. 1998. pp. 89-90.
[104] *Astronomisches Jahrbuch für 1795*. Berlin. p. 254-256. *Astronomisches Jahrbuch* Suppl. Bd 1. Berlin. p. 174-194. Suppl. 2. pp. 1-7.
[105] *Astronomisches Jahrbuch für 1794*. Berlin. pp. 203- 213. *Astronomisches Jahrbuch* Suppl. 2, Berlin p. 122-141.
[106] *Astronomisches Jahrbuch für 1794 Berlin*. p. 182.
[107] Strumpf, Manfred : Gothas astronomische Epoche. 1998. p. 90.
[108] *Astronomisches Jahrbuch für 1791*. Berlin. p. 131.

[109] *Astronomisches Jahrbuch für 1794*. Berlin. p. 207.

[110] Handschriften von Zach und Ernst II. zu astronomischen, geographischen, geodätischen und verwandten Gebieten. Chart. B, 1034/b. BI. 14-21. Aberrations und Ntutationstafeln. Quellen zur Astronomie in der Forschungs- und Landesbibliothek Gotha unter besonderer Berücksichtigung der Gothaer Sternwarte. Zusammengestellt und kommentiert von Oliver Schwarz, Cornelia Hopf, Hans Stein. Gotha 1998. p. 17.

[111] *Astronomisches Jahrbuch für 1795*. Berlin. pp. 248-250.

[112] *Astronomisches Jahrbuch für 1796*. Berlin. pp. 146-148.

[113] Zach, F. X. von : Tabulae motuum solis novae et correctae ex theoria gravitatis et observationibus recentissimis erutae. Quibus accedit fixarum praecipuarum Catalogus novus ex observationibus astronomicis annis 1787, 1788, 1789, 1790, in specula astronomica Gothana habitis editae auspiciis et sumtibus serenissimi Ducis Saxo-Gothani auctore Francisco de Zach, Gothae, 1793.

[114] *Astronomisches Jahrbuch für 1792*. Berlin. p. 164; *Astronomisches Jahrbuch für 1795*. Berlin. p. 111.

[115] Wolfschmidt, Gudrun : Gotha – the instrumentation of the observatory. The Message of he Angles – Astrometry from 1798 to 1998. Acta Historica Astronomiae Vol. 3. Verlag Harri Deutsch. 1998. p. 89-90.

[116] *Astronomisches Jahrbuch für 1793*. Suppl. 1. pp. 244-266.

[117] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938)., – Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. – The Banks' Archive. The British Library, London B.M. Add. MS. 8095-8099., Astronom, Weltburger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. – Briefe Franz Xaver von Zachs an C.F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss., Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. Wolf, Rudolf : Briefe Zachs Horner. Vierteljahrschrift der Naturforschenden Gesellschaft In Zürich. 1870-1873.

[118] Zach, F. X. von : Tabulae motuum solis novae et correctae ex theoria gravitatis et observationibus recentissimis erutae. Quibus accedit fixarum praecipuarum Catalogus novus ex observationibus astronomicis annis 1787, 1788, 1789, 1790, in specula astronomica Gothana habitis editae auspiciis et sumtibus serenissimi Ducis Saxo-Gothani auctore Francisco de Zach, Gothae, 1793., Fixarum praecipuarum Catalogus Novus ex observationibus astronomicis in Specula Astronomica Gothana annis 1787, 1788, 1789, 1790 habitis et ab initium anni MDCCC constructus, Gotha 1792.

[119] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). p. 6.

[120] *Connaissance des temps* pour 1798-1799 (1797).

[121] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). p. 84.

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[123] ibidem p. 105.

[124] ibidem p. 107.

[125] ibidem p. 125.

[126] ibidem p. 127.

[127] *Astronomisches Jahrbuch für 1799*, Berlin. p. 124.

[128] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). pp. 132-133.
[129] ibidem p. 137.
[130] ibidem p. 141.
[131] Olbers, Wilhelm : Abhandlung über die leichteste bequemste Methode die Bahn eines Cometen aus einigen Beobachtungen zu berechnen von Wilhelm Olbers. Weimar, 1797.
[132] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814.
[133] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 18. 1873 p. 342
[134] Allgemeine Geographische Ephemeriden, Weimar. Bd. 1. 1798 p. 679.
[135] ibidem p. 489.
[136] ibidem p. 489.
[137] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). p. 153.
[138] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 56.
[139] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1801. July 6.
[140] *Monatliche Correspondenz*, Gotha. 1803/Febr. p. 134.
[141] Allgemeine Geographische Ephemeriden, Weimar. Bd. 3. 1799. p. 293.
[142] Allgemeine Geographische Ephemeriden, Weimar. Bd. 1. 1798. p. 679.
[143] Gerdes, Dieter : Die Geschichte der Astronomischen Gesellschaft, Lilienthal. 1990. p. 18.
[144] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. pp. 53-54.
[145] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797–1814. 1798. March. 6,. May 1.
[146] Allgemeine Geographische Ephemeriden, Weimar. Bd. 3. 1799. p. 107.
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[148] ibidem p. 108.
[149] Magyar Országos Levéltár, Budapest. Helytartótanácsi Levéltár. Departamentum litterario-politicum. 1802. No 9.
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[151] Allgemeine Geographische Ephemeriden, Weimar. Bd. 3. 1799. pp. 324-326.
[152] ibidem pp. 410-413.
[153] *Monatliche Correspondenz*, Weimar. 1801/März.
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[158] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. pp. 58.
[159] ibidem p. 73.
[160] ibidem p. 87.

[161] Vargha, Magda – Patkós, László : St. Gellért's Hill Observatory's Chronicle. The Correspondence of Johann Pasquich and Paul Tittel. Konkoly Observatory Monographs 2. Budapest, 1996. pp. 107-191.
[162] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1802.. May 6.
[163] ibidem 1801. April 4. – 1802. Sept. 17.
[164] About the relationship between Franz Xaver von Zach and Carl Friedrich Gauss. In : Gauss Werke XI/2. Hrsg. von Martin Brendel. Göttingen, 1924-1929. Über die Astronomische Arbeiten von Gauss.
[165] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1799. Sept. 24.
[166] Gerdes, Dieter : Die Geschichte der Astronomischen Gesellschaft, Lilienthal. 1990. pp. 28-32.
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[170] Seydl, O. (Hrsg) : Briefe Franz Xaver von Zach … und seines Nachfolgers Bernhards von Lindenau von 1791-1854 an P. Martin Alois David. Publ. Obs. Nat. Prague 11 (1938). p. 175.
[171] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1801. November 10.
[172] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1801. December 18.
[173] ibidem 1802. January 14.
[174] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1802. February. 21.
[175] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 88.
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[177] The Banks' Archive. The British Library, London. 1802. May 1. B.M. Add. MS. 8099. pp. 215-217.
[178] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1803.. January. 16.
[179] *Monatliche Correspondenz* 1803/März. p. 248.
[180] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. Zach 1803. July. 29.
[181] The Banks' Archive. The British Library, London. 1802. May. 1. B.M. Add. MS. 8099. pp. 372-373.
[182] ibidem pp. 215-217.
[183] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1803. March 1.
[184] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1803..July. 29.

[185] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of he Correspondence. Zach to Oriani. 1797-1814. 1803. August 23.
[186] ibidem Zach 1800. March. 28.
[187] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. pp. 82-83.
[188] "… Frater vero Tuus Franciscus, qui assumpto pariter Militari Statu insumptioque penes Legiones pedestris Ordinis Nostras Antonio Eszterháziannám, et Nugentianum noinnullis annis, Semet mox Cathedrae Mechanicae quam hausit Scientiam devovendo peragritisque divorsis Europae partibus per Ducem Saxo-Gothanensem pro erigendo in Seeberg Turri Mathematica evocatus ibidemque primum in Suoremum Vigiliarum Praefectum dein vero Vice Colonellum renunciatus, Semet ob partam in mathematica evocatus Scientia eximiam Experimentiam, editque rara Astronomia Opera coram toto Orbe noturaque redidit …" Magyar Országos Levéltár. Az 57. Kancelláriai Levéltár. Libri Regii 60. köt. pp. 498-503.
[189] Brosche, Peter – Vargha, Magda : Briefe Franz Xaver von Zach in sein Vaterland. Publ. Astr. Dept. L. Eötvös University. No 7. Budapest, 1984. p. 83.
[190] Zach was elected to the Fellow of Hungarian Academy of Sciences at 12th March 1832- .Győry Sándor : Báró Zach Ferencz, külf. levelező tag. Magyar Tudós Társaság évkönyvei. 1833. pp. 210-212
[191] Titz-Matuszak, Ingeborg – Brosche, Peter : Das Reisetagebuch 1807 der Herzogin Charlotte Amalie von Sachsen-Gota Altenburg Gotha, 2003.
[192] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1804. September. 15.
[193] ibidem 1804. September. 29.
[194] *Monatliche Correspondenz*, Gotha. 1806/Jan. – Dec.
[195] *Monatliche Correspondenz*, Gotha. 1806/Jan. pp. 47 – 48, 52. 1806/June p. 519.
[196] *Monatliche Correspondenz*, Gotha,. 1806/June pp. 519-522.
[197] *Monatliche Correspondenz*, Gotha. 1806/Jan. p. 45.
[198] ibidem p. 52.
[199] ibidem pp. 51-54
[200] ibidem pp. 54-78.
[201] ibidem p. 75.
[202] *Monatliche Correspondenz*, Gotha, 1806/ June. pp. 522-544.
[203] *Monatliche Correspondenz*, Gotha. 1806/July p. 15 – 17.
[204] ibidem p. 16.
[205] *Monatliche Correspondenz*, Gotha. 1806/Nov. pp. 398-407
[206] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1806. February 5. Gauss married Johanna. Osthoff in 1804.
[207] Comet 2P/1786 B1 (Encke).
[208] Legendre, Adrien Marie : Nouvelle méthode pour la determination des orbit de comets. Paris, 1806.
[209] *Astronomisches Jahrbuch für 1791*. Berlin. p. 130.
[210] Comet 2P/1786 B1 (Encke).
[211] Legendre, Adrien Marie : Nouvelle méthode pour le determination des orbit de comets. Paris, 1806.
[212] *Monatliche Correspondenz*, Gotha. Bd. 24. 1811. p. 305, 409, 512, 515, 596, 597.
[213] Comet 2P/1786 B1 (Encke).
[214] Oriani, Barnaba : Arbeiten über die neuen Planeten, *Monatliche Correspondenz*, Bd. 23. 1811. p. 8, 10, 16; Oriani, Barnaba : Methode die Längen und Bereiten aus Abstand von

Meridian und Perpondikel zu brechnen, *Monatliche Correspondenz*, Bd. 23. 1811. p. 158, 249.

[215] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1806. June 20.

[216] ibidem 1806. July 20.

[217] ibidem 1807. January 20.

[218] Archivistic Heritage of the Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1807. January 26.

[219] Briefe Franz Xaver von Zachs an C. F. Gauss, Gauss-Bibliothek in der Niedersächsischen Staats- und Universitätsbibliothek Göttingen, Briefe A. Zach an Gauss. 1807. April. 7. The title of Güssmann's book : Über die Berechnung der Kometen-Bahnen. Gauss's article was published without his name in : *Monatliche Correspondenz*, Gotha. 1807/Mai pp. 452-460.

[220] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1807. April 10. The new detected planet was the Vesta.

[221] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. pp. 115-117.

[222] Titz-Matuszak, Ingeborg – Brosche, Peter : Das Reisetagebuch 1807 der Herzogin Charlotte Amelie von Sachsen-Gotha Altenburg Gotha, 2003.

[223] ibidem p. 47.

[224] ibidem p. 29.

[225] ibidem p. 37.

[226] *Correspondance Astronomique*, Genua. Tome 6. 1822. pp. 297-298.

[227] Titz-Matuszak, Ingeborg – Brosche, Peter : Das Reisetagebuch 1807 der Herzogin Charlotte Amelie von Sachsen-Gotha Altenburg. Gotha, 2003. p. 44.

[228] ibidem p. 49. "Der König sprach viel mit Zach und mir von französischen Kaiser".

[229] ibidem p. 51.

[230] ibidem p. 55.

[231] ibidem p. 51.

[232] ibidem p. 54.

[233] ibidem p. 66. – Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1807. September 23.

[234] ibidem "… und ich spielte Dreset mit dem Haus Herren un 3 andern mit Italienischen Karten, welche ich nicht erkannt, daher mit eine Herr half, um 11 Uhr kamen wir nach Hause, ich war müde und leib, aber meine Seele ist bis in todt betrübt und gebeugt, heute würde ich von Zach ein dummes Thier genannt, diese ausdrücke dachte ich nicht zu hören zu dürfen, da sie keine gebildeten Menschen hnlich sehen, aber seine prutalitet nimmt täglich mehr zu, er hat nicht mehr nöthig, sich gegen mich zu verstellen, meine einzige Hoffnung is, es lange nicht zu überleben."

[235] ibidem "Wir mussten in ein Zimmer absteigen, da alles vor war, bis unsere Zimmerleer wurden, wir soupierten und gieengen um 9 Uhr zu Bette."

[236] ibidem p. 68.

[237] ibidem

[238] ibidem p. 72.

[239] ibidem p. 70.

[240] C/1807 R1 (Great comet). ibidem p. 76.

[241] ibidem

[242] ibidem pp. 78-79.

[243] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1807. November 6.
[244] ibidem 1807. November 6.
[245] ibidem 1807. November 6.
[246] ibidem 1807. November 8.
[247] ibidem 1807. November 12.
[248] Philippe was Zach's servant who very often helped him at his astronomical observations.
[249] At November 29 there was partial solar eclipse in Northern-Italy.
[250] Titz-Matuszak, Ingeborg – Brosche, Peter : Das Reisetagebuch 1807 der Herzogin Charlotte Amelie von Sachsen-Gotha Altenburg. Gotha, 2003. p. 88. "Genua ist die schönste Stadt, welche ich je sah, die Pracht die Häuser und die schönen breiten Strassen mich frabiret"
[251] ibidem p. 106.
[252] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1808. November 30.
[253] C/1808 F1 (Pons). ibidem 1807. March 30.
[254] ibidem 1808. March 30.
[255] ibidem 1808. May 26.
[256] Quellen zur Astronomie in der Forschungs- und Landesbibliothek Gotha under besonderer Berücksichtigung der Gothaer Sternwarte. Zusammen gestellt und kommentiert von Olivier Schwarz, Cornelia Hopf, Hans Stein. Gotha, 1998. p. 17. Chart B 1034b B1, 14-21 Abberrations- und Nutationstafeln.
[257] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1808. June 7.
[258] ibidem
[259] ibidem
[260] ibidem
[261] ibidem
[262] ibidem 1807. June 22.
[263] ibidem
[264] ibidem
[265] ibidem
[266] ibidem 1808. July 5.
[267] ibidem 1808. September 10.
[268] ibidem 1808. October 9.
[269] Eugen Beauharnais, the stepson of Napoleon.
[270] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1808. October 9.
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[274] ibidem 1808. October 23.
[275] ibidem 1808. November 19.
[276] ibidem
[277] ibidem 1809. January 26.
[278] ibidem 1809. January 23.
[279] ibidem 1809. January 26.
[280] ibidem 1809. January 23.
[281] As far as I know this book was never published.

[282] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1809. January 26.
[283] ibidem 1809. January 23. A letter to Reichenbach.
[284] ibidem 1809. February 20.
[285] ibidem
[286] ibidem 1809. March 2.
[287] ibidem 1809. március 21.
[288] At Spring in 1809 the Austrian Army began new war aigainst Napoleon.
[289] Archivistic Heritage of the Osservatorio Astronomico di Brera. Catalogue of the Correspondence. Zach to Oriani. 1797-1814. 1809. March 26.
[290] ibidem
[291] ibidem 1809. April 12.
[292] ibidem 1809. October 9.
[293] ibidem 1809. November 10.
[294] ibidem 1809. December 13.
[295] Les archives de l'Observatoire de Marseille. Zach to Reboul 1813. March 20.
[296] L'Attraction des montagnes et ses effets sur les fils a plomb ou sur les niveaux des instrumens d'astronomie, constatés et déterminés par des observations astronomiques et géodésiques, faites en 1810 a l'Ermitage de Notre-Dame des Anges sur le Mont de Mimet et au fanal d'Isle de Planier près de Marseille … Par le Baron de Zach. Avignon, 1814. 1-2.
[297] *Zeitschrift für Astronomie und verwandte Wissenschaften, Tübingen/Stuttgart.* Bd. 1. 1816. pp. 73-75.
[298] Les archives de l'Observatoire de Marseille. Zach to Reboul. 1813. July 13.
[299] *Correspondance Astronomique*, Genova. 1 (1818) pp. 311-345, *Correspondance Astronomique* 2. (1819) p. 423, 525-566. *Zeitschrift für Astronomie und verwandte Wissenschaften*, *Tübingen/Stuttgart.* 1 (1816) p. 351. *Zeitschrift für Astronomie …* 2. (1816) p. 316, - *Zeitschrift für Astronomie …* 4. (1817) pp. 145-181.
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[302] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A.v. Schiferli 1821-1832. Hrsg. von Gosteli, L., Boschung, U., Brosche, P., Basel, 1998. p. 116.
[303] *Zeitschrift für Astronomie.* Bd. 2 (1816) p. 299.
[304] Brosche, Peter : Der Astronom der Herzogin. Leben und Werk von Franz Xaver von Zach 1754-1832. p. 232.
[305] Brosche, Peter : Observatorium in Marlia bei Lucca. Gauss Gesellschaft Mitteilungen 34. (1997) p. 35-41. 36 (1999) pp. 49-54.
[306] *Correspondace Astronomique* 4. (1820) p. 171-197. Wolf (1871) p. 72-73.
[307] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 16. 1871. pp.62-63.
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[310] ibidem pp. 67-69.
[311] ibidem p. 69
[312] ibidem p. 70.
[313] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. p. 119.
[314] ibidem p. 123.
[315] ibidem p. 126.
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[317] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. pp. 132-133.
[318] ibidem pp. 163-164.
[319] ibidem p. 170.
[320] ibidem pp. 105-106.
[321] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 16. 1871. p. 71.
[322] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. pp. 142-143.
[323] Zeitschrift für Astronomie. Bd. 4. (1817) pp. 145-181.
[324] Brosche, Peter : Der Astronom der Herzogin. Leben und Werk von Franz Xaver von Zach. 1754-1832. p. 234.
[325] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. p. 151.
[326] ibidem p. 149.
[327] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 16. 1871. pp. 151-154
[328] ibidem pp. 169.
[329] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. p. 141.
[330] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 16. 1871. pp. 76-78.
[331] ibidem p. 156.
[332] Astronom, Weltbürger, Blasensteinpatient. F.X.v. Zachs Briefe an R.A. v. Schiferli 1821-1832. Hrsg. Von Gostelli, L., Boschung, U., Brosche, P., Basel, 1998. pp. 157-158.
[333] ibidem pp. 165-166.
[334] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 16. 1871. pp. 273-274
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[340] ibidem p. 379.
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[342] *Zeitschrift für Astronomie Tübingen/Stuttgart*. Bd. 5. 1818. pp. 139-145.
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[348] *Correspondance Astronomique*. Tome 9. (1824) pp. 245-247.
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[351] ibidem p. 177.
[352] *Astronomische Nachrichten.* Bd. 1. No. 2. 1823. p. 17.
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[361] Brosche, Peter : Der Astronom der Herzogin. Leben und Werk von Franz Xaver von Zach. 1754-1832. p. 250.
[362] ibidem p. 250-253.
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[369] ibidem
[370] ibidem p. 208.
[371] ibidem pp. 30-31.
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[377] ibidem p. 259.
[378] ibidem p. 263.
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[380] ibidem p. 230.
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[382] ibidem p. 276.
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[386] ibidem p. 274.
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[388] ibidem p. 264.
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[422] Wolf, Rudolf : Historische Studie über den Freiherrn von Zach und seine Zeit. Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich. Jg. 18. 1873. pp. 76-77.
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