Stellar activity and the Konkoly Observatory: the beginnings

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The early observational facts on stellar activity are discussed with special emphasis on L. Detre's interest in those results.

Introduction

The discovery of starspots has a long history. Curiously, the establishment of the class of active stars is strongly connected with Detre's Institute. The real discovery of starspots (on AR Lac) happened just in the middle of the XXth century by Kron (1947) and soon after on two other objects. But this discovery was forgotten for more than a decade. In 1965 Chugainov (1966) made a series of observations on HDE 234677 (BY Dra) and explained the resulting light curve by starspots. That paper was published in the *Information Bulletin on Variable Stars*, which has been edited by the Konkoly Observatory from the beginnings. At that time the editor was L. Detre. Observing flare stars became popular: during 1971 *Information Bulletin on Variable Stars* published about 100 issues, and 25% of those dealt with flare stars and related objects. In 1971 the *General Catalogue of Variable Stars* announced a new class of variables, the so-called BY Dra-type stars. The final step of establishing the class of active stars is connected with an IAU Colloquium held in Budapest in 1975, which will be mentioned in the Epilogue. The interested reader may find a thorough review about the discovery of starspots in Hall's (1994) excellent work. L. Detre has been interested in this new type of variables, as in every other novelties. In what follows, a few examples of this interest is presented.

Starspots and flares

In late 1960s and early 1970s, flare stars were increasingly observed. Beside flares, rotational modulations were revealed in several cases. Some stars, like BY Dra showed flares as well as rotational modulation. *Fig. 1* shows a light curve of HDE 234677 observed in 1966 by Krzeminski (1968), which appeared in a conference proceedings on the light variation of dM and dMe stars. At that time the star did not have a variable star designation, but slightly later aroused L. Detre's attention: he marked the name of the variable in the book. This variable was later observed with the 60-cm telescope in Budapest, and in 5 colours ($UBVR_CI_C$) with the 1-m telescope at Piszkéstető mountain station, which is also plotted in *Fig. 1*.

Photoelectric monitoring of flare stars were carried out as well in the late 1960s. Among the targets were BY Dra itself and also AD Leo. A huge flare observed in the latter object by Szeidl (1969) is shown in *Fig. 2*. These measurements clearly show, that L. Detre was interested in this new type of variable stars. At that time, in lack of clear definition, one could not call them a *new class* of variables.

Long-term variations: cycles

From the time of the discovery of starspots it was obvious to relate these features with those observed on the Sun for already centuries. Flares were thought to be huge eruptions on stellar surfaces, just like those detected on the Sun. The search for solar analogues on stars continued and Wilson (1968) initiated a long-term study for searching cycles of solar-type stars through measuring CaII H&K activity, which is continuing to date. But before this, already in 1966, L. Detre published a note of just once sentence, calling the attention on the possible presence of a spot cycle on BY Dra, as shown in *Fig. 3* (upper and middle panels). This small remark was surely among the first ones (if not exactly the first) suggesting cycles on other stars than the Sun.

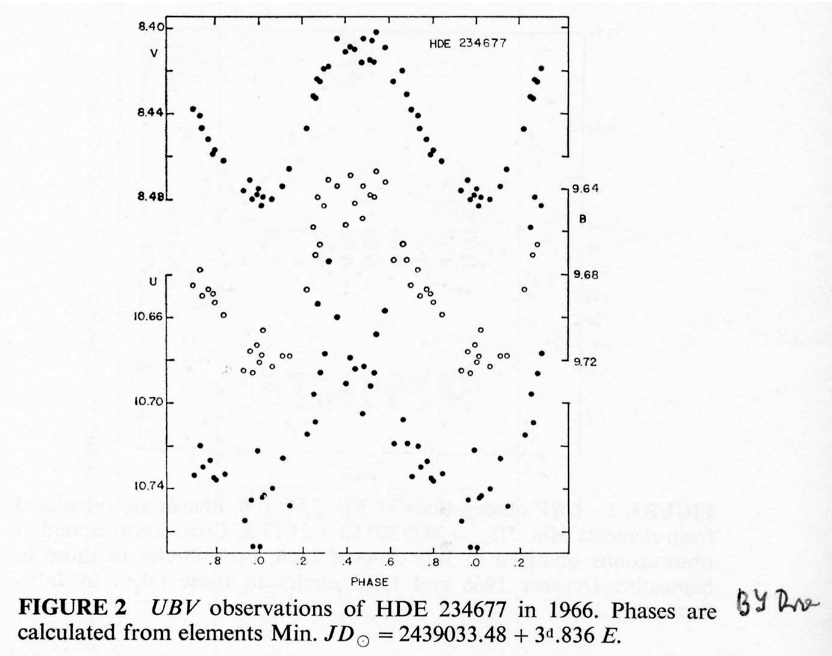
In the lower part of *Fig. 3* the continuation of the long-term light variability of BY Dra is plotted. Clearly, cycles are present in the overall brightness of this system with quasiperiods of decades, about 14 and 3 years (see Oláh et al. 2000 for the details).

University classes

The author had the pleasure to attend L. Detre's classes of astronomy. Those lectures usually dealt with the newest results in variable star astronomy, which were found very useful even long after the graduation. Another topic of his lectures was solar physics, which is strongly connected with the active star research. *Figures 4* and *5* are examples of L. Detre's handwritten notes for the university lectures on the solar cycle and on the differential rotation.

Epilogue

L. Detre passed away on 1974 autumn. At that time the organization of the IAU Colloquium No. 29, *Multiple Periodic Variable Stars* which he initiated, was underway. His successor, B. Szeidl took over the conference organization, and among others, he invited Douglas S. Hall to give a review on *The RS CVn Binaries and Binaries with Similar Properties*. This talk and its published version became of fundamental importance in studying active stars: it determined the class of active stars and its subsystems, which is used (with later modifications) to date. The paper has more than 400 citations during the last 30 years by the ADS.



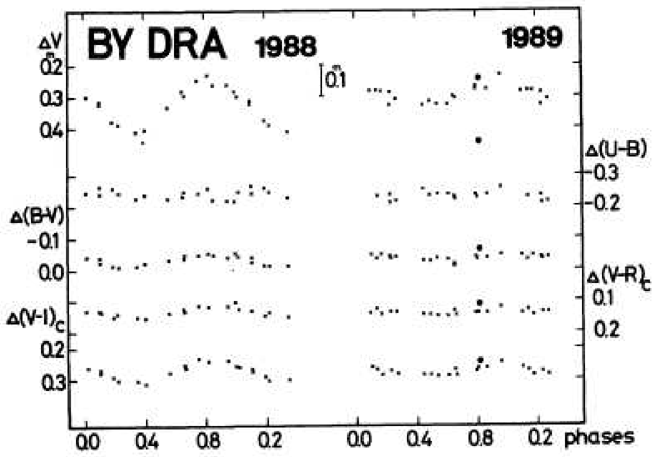


Figure 1: Top: An early light curve of HDE 234677 by Krzeminski (1968) from 1966. The star at that time did not have variable star designation. In the right corner L. Detre's handwriting is seen marking the name BY Dra of the variable. Bottom: Five colour observations of BY Dra with the 1 m telescope (see Pettersen et al. 1992).

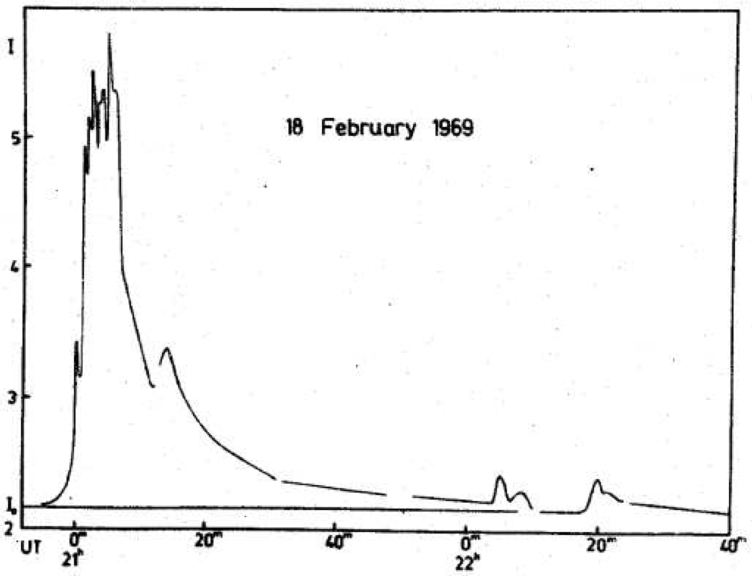


Figure 2: A flare of AD Leo observed by the 60-cm telescope of the Konkoly Observatory (Szeidl 1969).

Thus, the beginnings of stellar activity research is strongly connected with the Konkoly Observatory. It started with the rediscovery of starspots by Chugainov (1966) published in the *Information Bulletin on Variable Stars*, continued with publishing many observations there, and finished with Hall's (1976) historical talk. L. Detre played an active role in all of these.

Thirty years have passed already, and during all these years stellar activity research has been continuously developing. Simultaneously with the delivery of Hall's (1976) talk studying active stars began at the Konkoly Observatory as well, and the author of this paper, who talked about spotted stars with L. Detre as a student, finally got this subject as a lifetime project from B. Szeidl. It was a unique possibility to take part in a research field from its very beginning. At present, mapping stellar surfaces is a routine task. *Figure 6* shows the surface of an active giant star derived from spectral line profile analysis (Doppler imaging) and the modelled brightness variation from photometric measurements made in four colours by Oláh et al. (2002).

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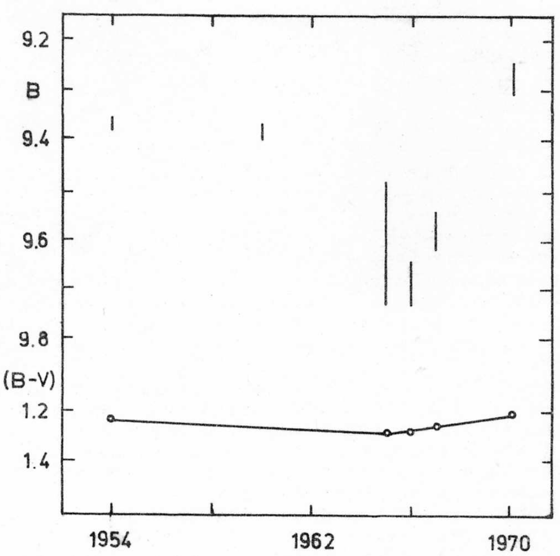


Editor's note:

The continuous observation of Chugainov's stars would be extremely important because diagrams like that on the opposite page may reveal the existence of cycles similar to the solar cycle in these stars.

L. DETRE

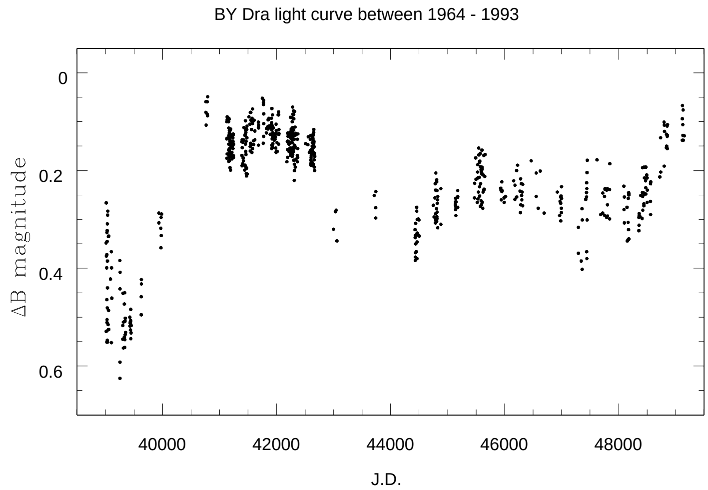
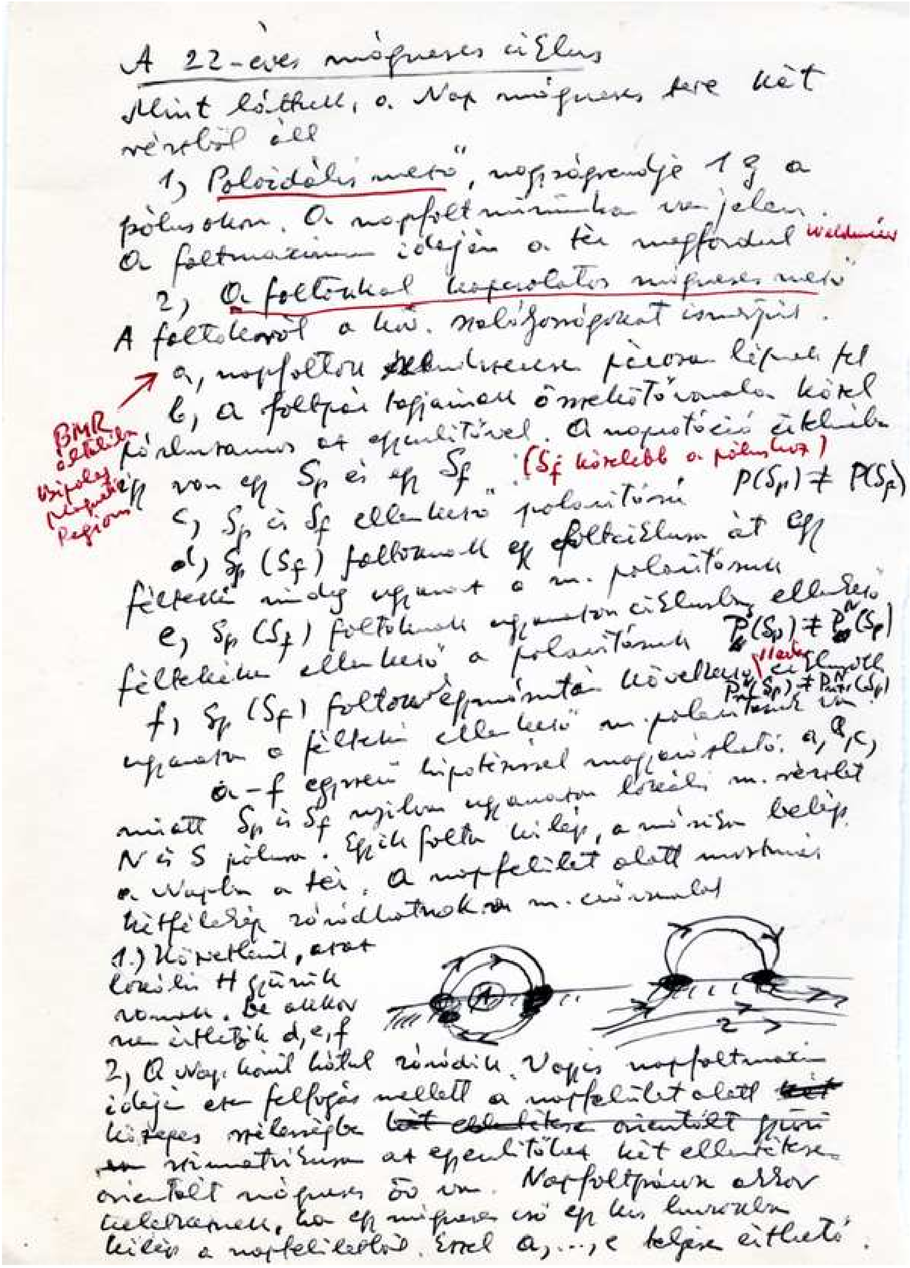


Figure 3: Top: Long-term brightness change of BY Dra by Chugainov (1971), and L. Detre's editorial note, commenting the figure. Bottom: the brightness change of BY Dra during almost 30 years, from the literature.



A 22-éves mágneses ciklus

Mint látható, a Nap mágneses tere két részből áll

1, Poloidális mező, nagyságrendje 1 g a pólusokon.

2, A foltokkal kapcsolatos mágneses mező

Figure 4: Excerpt from L. Detre's handwritten notes preparing the university classes, about the solar cycle (in Hungarian).

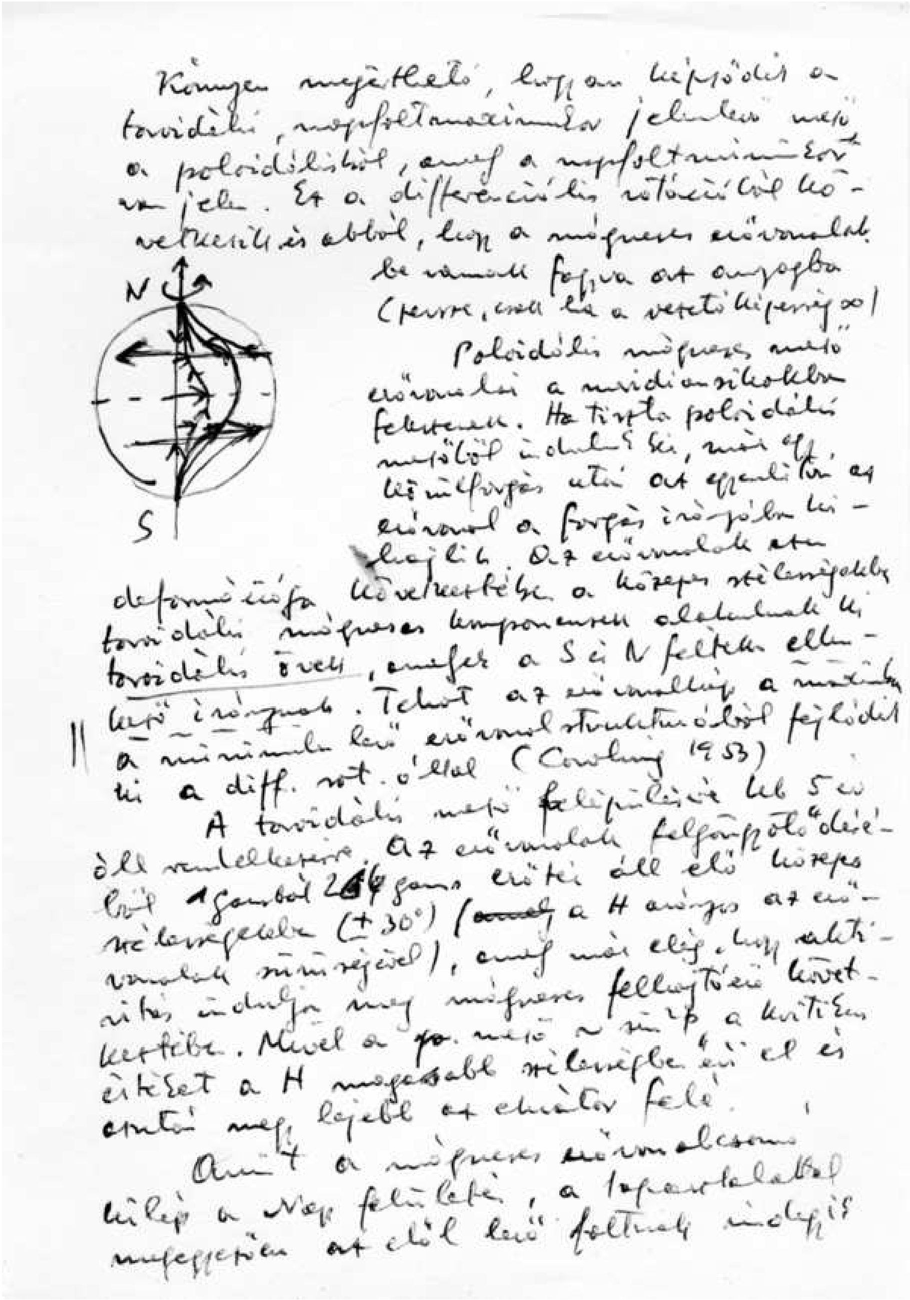


Figure 5: Same as *Fig. 4*, about the poloidal and toroidal magnetic fields, and the differential rotation of the Sun (in Hungarian).

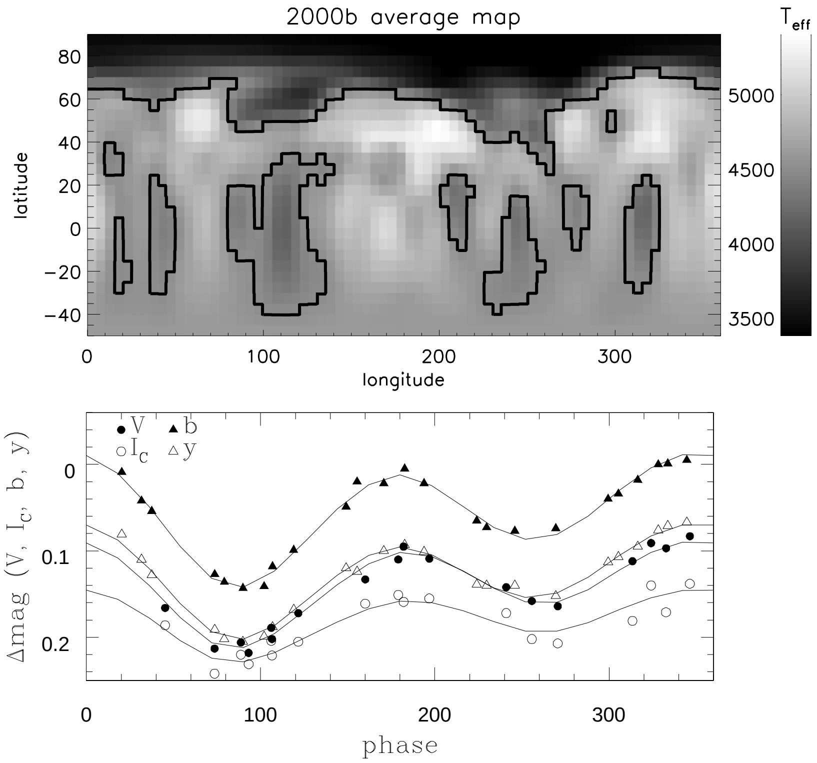


Figure 6: An example for the recent possibilities for modelling stellar surface structure: a surface temperature distribution map (Doppler image) of UZ Lib from high resolution spectra, and modelled light curves in 4 colours, for the same time interval (Oláh et al. 2002).

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