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INVESTIGATION OF 52 HER MAGNETIC FIELD VARIABILITY

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The investigation of such a phenomenon as the magnetic field variability at long times (years - decennials) is very interesting. If the explanation of the magnetic field variability with rotation period by the oblique rotator model is evident, then the reason of the long-period variability is not clear yet, despite the existence of some assumptions on its nature. All suppositional explanations of such a variability come to two alternative hypothesis: 1. Geometrical projection effects owing to the precession in binary systems where one of the components is a magnetic star. The magnetic field remains locally constant, rigidly "frozen" in the star atmosphere (Gerth, 1984: Lehman, 1988). 2. Physical magnetic field variability by analogy with solar (Krause and Scholtz, 1981).

In order to clarify the nature of the long-period magnetic variability we presented investigation results of 52 Her magnetic behaviour. This object was chosen for the investigations due to the following reasons: the presence of signs of the long-period variability, long series of magnetic field measurements available and its fitness to be observed on the 6-m telescope.

The magnetic field of 52 Her was discovered by Babcock (1958) who made two estimates only. Then the magnetic behaviour was investigated by Wolff and Preston (1978) from the spectra obtained at Lick and Mauna-Kea observatories in 1963 - 1968. It turned out that the magnetic field varies within the interval from 200 to 1900 Gs. Hereat the magnetic field measured from the spectra obtained at Lick Observatory is on the average two times stronger than that measured from the Mauna-Kea spectra, 1500 and 750 Gs, respectively. They have found a period for 52 Her from the spectral variability.

$$JD\ (K\ line\ max) = 2439247.^{d}7 + 3.^{d}8575E \qquad (1)$$

Borra and Landstreet (1980) have obtained six photoelectric magnetic field measurements for 52 Her. The field values on the whole are close to the results obtained by Wolff and Preston (1971), but with a certain phase shift relative to the elements of (1). Gerth (1990) using numerous spectral data (about 200 spectrograms obtained at various telescopes) found a long-term variability of the magnetic field.

In order to continue the investigation of 52 Her we made some additional photoelectric measurements of the magnetic field from hydrogen lines on the 6 m telescope. The hardware and methods are described by Shtol' (1991). The results are presented in Table 1: Julian date of the middle of exposure, the field magnitude B_e given in Gs, and a standard error $+\sigma$.

Table 1

JD(2440000.+)	B_e(Gs)	$+\sigma$(Gs)
5943.510	300	280
6634.313	480	210
7015.283	900	180
8138.271	640	130
8402.259	440	120
8403.260	170	80
8411.522	730	170
8442.229	70	140
8443.508	530	180
8463.521	320	110
8468.345	60	140
8501.282	820	110

All estimates of the magnetic field obtained by different authors are shown in Fig. 1. It is clearly seen that besides the short-period variability within the Julian date interval -2442600-44200 the long-period variability is observed as well. The measurements made by Borra and Landstreet (1980), Gerth (1990) are included in this Julian date interval. The estimates from the time interval under review are shown in Fig. 2 (a portion of Fig. 1). It can be seen from Fig. 2 that photoelectric measurements made by Borra and Landstreet show neither long-period variability nor contradict Gerth photographic estimates. Photoelectric estimates obtained in this investigation (the last dot group on the right in Fig. 1) do not contain long-period variability indications either. In addition to this it is necessary to continue magnetic measurements of this object, since, unfortunately, the data available is not sufficient to solve the question of the long-period variability nature.

Using more reliable photoelectric measurements of the magnetic field (both our and Borra & Landstreet (1980)) we constructed a phase dependence drawn in Fig.3. It was constructed from the elements by Wolff and Preston (1978). As one can see in Fig. 3 the field estimates yield a large scatter relative to the sinusoid found by the least- square method.

Therefore, in spite of the small number of the used B_e values (all in all 18) an attempt was made to look for the periods able to give a better description of the magnetic behaviour. The search for the periods was performed within the interval 0.5 to 2000 days using the method suggested by Skarglon (1982). As a result three new possible periods were found: $70^{d}.67148$, $2^{d}.6343$ and $0^{d}.92578$. It should be noted, that possible existence of a period less than one day was pointed out earlier by Stempien (1969). Phase relations with periods of $70^{d}.67148$ and $2^{d}.6343$ are shown in Fig.4 and 5, respectively. The authors consider this result as a preliminary one, that suggests the necessity of the further long-term investigation of 52 Her magnetic field by the high-precision photoelectric method. The measurements of this star magnetic field are supposed to be continued. It will allow to answer the major question of the investigation whether it is a "physical" or a "geometrical" reason that causes the long-period variability and to determine unambiguously the period of the magnetic variability connected with rotation.

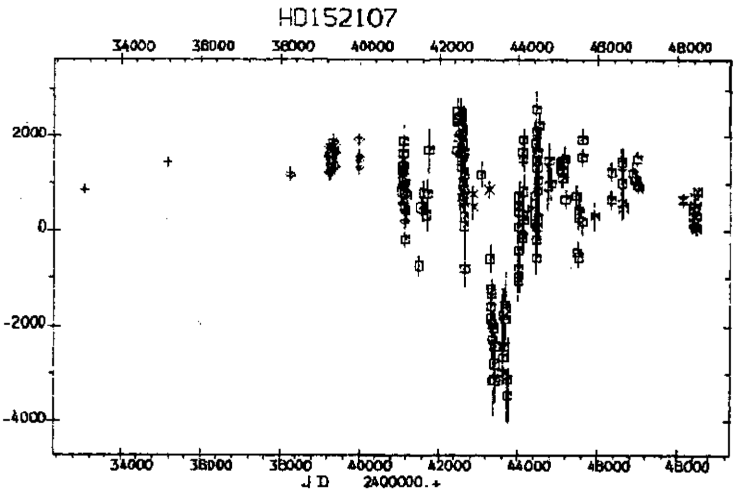

Fig.1. All variations of 52 Her magnetic field with time. Field values in Gs are laid off on the Y-axis, time in JD is laid off on the X-axis.

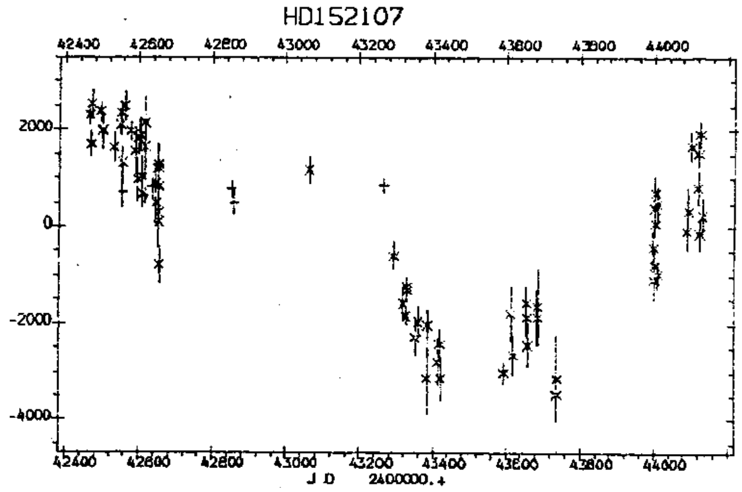

Fig.2. 52 Her magnetic field within the interval JD2442400-44200. + - Borra and Landstreet (1980), x - Gerth (1990).

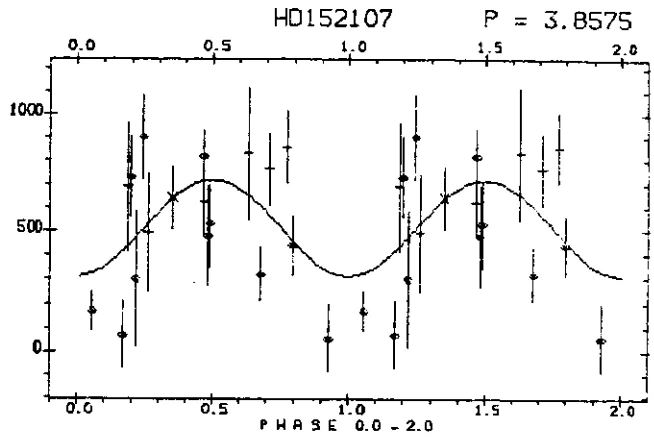

Fig.3. 52 Her magnetic field variations with the period 3.^{d}8975.

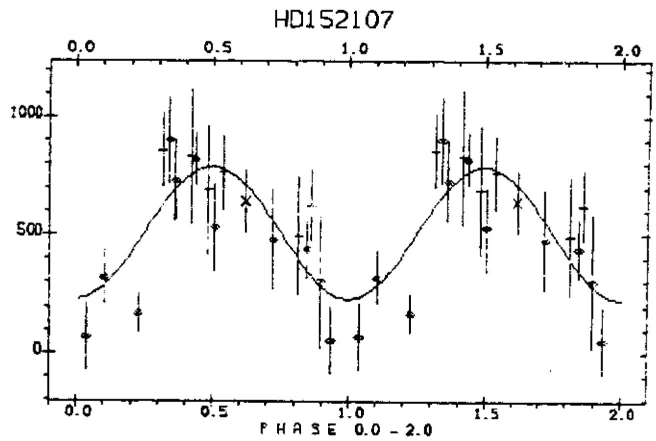

Fig. 4. 52 Her magnetic field variations with the period 2.^{d}6343.

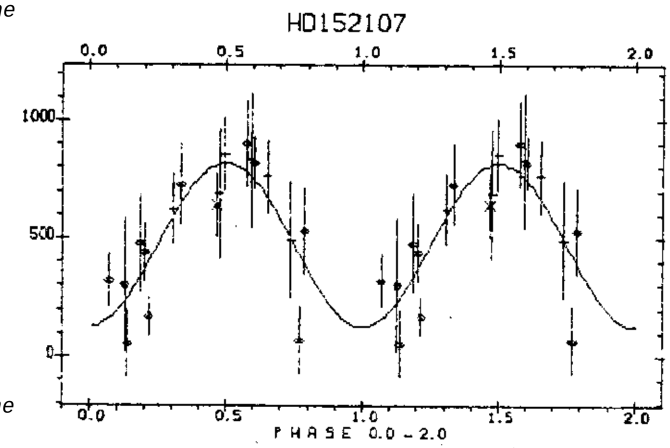

Fig. 5. 52 Her magnetic field variations with the period 70.^{d}67148.

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