

**OBSERVATION OF FOUR STOKES PARAMETERS IN THE CONTINUUM  
OF HE-RICH STAR HD37776**

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**ABSTRACT.** *Observations of the He-rich star HD37776 on the 6 m telescope have registered constant linear polarization ( $p = 0.44\%$ ,  $\theta = 38^\circ$ ) within AA 4580-4810 Å in August - October 1991. No circular polarization is found within the measurement errors. This may be explained under the assumption that emission polarization of this star has interstellar or circumstellar origin.*

The helium-rich star HD37776 is one of magnetic stars, whose quadrupole field component is stronger than dipole (Thompson and Landstreet, 1985). Bohlender and Landstreet (1990) have reported on possible existence of a field of ~60 kGs on the surface of this star.

From the Zeeman splitting of spectral lines Kopylova et al. (1991) have determined, that the existence of a complex structure magnetic field  $B_s$  reaching ~80 kGs is real. Since at such strong fields magneto-optical effects are possible, both in the star continuum and in its spectral lines, we decided to investigate spectropolarimetrically the continuum and to carry out a detailed investigation of lines.

In particular, of great interest is the question on polarization variability (if it is detected) with a period of magnetic and photometric changes, corresponding to the rotation period of HD37776  $P = 1.458$  (Thompson and Landstreet, 1985).

Kemp and Woltenscroft (1974) have investigated the linear polarization in the continuum of several CP stars and detected in some of them variability of the degree and angle of polarization.

The authors of the above mentioned paper believe, that the transversal Zeeman effect caused the appearance of the proper variable linear polarization. In this paper we presented the measurement results of 4 Stokes parameters in the continuum obtained

on the 6 m telescope. In August - October 1991 we had a possibility to perform several observations of 4 Stokes parameters in the continuum of HD37776 within the wavelength interval AA 4580 - 4810 Å with the prime focus spectropolarimeter of the 6 m telescope (Glagolevskij et al., 1988).

Regular observations of nonpolarized stars show, that in our investigations the instrumental linear and circular polarization does not exceed some hundredths of a percent.

4 Stokes parameters of the standard star HD7927 with strong interstellar linear polarization were measured on the same nights as HD37776. Bastien et al. (1988) presented a list of the following parameters of the linear polarization for this star:  $p_{\max} = 3.41\%$ ,  $\lambda(p_{\max}) = 5100 \text{ Å}$ ,  $\theta_{\lambda}^{\circ} = 92.3$ . Our measurements yielded the mean value of the degree of p and angle  $\theta^{\circ}$  (in the above mentioned spectral interval) of the linear polarization:  $p = 3.11\% \pm 0.26\%$ ,  $\theta^{\circ} = 94^{\circ}5 \pm 2^{\circ}2$ . No circular polarization was found within the measurement errors. Thus, no differences are found between the standard values and our measurements of p and  $\theta$ , the degree of instrumental transformation of the linear polarization into the circular one is insignificant.

Let us return to the observations of the peculiar star HD37776. The measurement results of its polarization are presented in Table 1:  $v = V/I$  is the normalized Stokes V-parameter, characterizing circular polarization.  $p = (q^2 + u^2)^{1/2}$ , where  $q = Q/I$ ,  $u = U/I$  - normalized Stokes parameters and  $\theta = 1/2 \cdot \arctg(u/q)$  - characteristics of linear polarization. The date and UT of the middle of the exposure as well as its duration in minutes are also presented in Table 1.

Table 1.

Date	UT	$t_{\text{exp}}$	$v \pm \sigma, \%$	$p \pm \sigma, \%$	$\theta^{\circ} \pm \sigma^{\circ}$
29.08	00 <sup>h</sup> 55 <sup>m</sup>	10 <sup>m</sup>	-0.009 ± 0.023	0.461 ± 0.023	41.6 ± 1.4
	01.19	15	-0.001 ± 0.023	0.431 ± 0.027	36.1 ± 1.8
31.08	00.40	10	+0.008 ± 0.033	0.414 ± 0.030	39.8 ± 2.2
	00.50	10	+0.038 ± 0.033	0.453 ± 0.032	43.1 ± 2.1
01.09	01.35	15	+0.007 ± 0.035	0.414 ± 0.031	40.0 ± 2.1
21.10	22.45	20	-0.005 ± 0.012	0.453 ± 0.015	32.7 ± 0.9
	23.10	20	-0.008 ± 0.012	0.427 ± 0.015	33.5 ± 0.9

Thus, as a result of our measurements, it was found, that the emission of HD37776 is linearly polarized. Within the measurement errors the degree of the linear polarization is constant, and at a wavelength of about 4700 Å the degree of polarization  $p = 0.44\%$ , and the angle  $\theta = 38^{\circ}$ . The number of observations is insufficient to judge about the reality of the polarization angle  $\theta$  variations. The circular polarization does not exceed the measurement errors. Since the period of magnetic and spectral

variations of HD37776 equals  $1.58$ , then, apparently, the absence of linear polarization variability is rather indicative of its interstellar or circumstellar origin. As for polarization magnitude in individual lines, we performed the first series of observations only, and although Zeeman effect is well pronounced in hydrogen lines, further investigations are needed.

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