

LINEAR POLARIZATION OF THE STAR ζ Tau

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Abstract. We present the linear optical polarization of the star ζ Tau measured at the Belgrade Astronomical Observatory in the period 1979-1992. Both parameters of polarization change with time on long-term and short-term scales. The percent of the polarization varies in the interval 0.92-1.98% on long-term scale. The position angle varies in the range 19.9-42.1°.

1. INTRODUCTION

Time variability of the polarization of Be stars is an important observational fact which has to be taken into account in the Be star modelling. The variability of the polarization reflects changes in the physical conditions in the circumstellar envelopes of Be stars. In the models the intrinsic polarization of Be stars can be explained by electron scattering in partially ionized hydrogen. The models and spectroscopic evidence for rapid rotation provide the arguments that the envelopes must be equatorially flattened in order to give the observed intrinsic polarization which can be as large as 2%.

The emission-line star ζ Tau (HD 37202, B2, $P = 132.9$ y IV, $m=3.03$ d) was monitored in a group of similar stars by several authors. At Mc Donald Observatory the polarization of this star was measured first in December 1984, then in January and December 1990, and in December of 1991. Based on these individual measurements McDavid (1986, 1994) concluded that ζ Tau shows some evidence of variability, but apparently the strong year-to-year variability was a relatively isolated episode. This is an example of the situation difficult to study polarimetrically without continuous monitoring. This also proves the importance of systematic polarimetric measurements performed at Belgrade Astronomical Observatory, where this particular star was observed in the period 1979-1992.

2. OBSERVATIONS AND RESULTS

Polarimetric observations of ζ Tau presented in this paper were performed in the visual spectral region with the 65cm Zeiss refractor and one channel polarimeter at the Belgrade Observatory from 1979-1992. The typical r.m.s. error of one 8-minute measurement is 0.07% for Stokes parameters U and Q .

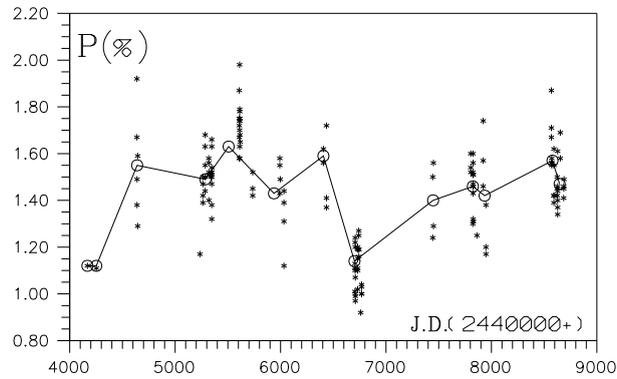


Figure 1: The observed polarization percentage of ζ Tau in V filter during the period 1979-1992.

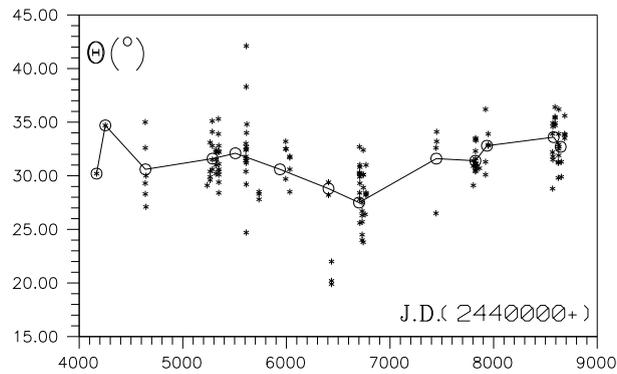


Figure 2: The position angle of the observed polarization of ζ Tau in V filter during the period 1979-1992.

The observed values of the visual linear polarization percentage P and position angle Θ of ζ Tau are presented in Figs. 1 and 2 respectively. Polarization parameters are on the y -axes and Julian days (J.D.) on the x -axes. The annual mean values of the observed polarization parameters P , Θ , and Stokes parameters Q and U are given in Table 1. Julian days in Table 1 correspond to the middle of the season of the observation. The annual mean values are marked by circles in Figs. 1 and 2.

From Figs. 1 and 2 one can see that polarization percentage shows long-term changes with small amplitude by varying between 0.92% and 1.98%. The position angle varies in the range 19.9 - 42.1°.

Table 1: Annual mean values of polarization percentage (P), polarization angle (Θ), and Stokes parameters (Q , U) for the star ζ Tau.

Year	JD (2440000+)	$P(\%)$	$\Theta(^{\circ})$	$Q(\%)$	$U(\%)$
1979	4167.599	1.12 ± 0.00	30.2 ± 0.0	0.553 ± 0.000	0.974 ± 0.000
1980	4252.375	1.12 ± 0.00	34.7 ± 0.0	0.392 ± 0.000	1.044 ± 0.000
1981	4640.032	1.55 ± 0.37	30.6 ± 0.1	0.750 ± 0.129	1.361 ± 0.221
1982	5287.346	1.49 ± 0.21	31.6 ± 0.4	0.670 ± 0.082	1.331 ± 0.116
1983	5507.327	1.63 ± 0.34	32.1 ± 2.0	0.711 ± 0.190	1.472 ± 0.128
1984	5937.321	1.43 ± 0.22	30.6 ± 0.2	0.689 ± 0.081	1.251 ± 0.131
1985	6406.524	1.59 ± 0.06	28.8 ± 0.6	0.854 ± 0.046	1.346 ± 0.009
1986	6700.967	1.14 ± 0.28	27.5 ± 2.2	0.654 ± 0.180	0.935 ± 0.107
1988	7446.594	1.40 ± 0.29	31.6 ± 1.8	0.631 ± 0.161	1.244 ± 0.125
1989	7823.987	1.46 ± 0.18	31.4 ± 0.4	0.666 ± 0.072	1.301 ± 0.097
1990	7935.326	1.42 ± 0.32	32.8 ± 1.3	0.585 ± 0.145	1.295 ± 0.169
1991	8579.591	1.57 ± 0.25	33.6 ± 1.9	0.608 ± 0.153	1.452 ± 0.089
1992	8646.376	1.47 ± 0.18	32.7 ± 1.3	0.613 ± 0.106	1.338 ± 0.074

Acknowledgments The authors would like to thank the observational and research team at Belgrade Observatory for their work and especially M.Sc. J. Arsenijević, the head of the project for monitoring the long-term variability of the polarization of selected stars.

References

- McDavid, D.: 1986, *Publ. Astron. Soc. Pacific*, **98**, 572.
 McDavid, D.: 1991, *Publ. Astron. Soc. Pacific*, **106**, 949.