

LINEAR OPTICAL POLARIZATION OF THE STAR BU Tau

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ABSTRACT. The intrinsic linear optical polarization percentage and position angle during the period 1986–1992 are presented. These data are the result of Belgrade polarimetric study of Be stars. Polarization percentage have a general decreasing trend starting with the value 0.57% and finishing with the value 0.32%. The position angle varied in a range between 58° and 71° without any general trend.

1. INTRODUCTION

During the long history of the survey of Be stars, BU Tau (Pleione, HD23862, B8Ve, $v \sin i = 350 \text{ km/s}$) exhibited two times the phases of the formation and dissipation of the shell. First episode started 1938 and lasted till 1954. Second shell phase, started 1972 according to Goraya *et al.* (1990) and Doroshenko (1989), but one year earlier according to Kogure (1990). The most intensive absorption line spectra was observed during the period 1977–1985. During 1986, as all authors agree, started the dissipation of the envelope accompanied by the weakening of the emission. Goraya *et al.* (1990) concluded that the shell phase of Pleione which started 1972 would be terminated during 1989.

The polarimetric measurements of Pleione were done sporadically by Van den Bergh (1956), Serkowski (1970), Coyne (1976), Markkanen (1977), Poeckert *et al.* (1979) and Breger (1984, 1986). The last shell phase is badly covered by measurements.

Polarization observations of Pleione started in Belgrade during 1986, when according to Doazan (1988) the shell spectrum began to weaken. That was initiated by V. Doazan after she started IUE observation of this star. During the same year the hydrogen emission, according to Doroshenko (1989) was still strong.

In this paper we present the Belgrade polarization data for Pleione in V spectral region during the period 1986–1992, when the weakening of the emission was announced.

2. OBSERVATION

Polarimetric observations were carried out with the 65 cm Zeiss refractor and Belgrade one channel stellar polarimeter in V spectral region during the period 1986–1992. The polarimeter (Kubičela *et al.* 1976) was modified in 1979 to digitize and record the data. The angular velocity of the analyser was one turn per minute. In most cases under "one measurement" one point in Figures 1 and 2, one can understand up to 8 polarimetric 1 minute sine – wave signals phase – averaged. The typical standard deviations for one 8 minute measurement are 0.07% for Stokes parameters U and Q. During the whole interval of observation the instrumental system was carefully checked by measuring polarized and nonpolarized standard stars.

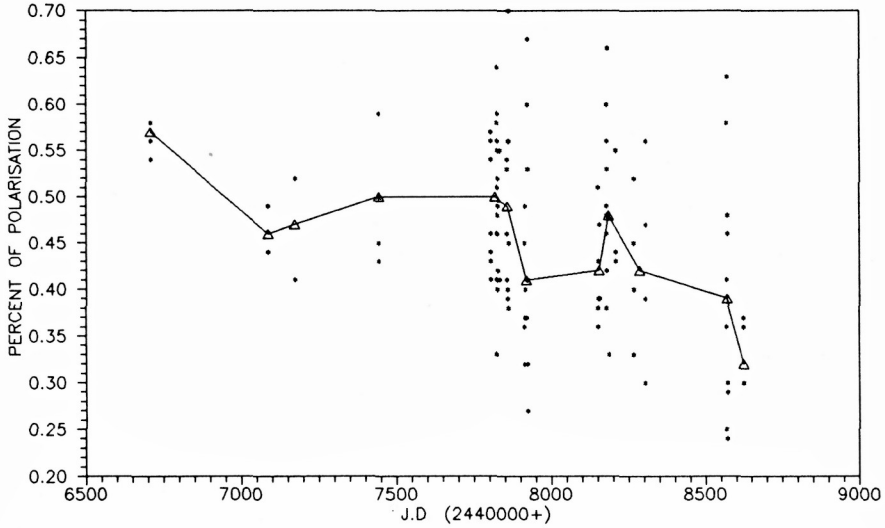


Fig. 1. *Intrinsic polarization percentage of the star BU Tau in V spectral region during the period 1986 - 1992 (dots). Triangles connected by full line denotes the monthly mean values.*

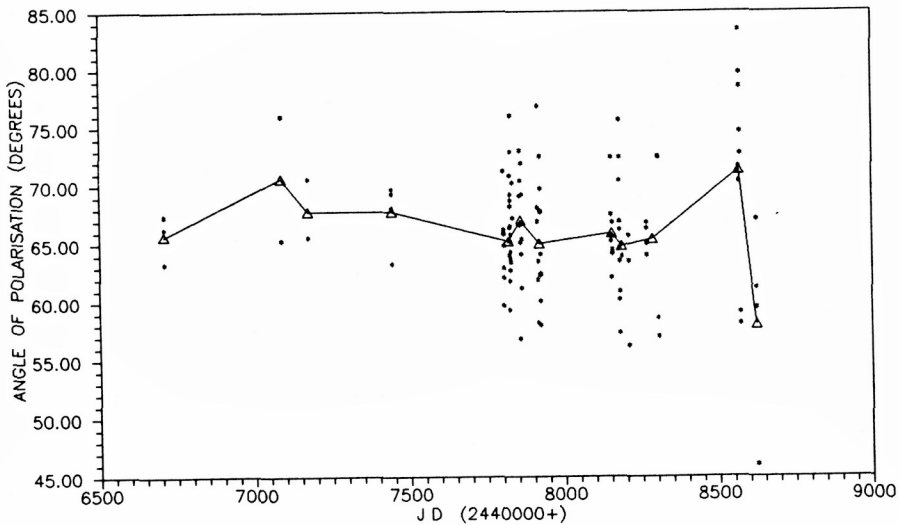


Fig. 2 *Position angles of the intrinsic polarization of the star BU Tau in V spectral region during the period 1986-1992 (dots). Triangles connected by full line denotes the monthly mean values.*

The detailed study of interstellar component in the direction of Pleione has been done and will be discussed elsewhere. For the moment we can say that beyond our expectations, in the eastern region of the cluster where BU Tau is situated the interstellar material, both inside and in front of cluster, is very uniform. In this situation the problem of interstellar polarization component estimation is not so difficult. We considered the values of interstellar polarization parameters estimated by Poeckert

et al. (1979), Mc Lean and Brown (1978) and Breger (1986), interstellar reddening, absorption and some other circumstances (Markkanen 1977) in the region of Pleione. It was found that Breger's (1986) values of interstellar polarization component in the direction of Pleione, with certainty, should be: percentage $P=0.27\%$ and position angle $\theta=113$ degrees.

After extracting the interstellar polarization from the observed data the intrinsic polarization parameters were determined. Individual values of the intrinsic polarization percentage P and the position angle θ are shown in Figures 1 and 2. Monthly mean values are denoted by triangle marks and connected by the full line in both Figures. The respective r.m.s. errors are within the intervals from $\pm 0.02\%$ to $\pm 0.13\%$ and from $\pm 2^\circ$ to $\pm 8^\circ$.

3. CONCLUSION

During the period 1986 - 1992 the intrinsic polarization percentage of Pleione weakened from the value around 0.57% to the value around 0.32% . Through the whole period polarization percentage decreased not more than 0.25% . General decreasing trend of polarization percentage was followed by the weakening of the hydrogen emission. Namely, during 1986 the weakening of the emission has started, and we predict further weakening according to the fact that correlation of the polarization percentage and the emission was observed in all stars of our programme. The same correlation for Pleione exists during the period 1974-1988 with increasing emission, according to the published data. The observed polarization percentage confirms the dissipation phase of Pleione during the period 1986-1992.

For the position angle it is difficult to say what of the observed changes is real. In the case of small percentage this is always the case. Further analysis which will include existing data of other authors will be probably fruitful.

As the dissipation of the envelope is usually accompanied by a V magnitude increase we expect the anticorrelation between polarization percentage and the magnitude of Pleione in the period 1986-1992 to be confirmed soon. This will be very interesting because, in the period 1974-1982, during an intensive shell phase, the behaviour was just the opposite. To our knowledge that was the exception in Be stars.

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