LONG-TERM SPECTROSCOPIC AND POLARIMETRIC VARIATIONS OF THE Be STAR κ Dra

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1. Introduction

The bright Be star κ Dra (HD 109387, B5 III, v.sini=249 km/s) is one of the rare mid B type stars which have presented FeII emission lines during strong emission phases. Spectroscopic variations were previously reported by many authors over different time scales: years, days and hours. Juza et al. (1991) proposed that κ Dra was the primary component of a binary system with Porb. = 61.55 days. Short-term and long-term variations in the linear optical polarization were also reported by Arsenijevic et al. (1986). We have tried, with our extensive joint material, to search for correlation between long-term spectroscopic and polarimetric variations with the aim of obtaining information on the behaviour of the circumstellar envelope.

2. Data and results

This star has been regularly monitored in Hα at the Haute-Provence Observatory since 1953 at low, and since 1960 at high dispersion, and for its optical polarization, at the Belgrade Observatory, since 1979.

2.1. Spectroscopy

The Hα emission line has presented a long term variation (24-25 years) of its equivalent width (defined here as the surface of emission above the stellar continuum); this time scale is an intermediate value between those obtained respectively by Jessup (1932) and McLaughlin (1949). For this determination additional data found in the literature were used.

Its profile has generally a rapidly changing complex structure which can be described as an asymmetric triple or quadruple emission with two prominent peaks. The variation of the separation of these prominent peaks shows an inverse correlation with the variation of the equivalent width (Δv(peaks)

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= 206 km/s at the minimum of emission around 1980, and Δv(peaks) = 69 km/s at the maxima in 1961-1962, and in 1985-1986).

The V/R variation relative to the two prominent peaks was analysed in term of an orbital motion effect, using a programme written by the author J.C. based on Stellingwerf's PDM technique. The most probable period of 61.5 days has been found, in a very good agreement with the determination P = 61.55 days obtained by Juza et al. (1991) from numerous RV data.

2.2. Polarimetry

The daily mean value of the intrinsic optical polarization in percent obtained from 1979, exhibits a close correlation with the equivalent width of the Hα emission line. As there is a lack of simultaneous observations we have to therefore assume that the minimum of polarization occured during the minimum of emission in 1979-1980, and the maximum of polarization during the probable maximum of emission in 1985-1986. As for ω Ori (Barker, 1986) and π Aqr (McLean, 1979) there is evidence for κ Dra of an increase of polarization associated with the development of a strong Be phase.

The position angle of polarization which increased from 5° to 22°, during the 1979-1982 period, has remained roughly constant since 1982. The polarization variation in the U,Q plane seems collinear, indicating an axisymmetric distribution of scattering.

3. Conclusion

Over the interval of time 1979-1986, the equivalent width of the Hα emission line, after correction for underlying photospheric profile, increased by about a factor 3 and the percentage of the intrinsic polarization by about a factor 5-6. Using the statistical relation of Dachs et al. (1992), the effective emitting envelope of κ Dra is found to have increased from 4 to 6.5 stellar radii. According to polarization results, the internal layers of the envelope have an axial symmetry, but the outer Hα emitting region, affected by the presence of the companion (V/R variation versus the orbital period), probably is associated with nonaxisymmetric external layers.

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