THE CIRCUMSTELLAR ENVIRONMENT OF L2 PUPPIS

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ABSTRACT. Polarimetric observations of the red semi-regular variable L2 Puppis, obtained over a period of several years, confirm significant variations across the CaI 4226 line and several TiO bands. Together with published infra-red data, the observations point to a fundamental symmetry plane to which all variations with wavelength and time are related. The data are also consistent with a combination of photospheric effects, including a non-uniform distribution of calcium across the stellar disk, and scattering from grains in a cloud in which there is a systematic variation in grain size with distance to the star. Grain growth and dissipation, as evidenced by the observations, occur on a time scale of several years, in contrast to the optical variability time scale of months.

1. OBSERVATIONS.

Previous data collected with three distinct (Minipol, Vatpol and IAG) polarimeters are presented in Magalhaes et al. (1986). Additional data obtained in 1986 are given in Fig. 1. The most noteworthy features of the observations are: (a) for all states of the continuum polarization, the polarization at the CaI 4226 line is larger than the interpolated continuum and at a different position angle; (b) across the TiO bands the polarization may decrease or increase with or without a position angle variation; (c) the general behaviour of the continuum polarization from short to long optical wavelenths presents a definite trend with time, in the sense that a change to less and less pronouced slopes is indicated.

2. INTERPRETATION. The observed secular changes in the wavelength dependence of the polarization in L2 Pup are consistent with grain growth. The overall spectral dependence of the position angle may also be explained, since it would be expected from a systematic variation in grain size and geometrical/optical symmetry plane with distance from the photosphere. As grains form, grow, and dissipate into the cloud, they would cause the spectral dependence of the polarization to be less

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steep, with an overall position angle reflecting the plane of symmetry indicated by the infrared and near infrared measurements. Our observations indicate that these processes take place on a time scale of several years in contrast with the optical variability time scale of 141 days.

The polarization in the TiO bands depends upon the variation of the ratio of absorption to scattering with optical depth at those wavelengths and upon the relative extent of the gas and dust and the amount to which they are mixed (Coyne and Magalhaes 1979).

The CaI 4226 data require a non-uniform, asymmetric calcium opacity, such as large spots, over the photosphere and a distinct geometry between such distribution and the scattering cloud. Note that this conclusion does not depend on any particular polarization model. For instance, light leaving the stellar surface at this wavelength may already be polarized due to Harrington's (1969) mechanism and/or to resonance scattering. In any case, the symmetry plane of the projected stellar disc in CaI 4226 must be different from that of the dust cloud.

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REFERENCES

Coyne, G.V. and Magalhaes, A.M. 1979, Astron. J. 84, 1200.

Dyck, H.M., Forbes, F.F., and Shawl, S. 1971, Astron. J. 76, 901.

Harrington, J.P. 1969, Astrophys. Lett. 3, 165.

Magalhaes, A.M., Coyne, G.V., Codina-Landaberry, S.J., and Gneiding, C. 1986, Astron. Astrophys. 154, 1.

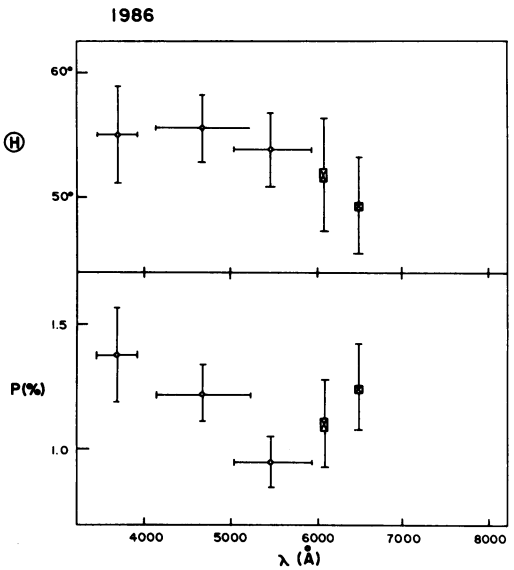

Fig. 1 Linear polarization and position angle for 1986.

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