

THE POLARIZATION OF $H\beta$ IN γ CAS

Y.M. JIANG, G.A.H. WALKER, N. DINSHAW and J.M. MATTHEWS
*Department of Geophysics and Astronomy, University of British Columbia,
Vancouver, B.C., V6T 1Z4, Canada*

High resolution (0.15 Å/pixel) spectropolarimetry across the $H\beta$ emission line of the Be star γ Cas is presented (solid line in Figure B), as well as the intensity profile (Figure A). Earlier observations of the linear polarization across the emission lines (P_L) in Be stars (Coyne 1975, Poeckert 1975) found that P_L is inversely proportional to the total intensity of the emission line. However, our data clearly show that the width of the polarization profile is much wider than that of the emission line. The dotted line in Figure B gives P_L , based on the relationship of:

$$P_L = \frac{I_A}{I_{\text{total}}} P_C \quad (1)$$

which follows directly from Coyne (1975), where I_A is the intensity of the underlying $H\beta$ absorption feature, I_{total} the observed intensity profile, and P_C the polarization in the adjacent continuum. The underlying stellar profile of $H\beta$ (dotted line in Figure C), adopted from models by Hubeny (1988), gives a good match to the wings of the depolarization profile.

We have modified the Be star model developed by Poeckert and Marlborough (1978) for γ Cas, by adding the 6th level for hydrogen atoms in the envelope, representing the photosphere of the central star by a Hubeny atmosphere model (1988), and correcting the geometry of the calculation of polarization to properly take into account the finite size of the central star.

We find

- Linear polarization profiles across emission lines are not only affected by the emission from the disk, but also by the profile of the underlying stellar absorption feature, which in turn provides information about the central star.
- The modified Poeckert/Marlborough model gives a good fit to the $H\beta$ emission line profile, but only a poor fit to the polarization profile, probably because of their assumption that polarization across the emission lines is only affected by the additional emission.

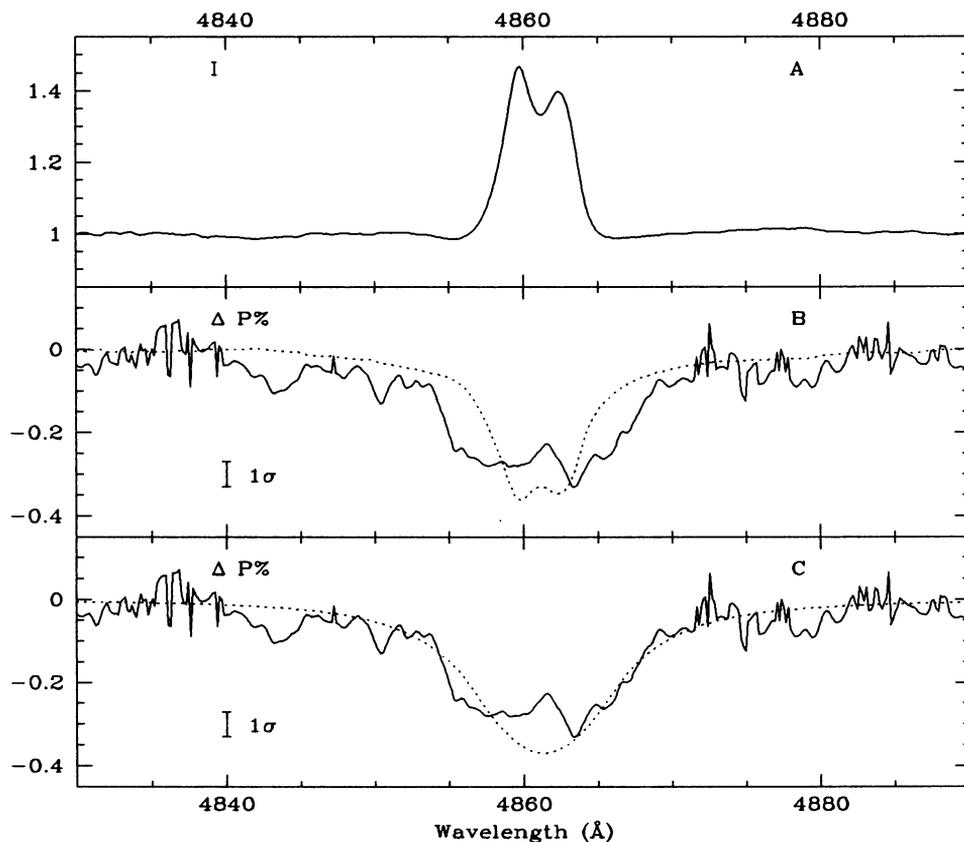


Figure A The emission line intensity profile of $H\beta$ on γ Cas, Sep. 23, 1990.

Figure B The solid line is the difference between the polarization within $H\beta$ and the polarization in the adjacent continuum. The dotted line is the polarization predicted by Equation (1), with the stellar $H\beta$ absorption feature given by Hubeny NLTE atmosphere model with $T_{\text{eff}} = 30000$ K, $\log g = 4.0$, $v \sin i = 325$ km/s. P_C is taken to be constant, $P_C = 0.75\%$.

Figure C The adopted stellar $H\beta$ profile (see B) scaled to 1.45% superimposed on the differential polarization profile.

References

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