MULTI-CHANNEL POLARIMETRY OF VV CEPHEI DURING THE 1997–1999 ECLIPSE

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Abstract

Multi-channel polarimetric observations of the long-period eclipsing binary system VV Cephei made during the 1997–1999 eclipse show slight changes in wavelength dependence and time variations of polarization.

1. Introduction

VV Cephei (P = 20.4 years, V = 5.2), a ζ Aurigae star, is a long-period eclipsing binary system consisting of a M-type supergiant of 1900 solar radii and of 2.5 solar masses, and a main-sequence Be star of 10 solar radii and 8 solar masses.

2. Observations

We wish to give a preliminary report of multi-channel polarimetric observations made of VV Cep at the Dodaira Observatory of NAOJ on 21 nights from 1996 to 1999. An eclipse occurred beginning in 1997 and it lasted until early in 1999. This is about 60 days later than our prediction. Semi-regular pulsation of the M star was also observed. The instrument used here was the eight-channel photomultiplier attached to the 0.91-m telescope, with which the photometry and polarimetry in all channels were made simultaneously. The effective wavelengths (micrometers) and bandwidths of each channel are given in Table 1.

3. Result and conclusion

We found that the average degree of polarization (p) is about 1.5% and there is a wavelength dependence, namely, p decreases as the wavelength becomes longer. The difference in average is 0.6%. There is no evidence for wavelength dependence in polarization position angle θ, which is between 30 degrees and 35 degrees. See Figures 1 through 8.

Table 1. Natural system for the photometry and polarimetry.

Channel	*λ(eff)*	*Range*	*Channel*	*λ(eff)*	*Range*
1	0.36 μm	0.31–0.39 μm	5	0.62 μm	0.60–0.65 μm
2	0.41	0.37–0.44	6	0.70	0.66–0.76
3	0.46	0.41–0.50	7	0.76	0.69–0.85
4	0.54	0.50–0.59	8	0.88	0.85–

In addition, we found that there is wavelength dependence in the Q-U plane; the values are 0.3% and 0.6% in average respectively. See Figures 1 through 8.

It seems that slight changes in wavelength dependence and time variations of polarization occurred during the eclipse.

References

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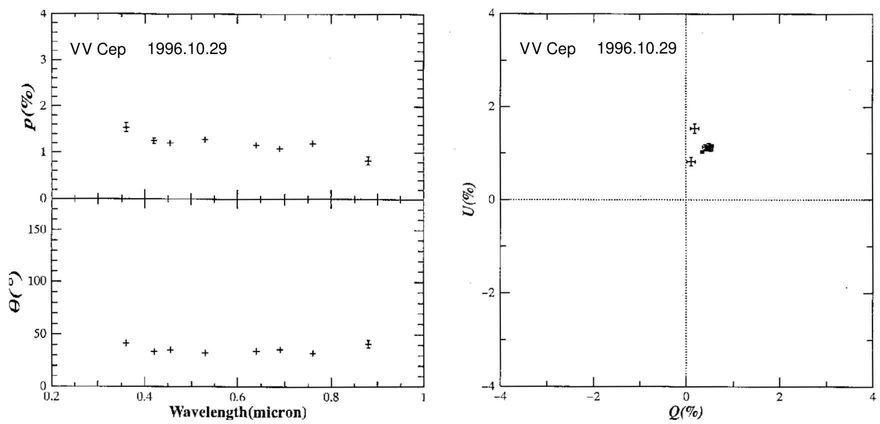

Figure 1. Left side: wavelength versus polarization degree (p) and polarization position angle (θ) for VV Cep (29 October 1996). Each point represents the size of the value p (upper portion of plot) and θ (lower portion), observed with channels 1–8. Right side: Stokes parameters plot (Q-U plane) for VV Cep (29 October 1996).

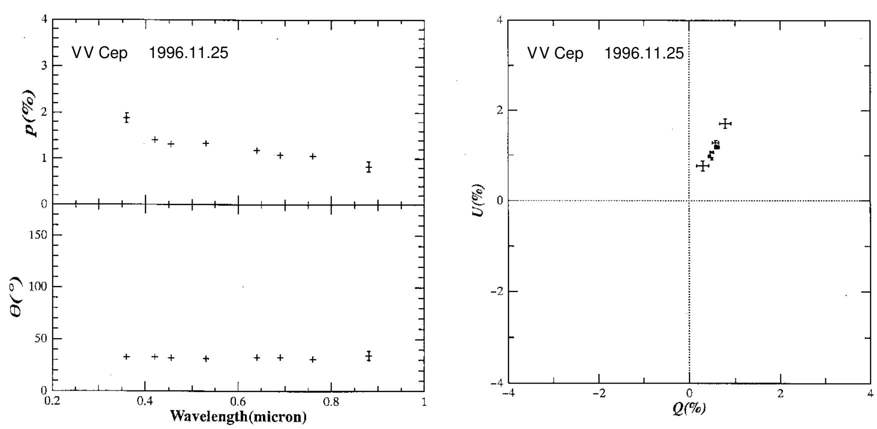

Figure 2. VV Cep (25 November 1996). See Figure 1 for details.

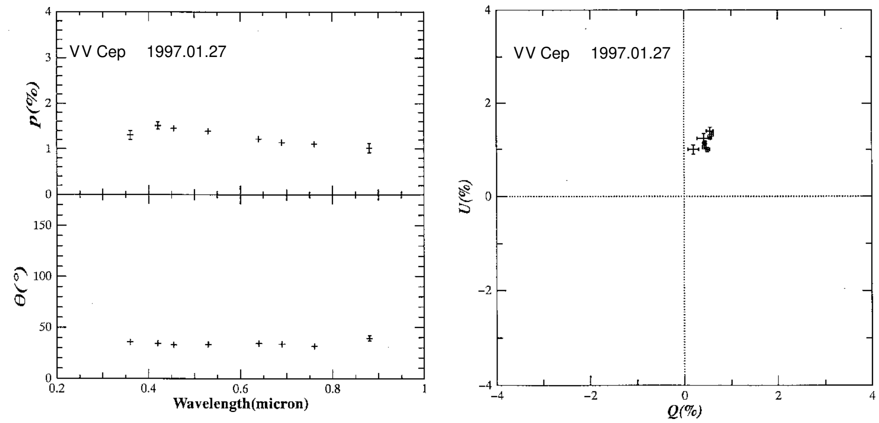

Figure 3. VV Cep (27 January 1997). See Figure 1 for details.

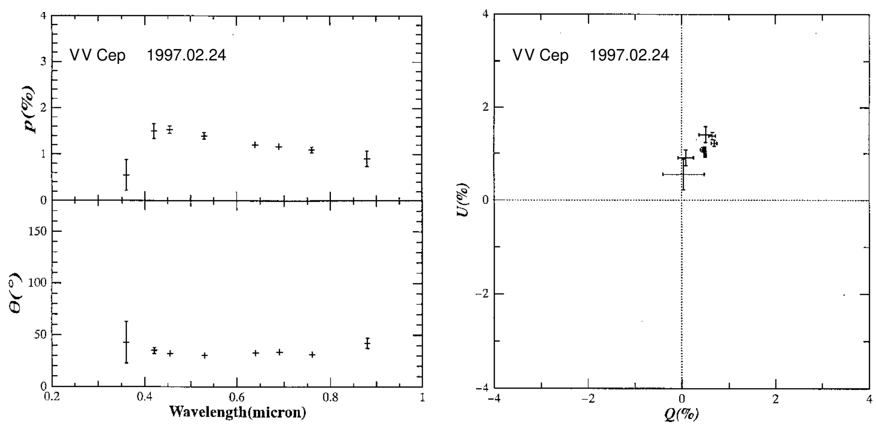

Figure 4. VV Cep (24 February 1997). See Figure 1 for details.

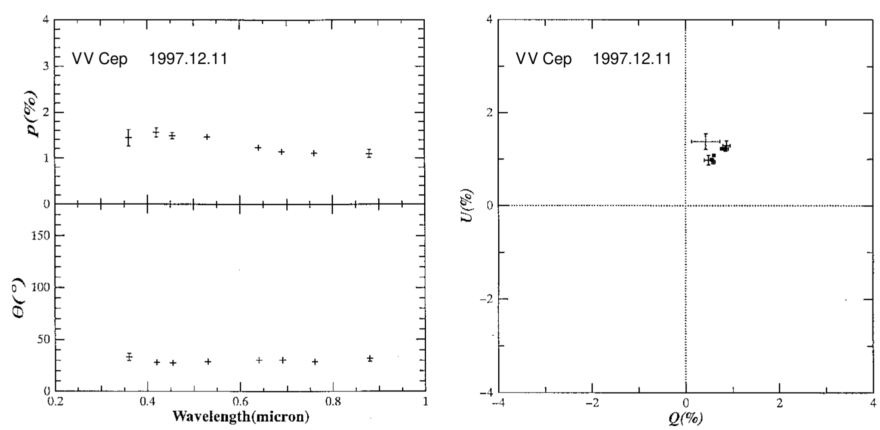

Figure 5. VV Cep (11 December 1997). See Figure 1 for details.

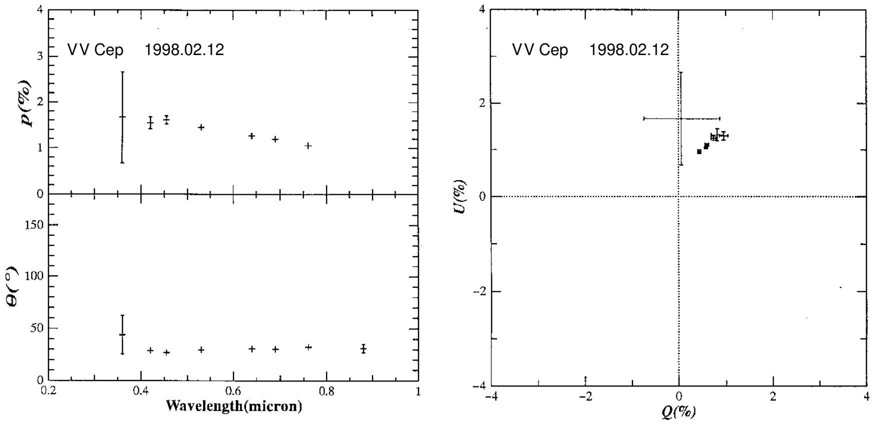

Figure 6. VV Cep (12 February 1998). See Figure 1 for details.

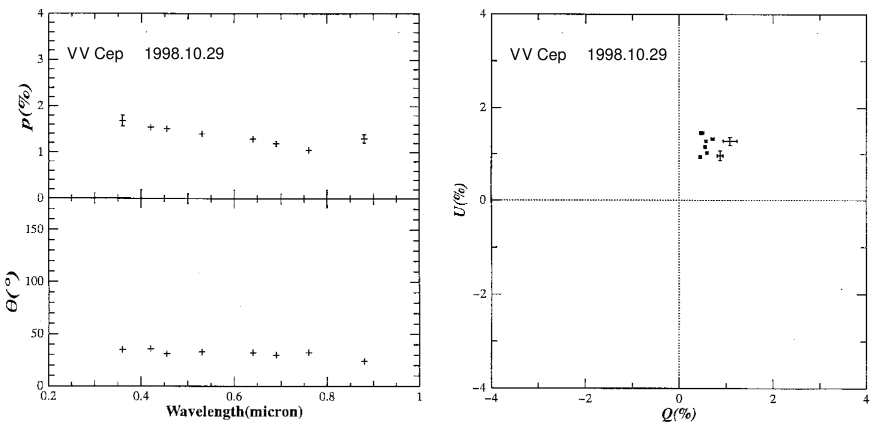

Figure 7. VV Cep (29 October 1998). See Figure 1 for details.

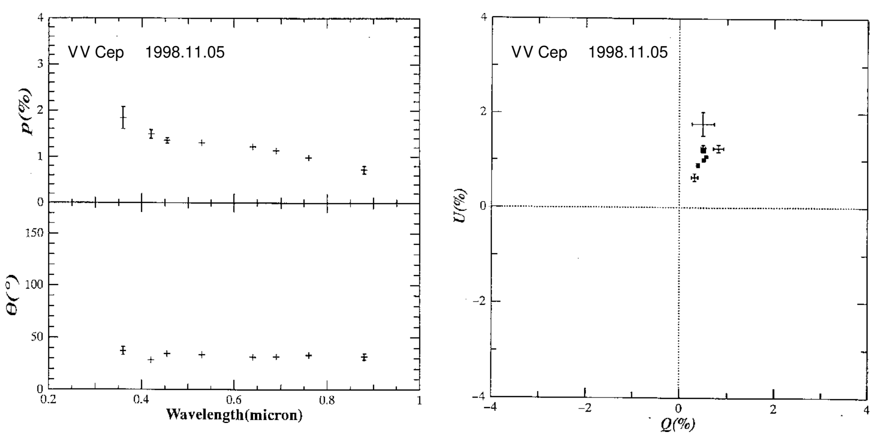

Figure 8. VV Cep (5 November 1998). See Figure 1 for details.