RESULTS FROM SIX MULTIWAVELENGTH CAMPAIGNS TO STUDY SHORT-TERM FUV FLUX VARIABILITY AND PHASE-DEPENDENT MASS LOSS IN Be STARS

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1. Overview

During the past six years we have carried through seven multiwavelength, multisite campaigns to investigate the cause for short-term (*rapid*) photometric and spectroscopic variability in Be stars and assess its importance in driving the mass loss in these objects. These campaigns usually included simultaneous observations in the UV with the *IUE* and *Voyager* spacecraft and optical region with ground-based telescopes worldwide (photometry, high resolution spectroscopy, and polarimetry). Typically 10–25 observers from 5–9 countries participated. Stars that have been observed include λ Eri, ω Ori, o And, ϵ Cap, 28 Cyg, η Cen, 48 Lib, ζ Tau, ψ Per, and 2 Vul. We briefly summarize some of the results from the UV study here. Additional results from the ground-based data are given in other papers in this volume by D. Gies, M. Hahula, J. Percy, and D. McDavid.

2. The Continuum

The *IUE* data were binned in 50 Å intervals to obtain FUV light curves as a function of wavelength. Periods from the UV observations agreed very well with the optical data. In every case the amplitude of the FUV light curve increased with decreasing wavelength, which suggests that the optical light variability is caused by a modulation in the star's photospheric temperature.

3. Wind Modulation Versus FUV Flux Variation

In all the campaign stars the C IV doublet showed phase-dependent variations in equivalent width and profile. The mass loss tends to be enhanced when the star is brightest, and in the Be-shell stars the absolute intensity of the C IV emission component is *anticorrelated* with the absorption strength and FUV flux level. The observations suggest that the mechanism that causes the photometric variability, which is associated with the photosphere, also modulates the wind. In Fig. 1 we show the maximum observed variation in the C IV wind absorption versus the amplitude of the star's

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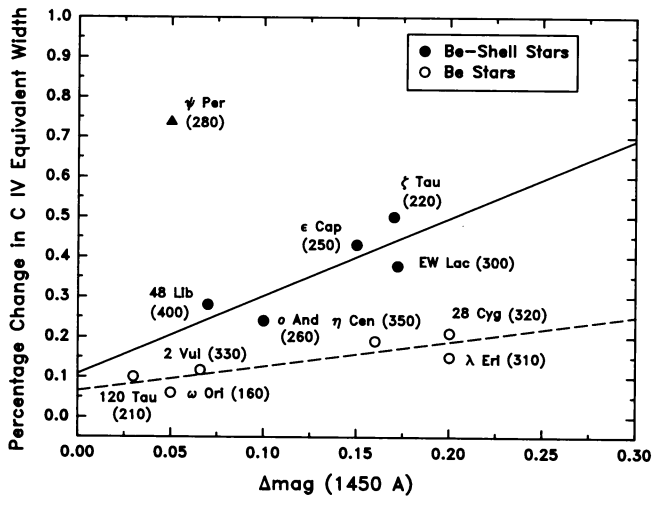


Fig. 1. Modulation of the wind versus the full amplitude of the 1450 Å light curve.

1450 Å light curve. We have further separated the Be-shell stars from their non-shell counterparts. Except for one anomaly, note that:

1) The degree of wind modulation correlates well with the amplitude of the FUV light curve. This further supports our assertion that the wind and flux variations are caused by a common mechanism.

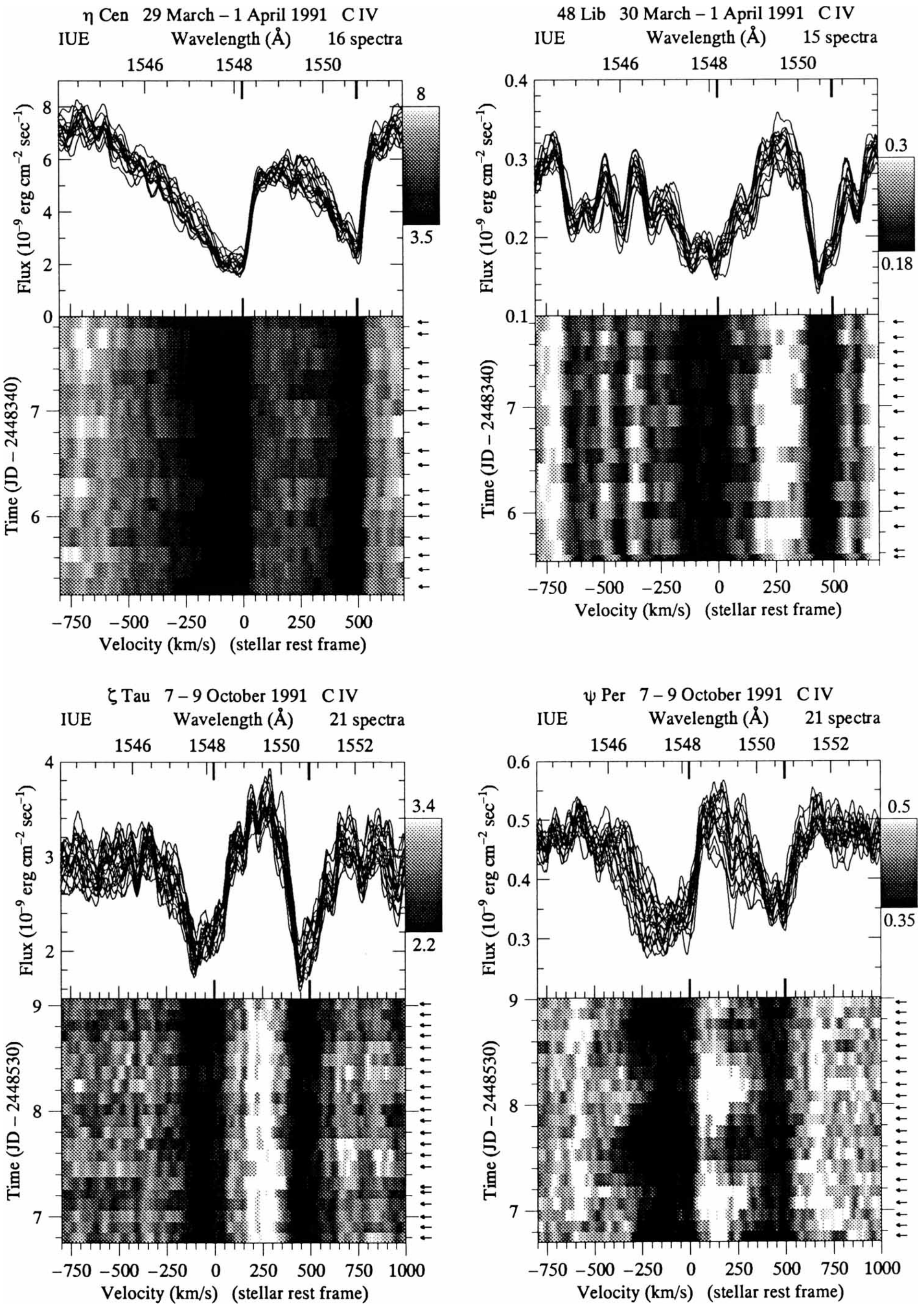
2) The wind is modulated more in the B-shell stars. This supports the consensus that the Be-shell stars are viewed almost *equator-on.*

3) The observed $v \sin i$ for each star is shown in parentheses below the label. *Neither the wind modulation nor the flux variability is a function of this quantity.* Stellar rotation does not appear to be as important as some other mechanism (NRP?) in producing this activity.

Many predictions (cf. Smith 1988 and references therein) of the NRP model ($\ell = 2$ sectorial mode) are supported by the data. The star is brightest when the hot crest is a disk center and vice versa. Our observations suggest that the mass loss is enhanced over the hot crest. This increased activity is seen at the limbs when the cool trough is in front, and can explain the stronger emission in the Be-shell stars at this phase. Finally, the correlations seen in Fig. 1 are also compatible with the NRP model: If mechanical input of energy from NRP is important in driving the mass loss as well as heating the region included in the crest, we might expect the wind modulation to be larger in stars with larger-amplitude light curves *and* the largest effects would be in the (equator-on) Be-shell stars.

References

Smith, M. A.: 1988, 'NRP and Early Be Stars: Ang. Mom. Considerations' in R. Stalio & L. A. Willson, ed(s)., *Pulsation and Mass Loss in Stars*, Kluwer: Dordrecht, 251



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