Ubiquitous C IV 1550 Variability in B and Be Stars

G. Sonneborn[1], M.P. Garhart[1], and C.A. Grady[1]

Astronomy Programs, Computer Sciences Corporation,
Beltsville, Maryland, U.S.A.

Studies of line profile variability of the ultraviolet 1550 Angstrom resonance transitions of C IV in Be stars (Sonneborn et al. 1986; Grady, et al. 1986a,b) have prompted an investigation into the short- and long-term behavior of the C IV lines in other types of B stars. We present examples of two well-studied Be stars, Omega Orionis and 66 Ophiuchi, and two non-Be stars, Beta Cephei and the standard star Zeta Cassiopeiae. Zeta Cas is also known to be a 53 Per variable (see Cox 1983). The IUE SWP high-dispersion spectra of Beta Cep and Zeta Cas have been obtained from the IUE archives. It has been known for some years that the C IV line profiles in Beta Cep vary in a time scale of several days (Fishel and Sparks, 1980). However, it came as a surprise to discover C IV variability in Zeta Cas. Available data allow us to set an upper limit of several months for the time scale of Zeta Cas C IV variability. The principal difference between the C IV variability in Be and non-Be stars appears to be the magnitude and velocity range of the effect.

Figure 1 shows IUE spectra of 66 Oph on eight dates in 1982. Four spectra were taken over a five-month period; four spectra were taken over an eight-day period. Beta Cep spectra are shown in Figure 2. They are from an eight-day period in 1979. Figure 3 shows two spectra each of Omega Ori and Zeta Cas; the similarity of the amplitude of variability in the Be and non-Be star is particularly striking.

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[1]Staff member of the IUE Observatory, at the Laboratory for Astronomy and Solar Physics, NASA Goddard Space Flight Center

https://doi.org/10.1017/S0252921100116422 Published online by Cambridge University Press

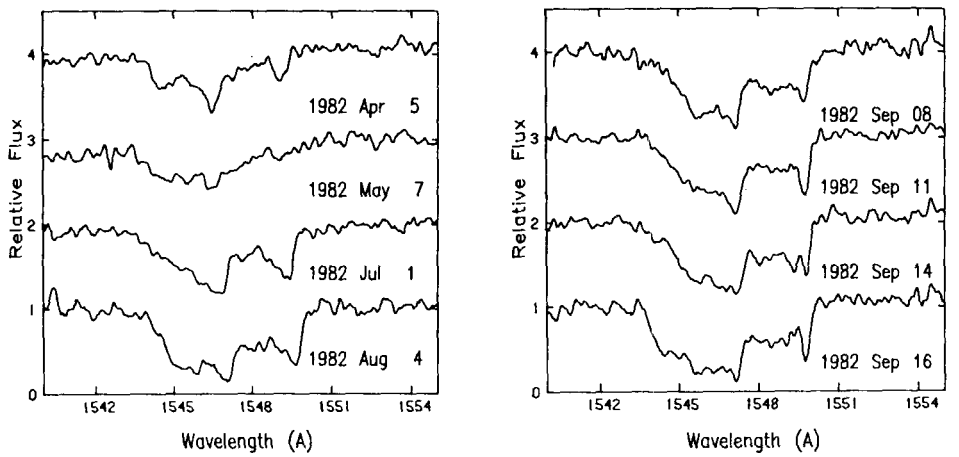

FIGURE 1. IUE SPECTRA SHOWING C IV 1550 IN 66 OPH ON 8 DATES IN 1982.

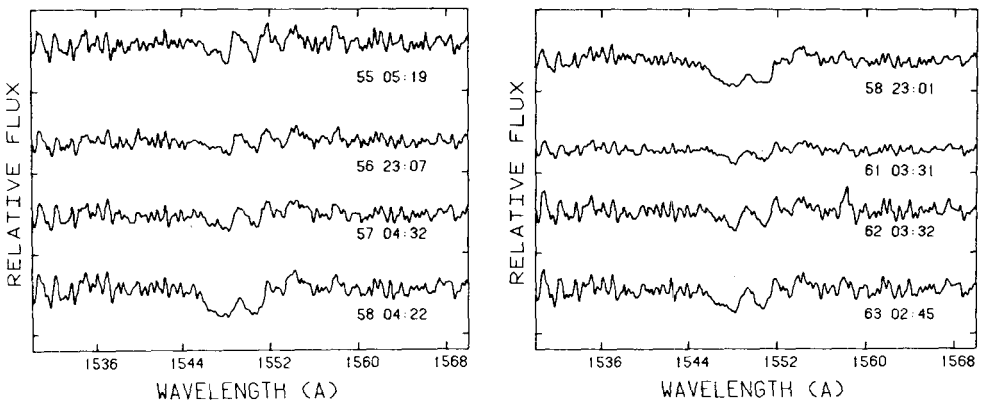

FIGURE 2. IUE SPECTRA SHOWING C IV 1550 IN BETA CEP ON 8 DATES IN 1979.

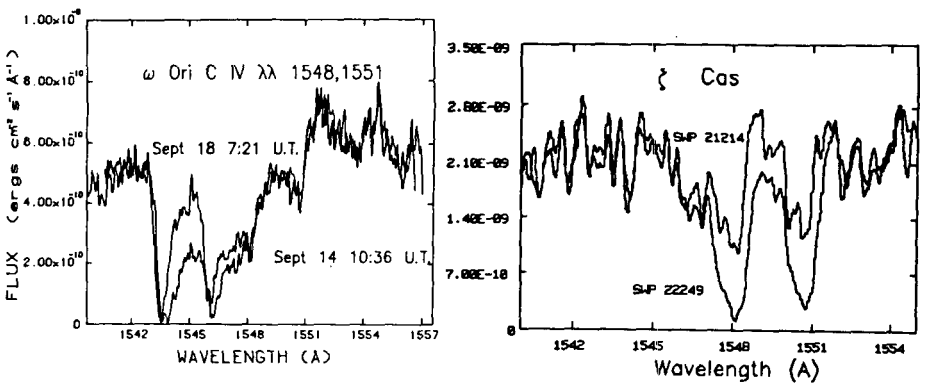

FIGURE 3. IUE SPECTRA OF OMEGA ORI AND ZETA CAS. NOTE THE SIMILARITY IN THE AMPLITUDE OF THE VARIATIONS.

https://doi.org/10.1017/S0252921100116422 Published online by Cambridge University Press

DISCUSSION FOLLOWING SONNEBORN

Underhill:

The line profile variations which you show are a strong reason why the conceptual division of stellar atmosphere into a photosphere and a mantle is useful. Conditions in the photosphere are controlled by conditions in the deep interior of the star. Conditions in the mantle of the star may well be controlled by superficial factors. Changes in these conditions result in changes in resonance line profiles. One is interested in developing appropriate models of photospheres.

Doazan:

Do you have simultaneous Hα observations of ζ Cas?

Sonneborn:

No.

Doazan:

So how can you know the behavior of the star during these epochs and its relation with the Be-phenomenon?

Polidan:

It is known that ζ Cas is a non-radial pulsator, specifically a 53 Per star.

Sareyan:

Did you fit your observations of β Cep with its actual photometric period and ephemeris, to know the phase of your observations?

Sonneborn:

The data presented are all archival spectra, taken in 1979 - 1980.

Grady:

Fahey et al (1982) found β Cep to have periodic variability in CIV. If I remember correctly, they found a 6.2 day period.

Henrichs:

The star β Cep is actually a very exceptional case. The work by Fahey, Sparks and Fishel showed a very stable 6.2 day period in the UV absorptions, very much unlike any other B star. In addition, the variable absorption in β Cep and ζ Cas is concentrated around zero velocity, also very much unlike the discrete components in Be stars.