VOYAGER OBSERVATIONS OF HOT LUMINOUS STARS

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This is a progress report on a study of the far-UV spectra of hot stars observed with the Voyager ultraviolet spectrometers (UVS); we discuss UV flux distribution and variability of a set of early type high luminosity stars.

The UVS's are objective grating spectrometers sensitive in the 500-1700 A region; the reciprocal dispersion is 9.26 A per detector channel yielding an effective resolution of about 20 A (approximately 2 channels). More information on the UV spectrometers is given in Broadfoot et al. (1977). The adavantages of their use for stellar work are discussed in Polidan, Stalio and Peters (1985, Paper I); the same authors give an evaluation of the mean error in flux per channel under typical observational circumstances: shortward of 1200 A the error is approximately 3%,longward of 1200 A it becomes of the order of 7%. Systematic errors due to uncertainties in the star position on the slit and to the effects of time variable instrument sensitivity are found to be negligible. The Voyager UVS calibration is discussed in Holberg et al. (1982).

In Paper I we have studied the problems of flux distributions, gravity darkening and flux variability in a set of main sequence B and Be stars. In particular we have shown that the far-UV flux of main sequence B stars is highly sensitive to stellar effective temperature. In this section we discuss the far-UV flux distribution of high luminosity stars of spectral type ranging from O4 to B8. Table 1 gives the basic information about the stars in study and Figure 1 shows the far-UV spectra which have been dereddened (see Paper I) and normalized at 1400 A. From these relative flux distributions one sees that the far-UV gives good definition of the spectral type of B-supergiants. Viceversa the relative fluxes of two supergiants (ζ Pup and ζ Ori), which lie at the lower and upper extremes of the O spectral class, are less separated in their relative far-UV fluxes. The likely reason for this smaller temperature dependence is that at the high effective temperatures of the O-stars one sees in the far-UV the rising (towards the extreme UV) part of the spectrum, not the region where the maximum flux occurs as is observed in the B stars. In addition, when comparing the relative fluxes of main sequence and supergiants B-stars of the same spectral type (see also Figure 1 in Paper I) one notices that the supergiants appear cooler due to either real differences in effective temperature and line blocking from both photosphere and stellar wind.

Five of the seven program stars were investigated for flux variability in the far-UV by intercomparing Voyager data when multiple observations were available. We have (1) measured integrated 950-1150 A fluxes, and (2) compared the absorption features at 980 and 1030 A which are mostly due to resonance lines of CIII and OVI ions

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respectively. Table 2 shows that no significant changes in the 950-1150 A continuum have been detected in most of the stars. There are probable variations in γ^2 Vel which could be ascribed to the binary character of the star. In the spectra of γ^2 Vel we also noticed a change of spectral shape shortward of 1100 A; with spectral shape changes there may be some line change as well. Figure 2 reports variations in the CIII and OVI profiles observed in ζ Ori. The line flux changes are of the order 7 sigmas and probably reflect a change in the rate of mass loss from the star.

We have presented the first results from a program to investigate the far-UV spectra of hot, luminous stars with the Voyager UV spectrometers. Two results have been obtained :

1) the far-UV range is a better discriminant for spectral types in the B-supergiant class than it is among the O-supergiants;

2) a remarkable "episode" of line flux variability has been detected in the spectrum of ζ Ori which we tentatively ascribe to variable mass loss.

REFERENCES

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Table 1: The stars in study

Star	Spectral Type	V	E(B-V)	Observation Date(1)
γ^2 Vel	WC8+07.5e	1.78		See Table 2
ζ Pup	04 If	2.22	0.05	38, 1980
ζ Ori	09.7 Ia	2.05	0.09	289, 1981
ϵ Ori	B0 Ia	1.70	0.06	202, 1981
ϵ CMa	B2 II	1.50	0.00	5, 1982
η CMa	B5 Ia	2.45	0.00	328, 1981
β Ori	B8 Ia	0.12	0.00	53, 1978

(1) The observation date reported refers to the spectra of Figure 1; for the other observation dates see Table 2.

Table 2: 950-1150 A flux ratios

γ^2 Vel	80/030:81/282:82/005=1.18:1.00:1.18
ζ Pup	80/038:81/328:82/005=1.08:1.00:0.96
ζ Ori	81/202:81/282:82/005=0.97:0.93:1.00
ϵ CMa	81/282:82/005=1.00:0.93
η CMa	81/328:82/005=1.00:1.00

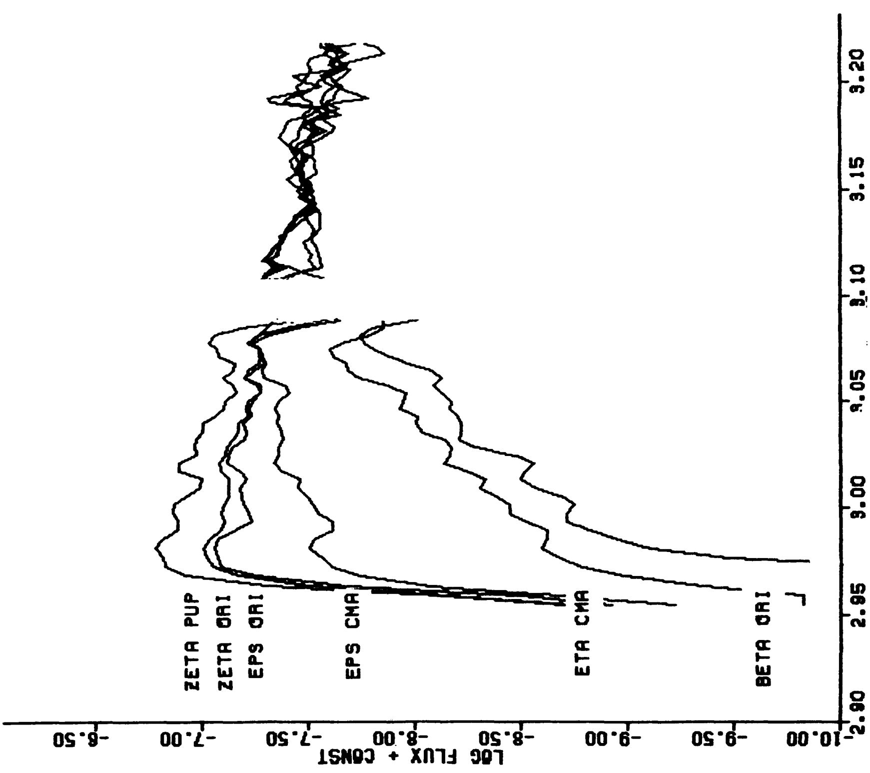

Figure 1: Voyager spectra of the hot, luminous stars identified in Table 1 (except γ^2Vel). All spectra have been dereddened and normalized at 1400 Å.

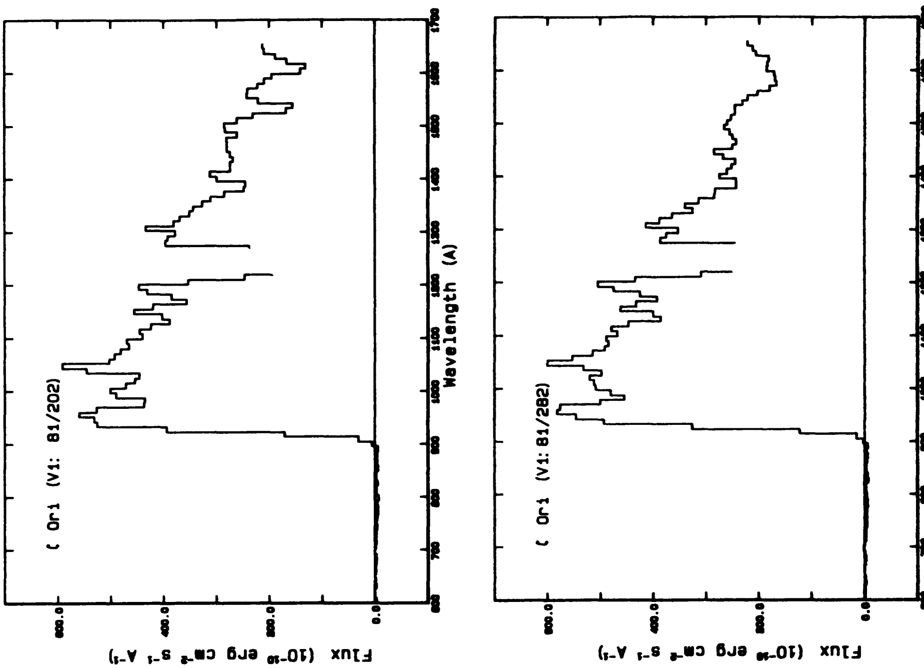

Figure 2: Variable OVI and CIII profiles in ζ Ori.

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