ULTRAVIOLET SPECTROMETRY OF PECULIAR STARS *

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The standard classification criteria, when applied to peculiar objects, such as emission line and shell stars, cannot easily be interpreted in terms of their intrinsic physical characteristics. Observations outside the optical spectral region may provide complementary information on their nature leading to a better spectral classification.

In the case of the symbiotic stars, their composite spectrum has been commonly attributed to the binary nature of these objects. However, prior to the IUE observations, there was no definite evidence for the presence of a hot secondary spectrum, in addition to the late type absorption spectrum normally observed in the symbiotic stars. The emission line spectrum does not necessarily require a hot photoionizing radiation, since the high ionization range could be explained by a coronal-type mechanism

In order to clarify this point, we have carried on ultraviolet spectroscopic observations of the prototype of the symbiotic stars, Z Andromedae, with the International Ultraviolet Explorer on

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1978, May and June. In the same period, objective prism spectra of Z And were obtained at the Campo Imperatore Observatory, covering the range 3400 to 8800 Å.

The ultraviolet spectrum of Z And, especially in the range 2000 to 3000 Å, is crowded by emission lines belonging - as for the optical region - to a large range of ionization energy. At shorter wavelengths, the crowding of the emission lines is smaller, and a faint continuum has been detected. The energy distribution, with no reddening corrections, is about that of a late B-type star. Actually, the object could be reddened by $E_{B-V} = 0.64$ (Caputo 1971). With this correction the energy distribution of the UV continuum is similar to that of an O-type star. From the objective prism plates, we have classified the present late type spectrum as M6. Assuming a luminosity class III, the hot continuum should be that of a subdwarf stars. Our present program is to derive a precise estimate of the interstellar extinction from the emission line intensity ratios.

Another interesting case of a peculiar star we have investigated with IUE is HR 5999, a variable A7 star with shell absorption and Hα in emission (Bessell and Eggen 1972). More recently, The and Tjin A Dije (1978) found that it is a pre-main sequence star subject to large fadings due to obscuration from local dust. According to their Walraven photometry, HR 5999 can be classified as A 5 III-II. We have compared the ultraviolet energy spectrum of this star observed by IUE on 1978, May 5, with the S 2/68 spectra of main sequence and giant stars from the Catalogue of Jamar et al. (1976), and from the Atlas of Cucchiaro et al. (1978). In Fig. 1 we show the smoothed IUE spectrum of HR 5999 between 1600 and 3000 Å (thick line) and the S2/68 spectra of main sequence A5, F0 and F3 stars (thin lines).

In the figure it is evident that the cutoff of the spectrum near 1750 Å, and the spectral patter between 1800 and 2500 A are characteristic of an early F-type spectrum, i.e. later than the spectral type derived from the optical observations, but with absorption features deeper than for a main sequence star. However, the continuum gradient near 2000-2500 A is more negative even than that of an intermediate A-type star. A possible explanation of this feature could be a strong absorption by the 2200 A interstellar band, and a strong line blocking by ionized metals in the circumstellar regions.

We may thus conclude that the observed ultraviolet spectrum of HR 5999 is probably mostly formed in a cooler circumstellar shell.

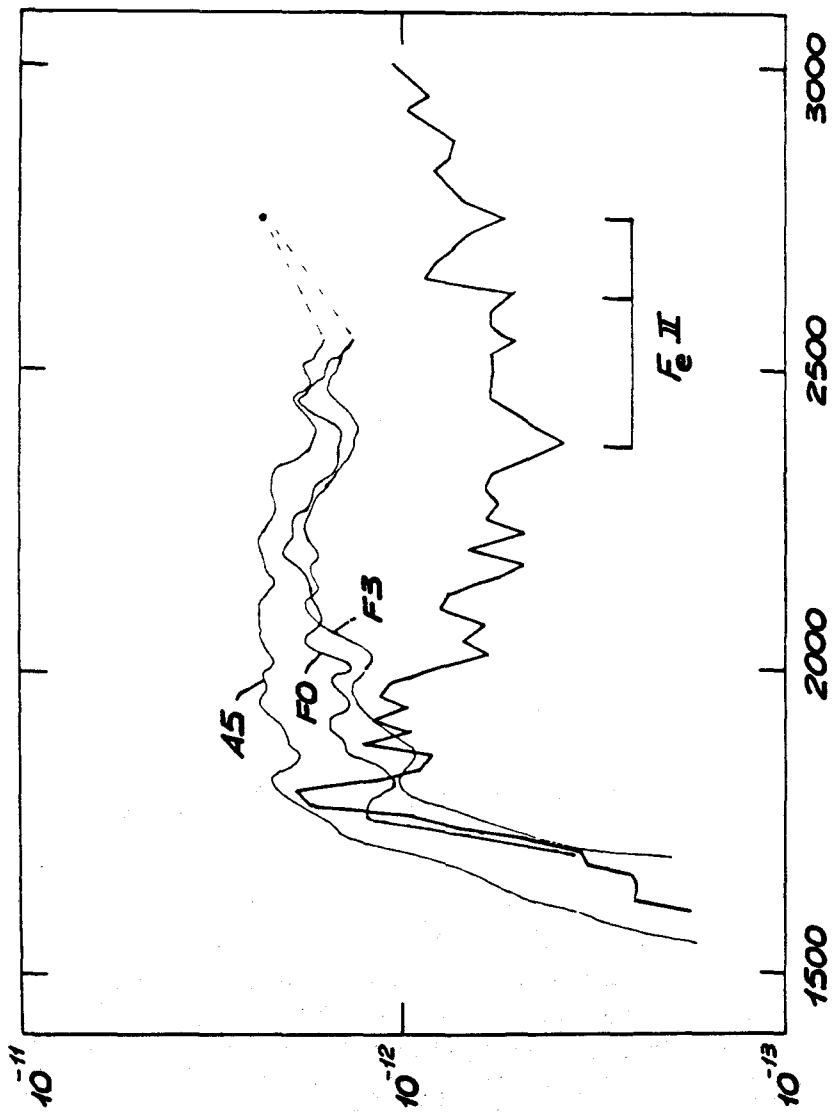

Fig. 1. The ultraviolet energy distribution of the pre-main sequence shell star HR 5999 (thick line) compared with TD 1 S2/68 spectra of main sequence stars (thin lines). The ordinate is in erg $cm^{-2}sec^{-1}Å^{-4}$.

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