A PRELIMINARY DIGITAL ANALYSIS OF THE SPECTRUM OF β LYRAE

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Abstract. This paper describes preliminary results from a digital analysis of the Fourier transform spectroscopy of β Lyrae. The spectra are photometrically precise in the 4800-10200 Å range with a spectral resolution of 3.85/cm. The most remarkable spectral features are the emission strength of some neutral Helium and Hydrogen lines, and their variability with time. Other fainter emission lines disappear, now and then.

An excellent review of the complex system of β Lyrae has been written by Sahade (1980) with an emphasis of the problems posed by this interesting eclipsing binary system. Sahade also gives extensive references to previous works.

This paper is based upon three Fourier-Transform Spectra of β Lyr obtained by Johnson on June 14, June 16 and October 10, 1976 with a Michelson Spectrophotometer. The system yields photometrically precise spectra (Johnson: 1977a, 1977b, 1978) in the 4800-10200 Å range. The spectral resolution is 3.85 cm^{-1}. The scan time of the interferometer was set to 2.8 seconds and it was necessary to add together many interferograms to obtain spectra of high quality. The probable error of noise ripple, expressed as a percentage of the stellar flux is around one percent (Mendoza 1981); except on both ends where it is near the two percent level. A compressed spectrum of β Lyrae is shown in Figure 1.

A preliminary analysis has been made in three directions: (1) wavelength measures for the purpose of line identification, (2) equivalent width measures of all the lines stronger than three times the probable error (Johnson and Mendoza, 1980), and (3) a study of line variability. The accuracy of measurement is limited by line blending; part of this blending is due to instrumental blending and part to blending of the stellar line themselves, and by profile and line strength variability. It is prohibitive to publish here all the measurements that we have made.

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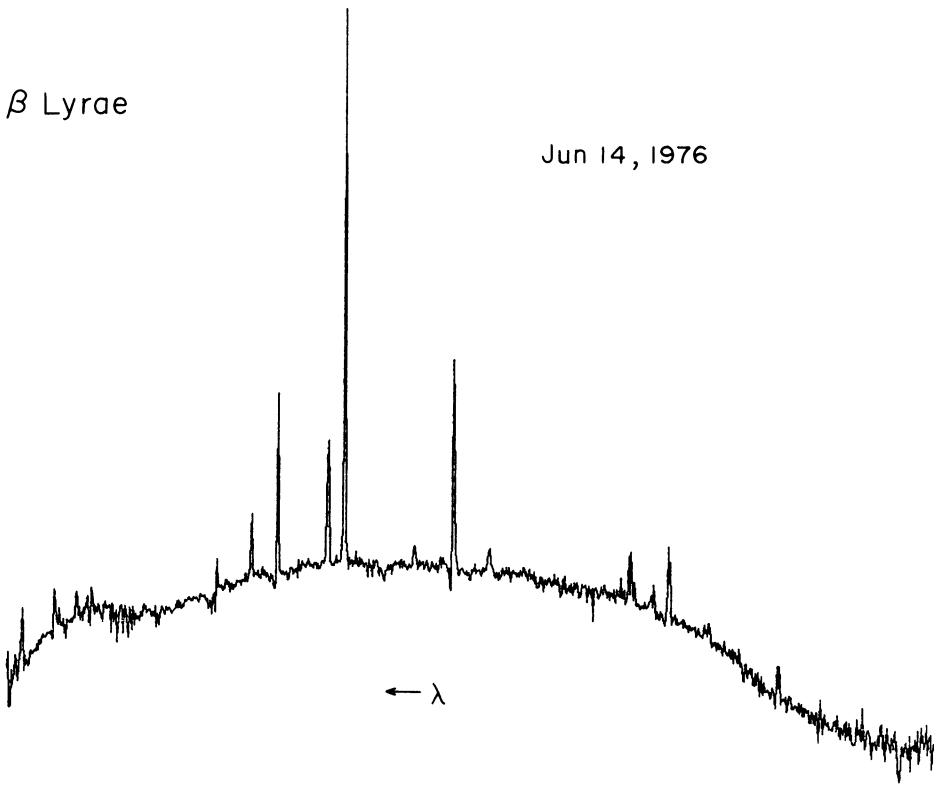

Fig. 1.- The compressed spectrum of β Lyrae from 4000 Å (right) to λ10300 Å (left). The strongest emission line is Hα. The abscissae are frequencies (cm^{-1}) and the ordinates relative intensity.

A great enhancement by emission in some neutral Helium and Hydrogen lines are among the most remarkable spectral features seen in our three spectra. Furthermore these lines are double, with the red component stronger than the blue one, in general but not always. These lines are variable in profile and strength. The changes are dramatic sometimes. Other fainter emission lines appear and disappear with time. We show in Figure 2 the spectral behavior of the N II(λ6329 Å) and the He I (λ7281 Å) lines, to illustrate the above.

Hα is the strongest emission line in our spectra of β Lyrae (see Figure 1). However, the higher Paschen lines are very little contami-

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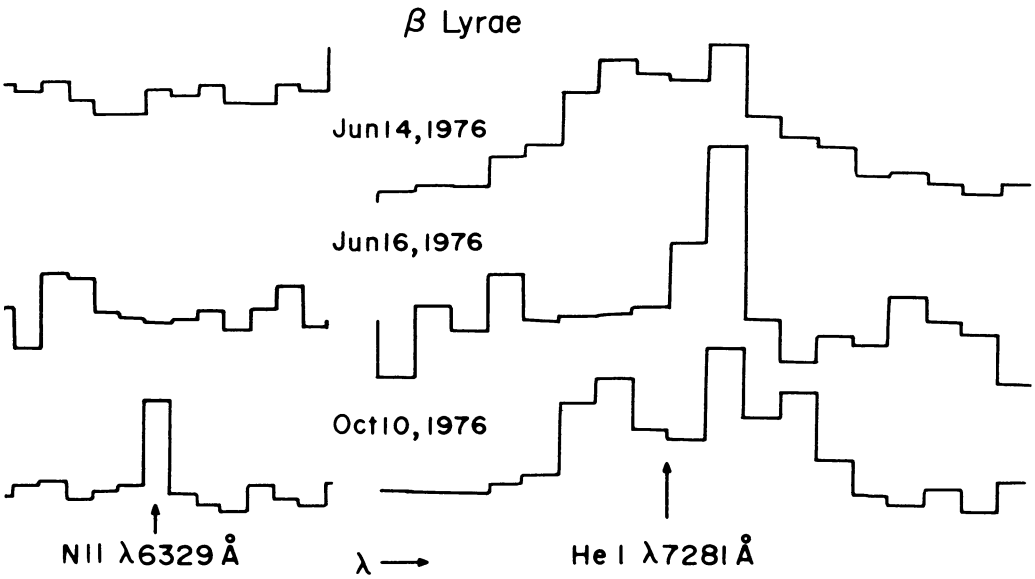

Fig. 2.- The spectral behavior of N II and He I lines in β Lyrae.

nated by emission, if any.

We have measured 600 absorption and 60 emission lines, in round figures. We find, in a first approximation, the same multiplets found in γ Cas, φ Per and P Cyg by Johnson et al. (1978), including the Mg II doublet (λλ9218, 9244 Å).

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