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EMISSION LINE INTENSITY VARIATIONS DURING THE 1982 ECLIPSE OF CI CYGNI

The observations of the last 1982 eclipse of the symbiotic star CI Cyg were carried out with the Canadian Copernicus Spectrograph attached to the 90 cm Schmidt-Cassegrain telescope of Toruń Observatory. The spectrograph has a Richardson image slicer of 3.5 arcsec aperture. 29 spectra of this star with a dispersion of about 160 \AA mm^{-1} in the blue spectral range ($\lambda 3400 - \lambda 5100 \text{ \AA}$) have been obtained during the period August 1981 - April 1983. All the spectra have been taken on Kodak IIa-O preflashed plates.

Spectra have been converted to the intensity scale by means of the automatic reduction system "Antares" (Turžo et al., 1983) with the output on paper tape, using a calibration obtained with a spot sensitometer. The spectral response of the spectrograph and the atmospheric extinction have been corrected by using the mean coefficients obtained from the observations of the standard star α Lyr. The spectra of CI Cyg have been de-reddened with $E_{B-V} = 0.45$ (Mikołajewska, Mikołajewski 1980, 1983).

The spectra are typical for the quiet phase of a symbiotic star. The most prominent emission lines are the Balmer series of HII, HeII 4686, [NeV] 3426 and [OIII] 5007, [OIII] 4363, [NeIII] 3869. Some other emission lines are also present, for example NIII 4641, HeI 4026, 4471 and 4921, OIII 3450 and 3760, and the permitted and forbidden lines of ionized iron. The strongest TiO absorption bands 4955, 4804 and 4761 have been also identified.

During the 1982 eclipse the strong emission line flux variations have been detected, similar to those observed during the 1980 eclipse (Mikołajewska, Mikołajewski 1982, 1983, Oliverson, Anderson 1982). Figure 1 presents the observed variations in the relative intensities of Balmer H-beta and H-gamma, HeII 4686, HeI 4471 and NIII 4641 lines. The forbidden [OIII] 5007 and 4363, [NeIII] 3869 and [NeV] 3426 lines have not shown eclipse effects and have been constant within the observational errors (11% for [OIII] and 18% for [NeIII] 3869 and [NeV] 3426). Figure 2 presents the intensities of the forbidden [OIII] 4363 line in relation to the sum of depths of TiO bands heads

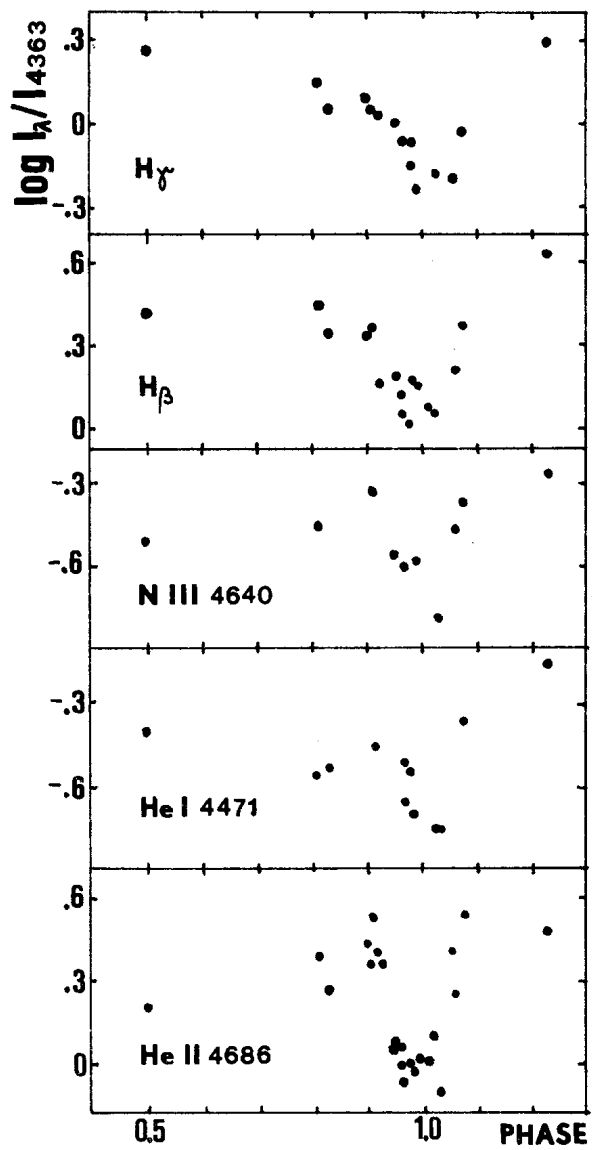


Figure 1

Changes of relative emission line intensities. Phases have been calculated from the ephemeris (Mikołajewska and Mikołajewski 1983):
 JD Min = 2 444 396 + 855.25 · E

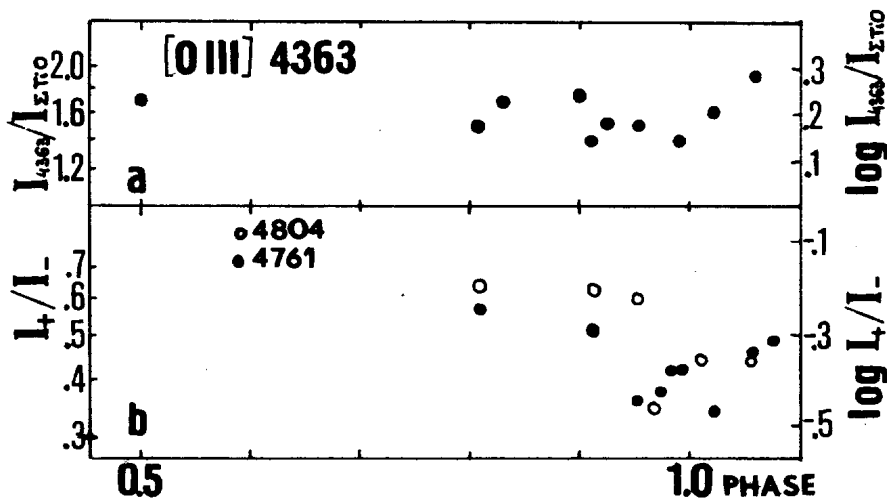


Figure 2

(a) Intensities of [OIII] 4363 emission line in relation to the sum of the depths of TiO bands. (b) Changes of relative depths of TiO 4804 and 4761 bands.

4955, 4804 and 4761. The differences $I_{\lambda}^{-} - I_{\lambda}^{+}$ have been adopted as the depths of the TiO bands.

The 1982 eclipse in HeII 4686 seems to be slightly shallower and broader than those observed in 1980. Assuming the inclination angle of the orbit near 90° we have:

$$(R_{\text{cool}} + R_E)/\pi a = D/P$$

$$(R_{\text{cool}} - R_E)/\pi a = d/P$$

where D is the total duration of the eclipse and d - the duration of the total eclipse. Adopting a period $P = 855^d.25$ the relative sizes of the eclipsing star $R_{\text{cool}}/a = 0.366$ and the HeII 4686 emission region $R_E/a = 0.146$ have been calculated. The radius of the cool eclipsing star agrees well with the results obtained from the V photometry during the 1980 eclipse ($R_{\text{cool}}/a = 0.371$, Mikołajewska and Mikołajewski, 1983). The HeII 4686 emission region is larger than in 1980 ($R_E/a = 0.117$). There are no significant changes in the shape of the 1980 and 1982 eclipses in the Balmer H-beta and H-gamma lines.

Figure 3 shows the secular variations in HeII 4686 and H-beta and H-gamma lines. HeII 4686 has been showing a strong increase of intensity since 1977.

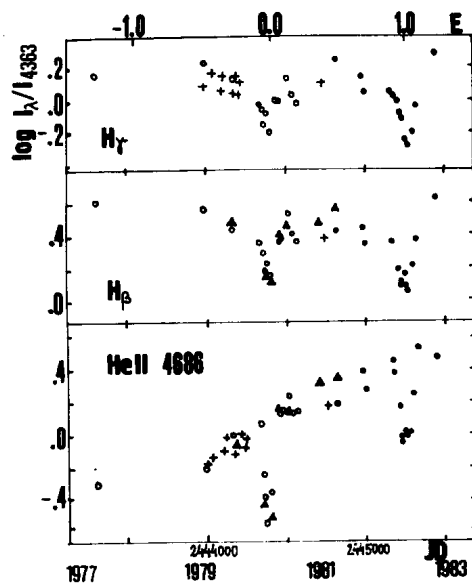


Figure 3

Secular variations of HeII 4686 and Balmer H-beta and H-gamma emission lines. Crosses mark observations of Iijima (1981, 1982), triangles - those of Oliverson and Anderson (1982), open circles - those of Mikołajewska and Mikołajewski (1983) and points - present paper.

The H-beta and H-gamma intensities seem to be constant during the same period.

The more detailed analysis of the obtained results will be published elsewhere.

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