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BIPOLAR EJECTION FROM THE SYMBIOTIC BINARY Hen 3-1341 DURING ITS 2012 OUTBURST

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The binary star Hen 3-1341 consists of a cool primary of spectral type M4 (Mürset & Schmid 1999) and a hot luminous compact object with an effective temperature of 1.2 $\times$ 10^5 K as a secondary component (Munari et al. 2005). The stellar components are embedded in a dense, radiation bounded circumbinary nebula (Munari et al. 2005). The system underwent a large optical outburst lasting from 1998 to 2004 with a V amplitude of about 2 magnitudes (Tomov et al. 2000, Munari et al. 2005). The data of Tomov et al. (2000) show that the line Hα had an intensive central component and additional weaker emissions symmetrically displaced to the central component at a velocity of about 800 km s^{-1} indicating bipolar jets. The profile of the line He I λ5876 contained the same components, but it had one P Cyg absorption in addition. The system Hen 3-1341 underwent second outburst in 2012 (Munari et al. 2012a). Munari et al. (2012b) established the appearance of satellite emissions with a velocity of 1100 km s^{-1}, symmetrically displaced to the center of the line Hα, indicating bipolar collimated outflow. They noted that the helium lines acquired P Cyg signatures of stellar wind. Because of the uniqueness of the event we organized spectral observations of this star with the aim to take high resolution data in the region of its lines where indication of mass outflow was detected.

Spectroscopic data were obtained on June 6 and August 4, 2012 with the Photometrics CCD camera mounted on the Coudé spectrograph of the 2m Ritchey-Chrétien-Coudé (RCC) telescope of the Rozhen National Astronomical Observatory. Because of the weakness of the star and its small height above the horizon we were able to take frames covering only Hα and He I λ5876 lines. The resolving power in their ranges was 32000 and 29000. Two exposures with duration of 20 minutes were taken in each range and the spectra were added with the aim to improve the signal-to-noise ratio. The IRAF package[1] was used for the data reduction as well as for obtaining the dispersion curve, calculating the radial velocities and equivalent widths.

On June 6 the profile of the line Hα was multicomponent one consisting of a central emission located around the reference wavelength, broad wings with low intensity extended to not less than $\pm$ 2000 km s^{-1} from the center of the line, and additional satellite emission components with a velocity of 1160 km s^{-1} on both sides of the central emission, indicating

[1] The IRAF package is distributed by the National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract with the National Science Foundation.

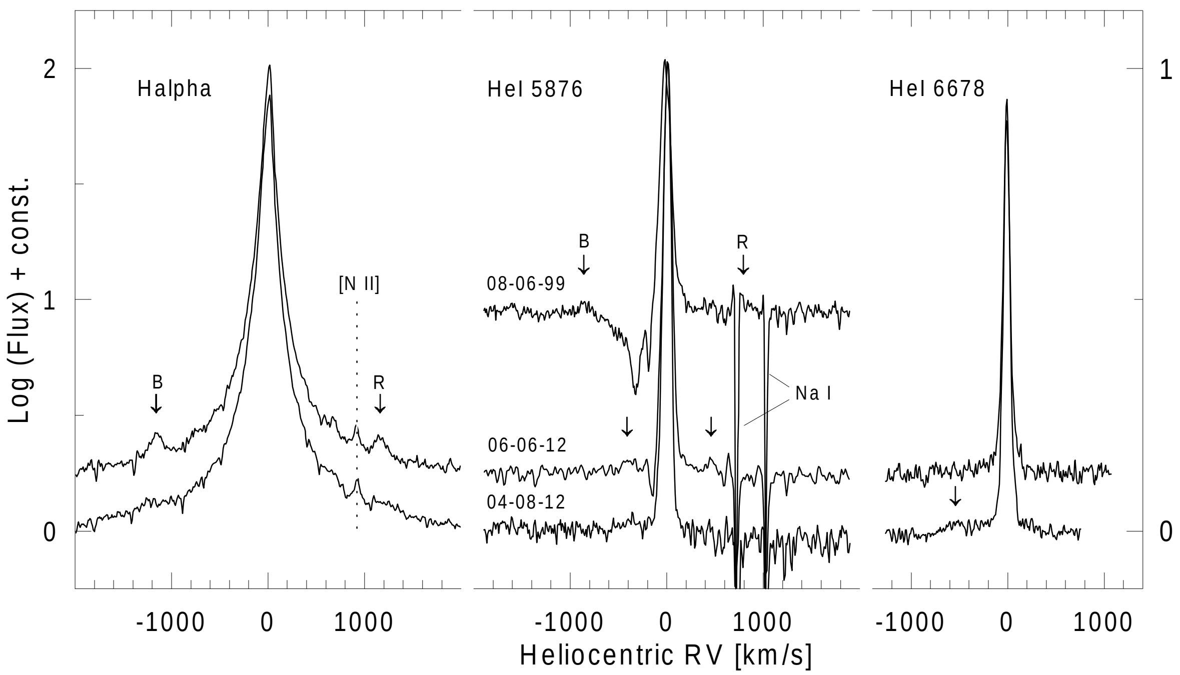

Figure 1. The profile of the Hα, He I λ 5876 and He I λ 6678 lines. The spectra are in units of the continuum and a logarithmic scale is used for better visibility of the profile. The right y-scale is related to the intensity of the helium lines only. The profile of the He I λ 5876 line on June 08, 1999 from the paper of Tomov et al. (2000) is shown for comparison.

Table 1: The radial velocities RV ($\mathrm{km\,s^{-1}}$), widths FWHM ($\mathrm{km\,s^{-1}}$) and equivalent widths W_λ(Å) of the satellite emissions in the Hα line. The third column compares the total Hα equivalent width.

Date	HJD(245...)	W_λ(Å)	Blue			Red		
			RV	FWHM	W_λ	RV	FWHM	W_λ
June 6, 2012	6085.335	221.53	−1160	141	0.90	1164	144	0.74
Aug. 4, 2012	6144.312	282.02						

bipolar collimated ejection from the system (Fig. 1). The satellite components were fitted with Gaussian, and the rest of the line (the core plus the wings) – with Lorentzians to determine their radial velocity position and equivalent width. Resulting parameters are presented in Table 1. The uncertainties in the equivalent width of the whole line and the satellite emissions are 3 and 15-20 per cent. The uncertainty in the radial velocity of the satellite emissions is about 3 $\mathrm{km\,s^{-1}}$. The ratio of the equivalent widths of the satellite components and the rest of the line is 1:134 which is equal to the ratio of the Hα fluxes of the area of bipolar ejection and the other part of the circumbinary nebula. On August 4 the profile of the line Hα was similar, the satellite emissions disappeared and only weak remnants were visible at their radial velocity position. Having in mind they emerged in the beginning of March 2012 (Munari et al. 2012b) it can be concluded that they have been presented in the spectrum of the star for about five-six months.

The profile of the He I λ 5876 line (Fig. 1) on June 6 consisted of emission component of nebular origin and a P Cyg absorption indicating mass outflow from the system with a velocity of about 150 $\mathrm{km\,s^{-1}}$. On both sides of the nebular component, however, two

Table 2: The radial velocities RV ($km\,s^{-1}$), widths FWHM ($km\,s^{-1}$) and equivalent widths W_λ(Å) of the He I lines.

Date	HJD(245...)	He I λ 5876			He I λ 6678		
		RV	FWHM	W_λ	RV	FWHM	W_λ
June 6, 2012	6085.335	10	80	11.6	−11	66	7.8
Aug. 4, 2012	6144.312	6	71	13.8	−9	57	10.6

very weak emission details were visible pointed with arrows in the figure. Their velocity was much lower than the velocity of the Hα satellite components. The velocity of the blueshifted one was 410 $km\,s^{-1}$ and the velocity of the redshifted was 460 $km\,s^{-1}$. On August 4 only the blueshifted emission was visible together with the central nebular component.

The emission line He I λ 6678 had nebular profile (Fig. 1). Possible blueshifted emission component with a velocity of about 500 $km\,s^{-1}$ in the August 4 spectrum was very faint.

The emission components of the helium lines were fitted with Gaussian. Resulting parameters are presented in Table 2. The uncertainties in the equivalent width is 5 per cent and the uncertainty in the radial velocity is not more than 3 $km\,s^{-1}$.

Our observations confirmed the emergence of high-velocity satellite emission Hα components indicating bipolar collimated ejection and P Cyg He I absorption with intermediate velocity indicating stellar wind from the compact object in the system Hen 3-1341 (Munari et al. 2012b) and demonstrated their transient nature being observed for five-six months.

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