*Jets at all Scales*
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# Do cataclysmic variables produce jets?

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**Abstract.** It is believed that CVs do not produce jets unlike other, more massive interactive binaries. Here we present spectrophotometric observations of the super-outburst of V455 And. We show here that a strong wind perpendicular the the accretion disc at the maximum of the super-otburst, i.e a jet, can probably explain the observed spectroscopic behavior of this system.

**Keywords.** (stars:) binaries: spectroscopic, (stars:) novae, cataclysmic variables

## 1. Introduction

V455 And is a 81.08 min, eclipsing dwarf nova (DN). Its primary is a magnetic WD with 1.12 min spin period. It is also pulsating. The most intriguing feature of this object is its $\approx 3.5$ h spectroscopic period detected in the wings of emission lines (Araujo-Betancor *et al.*, 2005). In 2007, V455 underwent an $8^m$ superoutburst. We report here the spectral observations during the rise and possible interpretation of its unusual behavior.

The early rise to the super-outburst spectral observations were obtained on 4.2-m WHT, whereas the rest of the data comes from 2.1 m telescope of OAN SPM. The photometric data used here was obtained from the AAVSO data base.

## 2. Photometric and Spectral behavior

The object at quiescence is V$\approx$ 16.3. It was slightly fainter than V=14 when the first spectrum was obtained. From that moment and through the rise to the max 8.5 mag 160 spectra covering more than 10 hours were taken. The light curve (*lc*) of the outburst is presented in Fig. 1a. For comparison, we over-plotted in blue the *lc* of a similar object

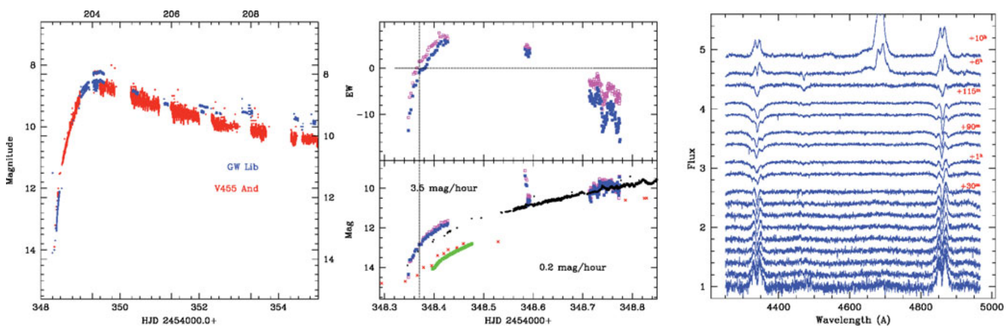


**Figure 1.** The rise to the superoutburst: a. the superposition of *lc*s of V455 (red) and GW Lib (blue); b. the zoom on early rise. On the lower panel, the black points are from photometry, while the blue and magenta points are measurements of the continuum level around $H_\gamma$ & $H_\beta$ lines correspondingly. The green points and the red crosses are measurements of GW Lib in V and visual correspondingly. On the upper panel the measurements of equivalent widths of the same lines are presented, showing the rise of absorption first, then turn around and return of emission; c. the progression of spectra from the start of observations. The time since the start is marked on the right side of spectra.

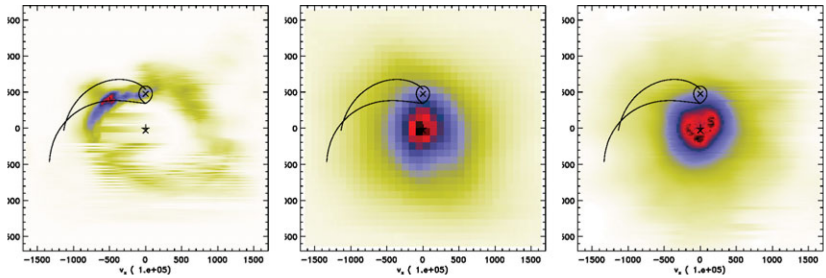

**Figure 2.** The Doppler tomograms of three orbits taken at the very beginning, several hours later after emission lines re-emerged and at the top of the super outburst.

GW Lib (axes are shifted to coincide c;osely with the V455). GW is only the second object of that class observed during the rise. One notable difference between two *lc*s is that the V455 was rising very steeply at first, which has changed into a slower rise later. This switch in growth rate was accompanied by the reemergence of the emission lines.

From the onset of observations the spectra of V455 evolved in a common to DN way. Emission lines gradually convert into absorptions. Usually the emission lines do not disappear completely, but display small peaks inside absorptions. Such condition of the disk usually prevails during most of the rise, maximum and plateau of the outburst. Only after about a dozen of days the lines start to return to emission, indicating that the disk clears out, becoming optically thin.

The 2007 superoutburst of V455 was different. After 6h from the start of observations, and well before the max of outburst, the emission lines reemerge and by the end of the night (10h later) they were extremely intensive with the addition of a very strong He II line (Fig. 1c). The line profiles evolved from markedly double-peaked to single peaked, and the corresponding tomograms changed from showing extended ring of accretion disk into a single concentrated spot close to the center of the mass of the binary. The system remained in that condition for $\sim 10$ days since the start of the outburst. Only 13 days later wide double-peaked lines and donut-shaped tomograms returned.

## 3. A possible scenario

Among possible explanations of such behavior we find a strong wind from the accretion disk, to be the most plausible. Ribeiro & Diaz (2008) demonstrated that a biconic wind, optically thick in lines from the accretion disk, will produce single peaked emission lines strong enough to dominate over the hot optically thick accretion disk. Fig. 2 shows the evolution of Doppler tomograms of the object at the rise and its maximum. The accretion disk appears as a ring on tomograms at the very beginning. But after the emission lines reemerge, they become single peaked and their corresponding tomograms exhibit a rather dense spot centered at zero velocity. We interpret the observed behavior in context of the wind model. As the the outburst starts, the disk turns hotter and optically thick, rapidly increasing the brightness. At some point however, the wind commensurates, possibly as a result of the soaring accretion rate and being reinforced by a wobbling magnetic field of the white dwarf and a portion of matter is blown perpendicular to the plane of the disk, giving rise to the emission lines. We again see the disk in the lines after the outburst plateau, when the wind lines turn back optically thin.

## References

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