

Second outburst phase of McNeil’s nebula (V1647 Orionis)

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Abstract. The FU Ori/EX Ori phenomenon represents a rare and not yet fully understood phase of the early evolution of low mass stars. Therefore, the photometric and spectroscopic monitoring of the post-outburst phase of these objects is required to settle the class of eruptive variables to which they belong. V1647 Ori had gone into outburst phase in early 2004 (McNeil 2004) and faded considerably around late 2005 (Ojha et al. 2006). It underwent another strong outburst in 2008 (Itagaki et al. 2008, Ojha et al. 2008). Such observed properties are rarely seen in cases of very young low mass stars. Our long-term observations from Sep 2008 to Sep 2009 show that V1647 Ori has not yet faded back to the pre-outburst phase.

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(McNeil’s nebula)

1. Observations and Results

Optical and near-infrared (NIR) imaging and optical spectroscopic observations were carried out from 2007 Oct to 2009 Sep with the 2-m Himalayan Chandra Telescope (HCT), and from 2008 Nov to 2009 Feb with the 2-m IUCAA Girawali Observatory telescope.

The light curve of V1647 Ori in *R*-band is shown in Fig. 1 (*left*). In our

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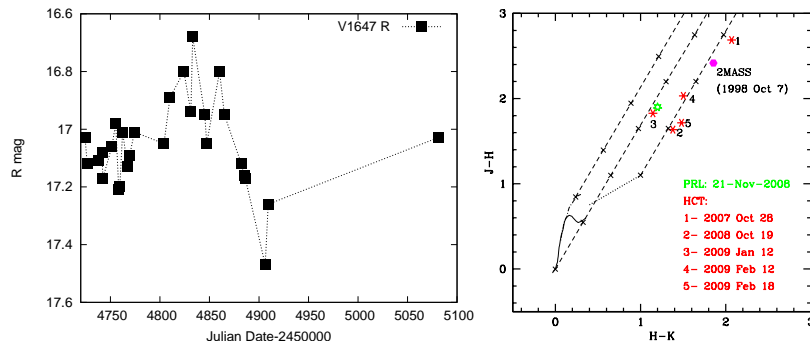


Figure 1. (*left*) The light curve (2008 Sep - 2009 Sep) of V1647 Ori in R -band. (*right*) $J - H/H - K$ CC diagram showing the location of V1647 Ori as observed with 2MASS (filled circle) and HCT & PRL (asterisks).

recent observations, we found that the brightness of V1647 Ori had decreased by 0.5 mag in R -band during the period from 2008 Sep to 2009 Sep (see Fig. 1). This possibly indicates that the object has again started accreting matter. A comparison of the JHK magnitudes of V1647 Ori shows that the source has varied over the time of observations between pre-outburst (Oct 2007) and post-outburst (Sep 2009). We find that the object has become brighter by ~ 2 mag in JHK -bands. We also noticed changes in the infrared colors from before (2007) to after the eruption (2008) in the $J - H/H - K$ color-color (CC) diagram (see Fig. 1; *right*). The star has moved precisely along a reddening vector due to the intrinsic brightening of the star over one and half year. The infrared colors suggest that circumstellar matter of $A_v \sim 8$ mag has probably been cleaned due to the recent outburst.

2. Conclusions

Due to unexpected second outburst of V1647 Ori (in 2008) in a short time scale after the first quiescent phase (2006), it is possible that we are witnessing a new kind of low mass young variable rather than FU Or or EX Or. A photometric comparison of McNeil's nebula between 2004 (first outburst) and 2008 (second outburst) suggests that the 2008 outburst may be more due to surface accretion of matter than an internal re-arrangement effect. Regular monitoring of V1647 Ori is under way in optical and NIR wavelengths to characterize the nature of the source.

References

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