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## V1178 Sco: A NOVA WITH EARLY STAGE OSCILLATIONS

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V1178 Sco was originally discovered by K. Haseda as a possible nova (Haseda 2001). Yamaoka (2001) examined the DSS, and noted that the object brightened by more than 8 magnitude. One of the authors (M.F.) further obtained a spectrum (resolution 1 nm) on June 24 with a 28-cm telescope, and detected a very strong H $\alpha$  (FWHM about 1300 km s<sup>-1</sup>) emission line and a weaker H $\beta$  line (Figure 1, upper panel). These observations confirmed that V1178 Sco is indeed a classical nova. A higher quality spectrum was obtained on July 2.57 UT, which shows the weak presence of P Cyg-type profile both in H $\alpha$  and H $\beta$  lines (Figure 1, lower panel). The Fe II emission series are characteristic to the early stage of a Fe II-class nova.

Since the discovery alert, V1178 Sco has been intensively followed by a number of observers of the VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/). The resultant light curve, together with prediscovery observations by K. Haseda, K. Takamizawa and K. Kanatsu, showed a rapid decline by  $0^m$ 7 between 2001 May 13 and May 16. The object rose again by  $0^m$ 7 on May 25 within five days. The object further showed a rapid decline by  $\sim 0^m$ 8 between June 23 and 24. Such rapid, large-amplitude fluctuations are rare among known classical novae, although similar oscillations during the nova "transition" stage are more frequently met (Bode and Evans 1989).

Among recent novae, V4361 Sgr = Nova Sgr 1996, showed a similar feature. Figure 2 shows the comparison of light curves between V1178 Sco and V4361 Sgr. The horizontal scale is 1.5 times different between these two objects, possibly suggesting that V1178 Sco may be evolving more rapidly. However, the exact scaling is uncertain because of the lack of early observations in V4361 Sgr. The lack of information of line widths of V4361 Sgr in the literature makes it difficult to make a comparison between the time-scales of evolution and expansion velocities. The amplitude of oscillations looks larger in V1178 Sco than in V4361 Sgr. Whether such a difference is a result of a different speed of evolution needs to be examined by future observations and theoretical modeling. The mean decline rate of V1178 Sco was  $0.03 \text{ mag d}^{-1}$ , which suggests a nova of a moderate speed class. The strongest period of the nova oscillations is 21 d.

On the occasion of V4361 Sgr, the early stage light variation was not unfortunately recorded because of a substantial delay in spectroscopic confirmation and the announcement in IAUC, in spite of the early detection by Sakurai (Sakurai, private communication).



Figure 1. The spectra of V1178 Sco on June 24 and July 3. The spectra were taken with a 28-cm telescope at Fujii-Bisei Observatory. The unit in flux is  $erg s^{-1} cm^{-2} Å^{-1}$ , calibrated using a standard star HR 7950



Figure 2. Comparison of light curves between V1178 Sco and V4361 Sgr. Visual, selected CCD observations (ones close to the V system), prediscovery photographic observations (either on photographic V system or on a system close to photovisual) are plotted. Photographic upper limits are marked with ' $\lor$ ' symbols. The both light curves are drawn from reports to VSNET

V1178 Sco was fortunately covered by observations, and the present early announcement will provide an unprecedented opportunity to study such early stage oscillations of a nova in detail. Since V1178 Sco apparently belongs a rare class of classical novae with remarkable early phase oscillations, further observations are strongly encouraged.

The authors are grateful to VSNET members for providing vital observations of both novae.

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