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Observations of the type IIp supernova 2001X during the plateau phase

G.C. Anupama[1], D.K. Sahu[2]
[1] *Indian Institute of Astrophysics, Bangalore 560034*
[2] *Centre for Research in Science & Technology, Indian Institute of Astrophysics, Hoskote*

1. Introduction

The supernova SN2001X was discovered by the Beijing Astronomical Observatory Supernova Survey team (Li 2001) on 2001 Feb 27.8 UT located 15.5 arcsec west and 32.4 arcsec south of the nucleus of the barred LINER NGC 5921, with a discovery magnitude of 17.0. The confirmatory image obtained on Mar 2.5 showed the object at a magnitude of 15.2. Early spectra of the supernova obtained on March 3.5 showed a very blue continuum with strong hydrogen Balmer lines, indicating the supernova was of type II (Chornock et al. 2001). He I 5876 Å was also found in the spectrum. A later date spectrum obtained on Mar 22 (Gal-Yam & Shemmer 2001) showed strong Balmer lines, with a pronounced P-Cyg profile, similar to the spectra of type IIp supernovae, several weeks past maximum light.

We present in this poster preliminary results based on VRI photometry from the Indian Astronomical Observatory (IAO) and optical spectra obtained from the Vainu Bappu Observatory (VBO).

2. Photometry

Broad band CCD photometric observations of the supernova were made using the 2-m telescope at IAO during 6 March – 18 May. The VRI magnitudes were obtained by performing differential photometry with respect to the standard star C (Skiff 2001) which has the following magnitudes and colours: $V = 12.92$; $B - V = 0.58$; $V - R = 0.31$ and $V - I = 0.55$. Figure 1 shows the estimated VRI magnitudes for SN2001X. From the figure, it is seen that the IAO observations were made during the plateau phase.

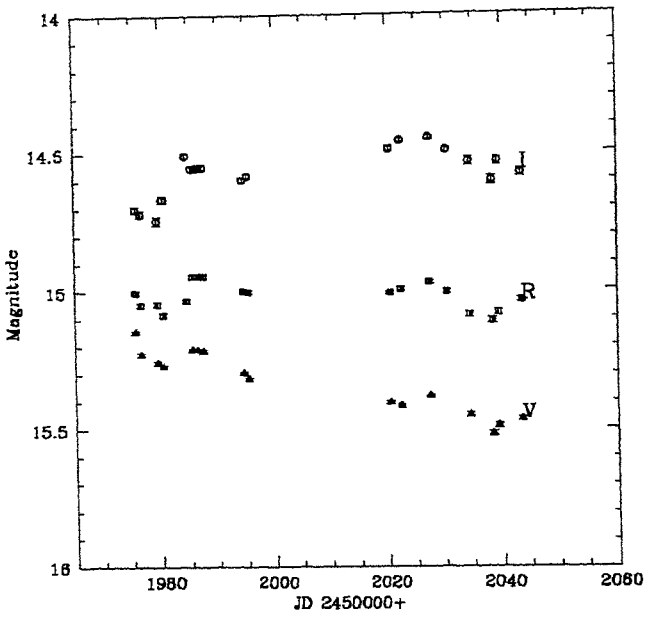

Figure 1. *VRI* light curve of SN2001X based on photometry from IAO.

3. Spectroscopy

CCD spectra were obtained using the OMR spectrograph on the 2.3m VBT at VBO on 2001 March 14.95, March 18.87, March 19.79 and April 30.72. Figure 2 shows the temporal development of the spectrum. The spectra of March 19 and April 30 were calibrated to absolute fluxes using photometric magnitudes for these nights.

The spectrum of March 14.95 shows Hα line with a broad P Cygni profile. Hβ is seen at the blue edge of the spectrum. No other lines are detected in the spectrum. The Hα absorption has a velocity of -9550 km/s, with the fastest material blueshifted to 18 000 km/s.

The spectrum of March 18–19 shows the hydrogen Balmer lines. The spectrum has developed lines due to Fe II at 5018 Å, 5169 Å; lines due to N II at 4623 Å, 5537 Å, 5679 Å; Ca II H & K and the IR triplet. Ba II lines (blended with Fe II) and He I 5876 Å are also weakly present. Na I D absorption has begun to develop. The Hα absorption has a velocity of -9230 km/s, with the fastest material blueshifted to 17 700 km/s. The absorption velocities of the other lines are: Hγ = -9190 km/s; Hβ = -8147 km/s; Ca

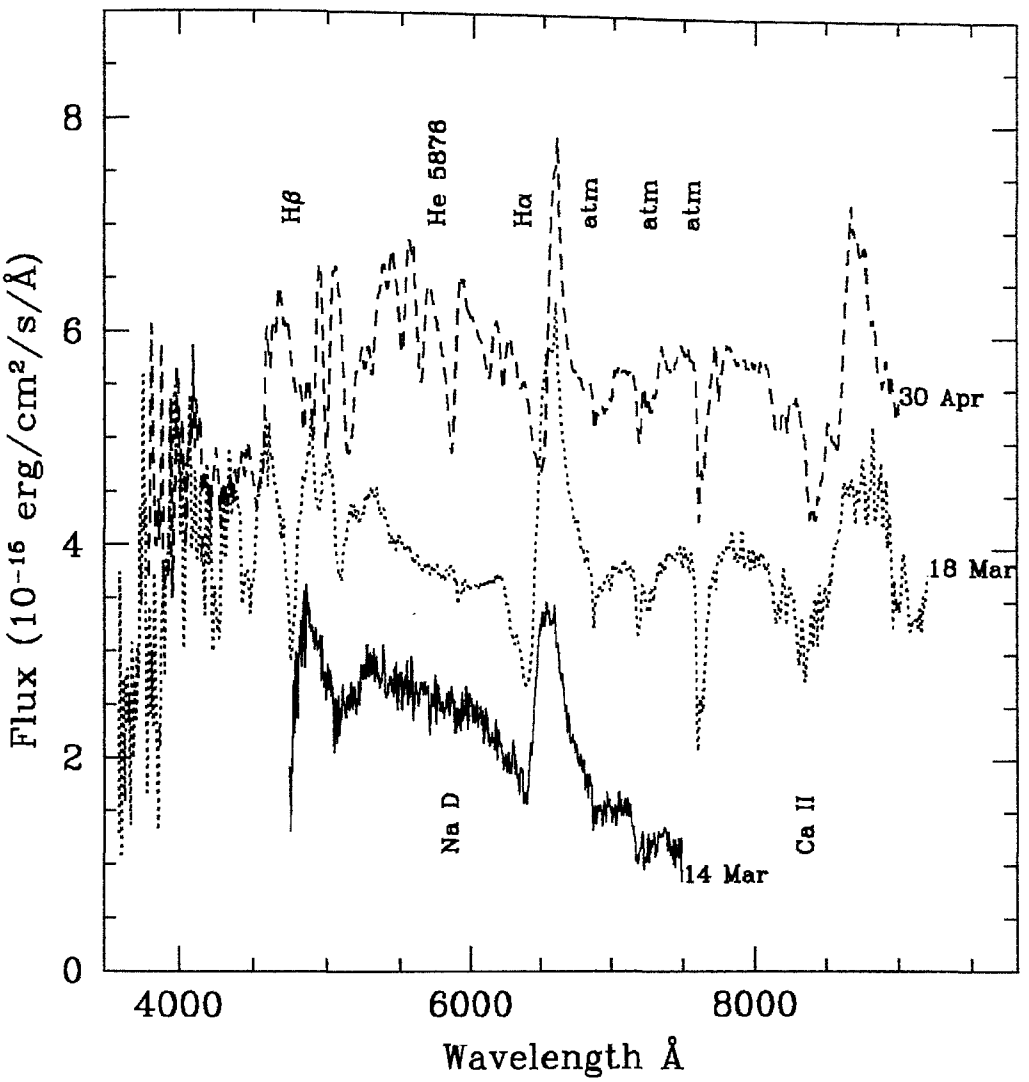

Figure 2. Temporal development of the spectrum of SN2001X based on VBO data. The spectrum of 18 March is offset by +1 and that of 30 April is offset by +3.0 in flux units.

II $= -8830$ km/s. The photospheric temperature obtained from the best fit blackbody spectrum to the continuum is $T_{\rm ph} = 5825 \pm 400$ °K.

In the spectrum of April 30, the lines have narrowed as compared to the March

spectra. Fe II lines have increased in strength, while Hβ and other lower wavelength Balmer lines have weakened considerably. The He I line has disappeared and the Na I absorption has strengthened. The Ca II IR triplet has also strengthened. O I 7775 Å line has begun to develop. The Hα absorption velocity has decreased to -9230 km/s, with the fastest material blueshifted to 10 330 km/s. The absorption velocities of the other lines are: Na I D $= -3510$ km/s; Ca II $= -4800$ km/s. The photospheric temperature obtained from the best fit blackbody spectrum to the continuum is $T_{\rm ph} = 4550 \pm 200\,^{\circ}$K.

4. Summary

The photometric and spectroscopic observations present here indicate the supernova to be of type II-P and also the observations were made during the plateau phase. The photospheric temperatures obtained based on spectra are very similar to those obtained for the type II-P supernova SN1999em at similar phases (Hamuy et al. 2001).

References

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