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SN 2002ap, the Hypernova of Class Ic

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Abstract. The supernova SN 2002ap was discovered in the outer regions of the nearby spiral M74 on January 29.4 UT. Early photometric and spectroscopic observations indicate the supernova belongs to the class of Ic hypernova. Late time (After JD 2452500) light curve decay slopes are similar to that of the hypernovae SN 1997ef and SN 1998bw. We present here the *BVRI* photometric light curves and colour evolutions of SN 2002ap to investigate the late time nature of the light curve.

Keywords: Photometry – Hypernovae – Light-curve

1. Introduction

Hypernovae of class Ic are characterized by smooth and featureless spectrum at early epochs, with no lines due to hydrogen and helium in their spectra. These objects have the usual lines of SN Ic but with extreme Doppler broadening caused by unusually high expansion velocities. The maximum brightness of SN 2002ap was $M_v = -17.2$ mag comparable to that of SN 1997ef but fainter than SN 1998bw (Patat et al. 2001, Pandey et al. 2003). Spectroscopically also, SN 2002ap was found to be closer to SN 1997ef than to SN 1998bw (Mazzali et al. 2002). The late time light curve of SN 2002ap indicates a decay rate of ~0.016 mag day^{-1}, around ~300 days after the explosion. During a similar time interval SN 1998bw also decayed at the same rate.

2. Late Time *BVRI* Light Curve of SN 2002ap

BVRI photometric observations were carried out from 104–cm NainiTal and 2–m Himalayan Chadra Telescope (HCT), Hanle using CCD cameras. Fig. 1 shows the *BVRI* light curve of SN 2002ap including late time observations. The span of our present observations are from ~

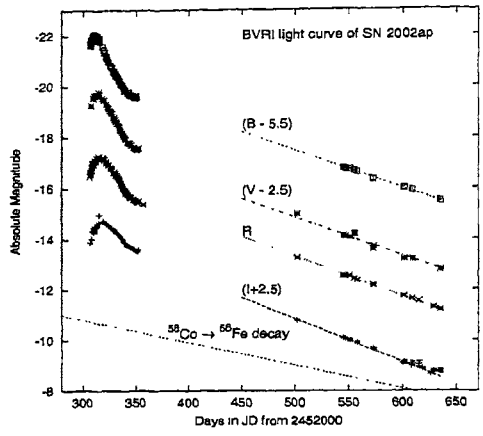

Figure 1. *BVRI* Photometric Light curves of SN 2002ap Hypernova.

2452500 JD to ~ 2452640 JD, similar to that in SN 1998bw (Galama et al. 1998, Patat et al. 2001). The values of late time decay slopes are 0.0173±0.0005, 0.0158±0.0002, 0.0151±0.0005 and 0.0147±0.0002 mag/day for I, R, V and B bands respectively for the phase range of 200 – 330 days from B maxima. These values match with the corresponding slopes of SN 1998bw for the phase range 40 – 330 days from B maxima (Patat et al. 2001). If we consider the phase range 40 – 330 days from B maxima to determine the slope values, they are steeper than the slope values of SN 1998bw for the same phase range (Patat et al. 2001, Pandey et al. 2003).

3. Conclusions

BVRI photometric results are presented to investigate the light curve of SN 2002ap. The determined late time decay slope values for B, V, R and I passbands for the phase range 200 – 340 days from B maxima for SN 2002ap, indicate that the values are almost the same in all filters but slightly flatter than that mentioned in Pandey et al. (2003) due to longer coverage. This behaviour is similar to that observed in SN 1998bw during the same evolutionary phase (Patat et al. 2001). The (B - V), (V - R) and (R - I) colour evolutions show no considerable changes in the values during the late time, indicating a slow evolution of the late time spectrum. In the light of above, we conclude that SN 2002ap has not yet reached the evolutionary stage powered by ^{56}Co →^{56}Fe decay ie. 0.009 mag/day.

References

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