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UBVRI PHOTOMETRY OF SN 2002ap IN M74

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The Supernova SN 2002ap in M74 was discovered by Y. Hirose (reported by Nakano et al., 2002) on Jan. 29, 2002. Low resolution spectra by Kinugasa et al. (2002), Meikle et al. (2002), and Filippenko and Chornock (2002) showed that overall spectral features resemble that of the Ic SN – type, called also “hypernovae” (see Filippenko, 1997). Detailed studies revealed that progenitor mass of SN 2002ap, as well as explosion energy and ejected mass are smaller than the respective values for a typical “hypernovae” (Mazzali et al., 2002). The radial velocity of SN 2002ap matches well the red - shift of M74 (Smartt and Meikle, 2002), which confirms the association of SN 2002ap with the M74 host galaxy.

In this note we report *UBVRI* photometry of SN 2002ap, obtained at Rozhen National Astronomical Observatory, Bulgaria, and using all our 3 optical telescopes: 2-m Ritchey – Chretien telescope with Photometrics CCD camera (1024×1024), 60-cm Cassegrain with photon counting, UBv photometer, and the 50/70-cm Schmidt telescope with SBIG ST8 CCD. The observations were carried out during February and March, 2002. Standard reduction procedure was applied to the differential photometry of SN 2002ap with respect to the comparison star No 1 = GSC 1205 789 (see Gal-Yam et al., 2002), where the *UBVRI* mags are from Henden (2002). We estimate that our errors are not larger than 0.06 mag.

The Rozhen observations are listed in Table 1.

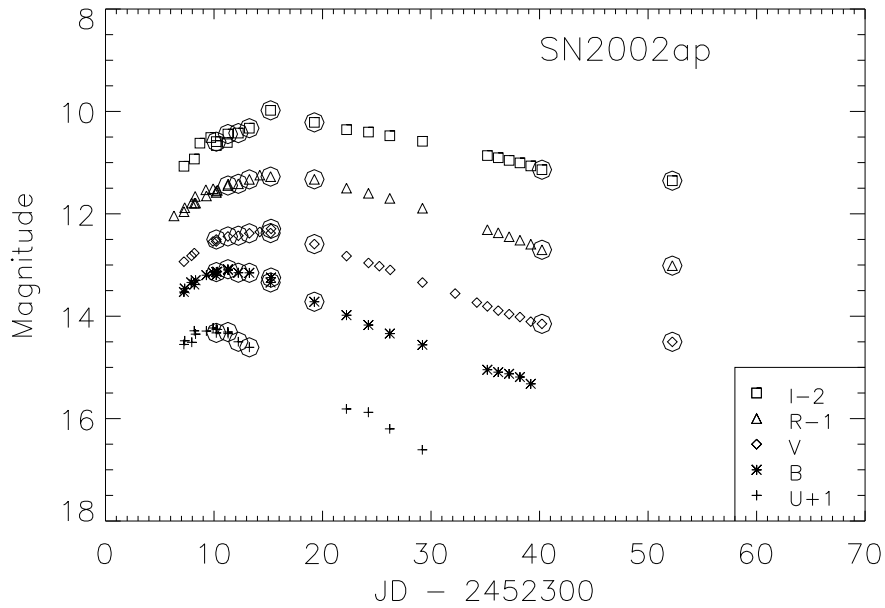
For the light curves, we added other observations, as follows : 7U, 12B, 326V, 13R, 15I - data by Gal-Yam et al. (2002); 2I data by Mattila and Meikle (2002); 3R data by Hornoch (2002); 2U, 2B, 2V and 2R data by Yoshii et al. (2002); 5U, 5B, 5R data by Riffeser et al. (2002). We find good agreement of all data sets and the combined light curves of SN 2002ap are shown on Figure 1. From Figure 1, we estimate that maximum brightness in V occurred on Feb 8.7 UT. However, there is a shift of the maximum light in the different passbands, with a progressive delay of maximum at longer wavelengths. This has also been noticed by Gal-Yam et al. (2002). In Table 2, we show for respective passbands the JD and the magnitude at maximum, as well as the slopes of the light curves after maximum. Figure 2 shows the color curves. In Figure 2, reddening in all colours is apparent, which is caused by the delay of maximum and by the different slopes after the maximum in the different passbands. The total light amplitude of SN 2002ap remains unknown, as pre-discovery images (Vreeswijk and Smartt, 2002) show no visible star at that position to the limiting magnitude. For the maximum light, with $V = 12^m38$, $E(B - V) = 0^m09$ (Takada - Hidai et al., 2002, see in Mazzali et al., 2002), standard reddening law and distance to M74 of 8 Mpc (Sharina et al., 1996), we get for the SN 2002ap : $M_v = -17.4$.

Table 1: UBVRI Photometry of SN 2002ap from Rozhen NAO.

JD	<i>U</i>	<i>B</i>	<i>V</i>	<i>R</i>	<i>I</i>	Telescope
2452310.213	13.326	13.138	12.501	12.582	12.590	2-m RCC
2452311.280	13.309	13.082	12.442	12.447	12.442	2-m RCC
2452312.242	13.499	13.150	12.427	12.413	12.423	2-m RCC
2452313.256	13.608	13.152	12.380	12.327	12.327	2-m RCC
2452315.259	—	13.245	12.292	—	—	60-cm
2452315.214	—	13.341	12.376	12.273	11.979	Schmidt
2452319.249	—	13.717	12.591	12.326	12.214	Schmidt
2452340.221	—	—	14.149	13.702	13.138	2-m RCC
2452352.235	—	—	14.500	14.012	13.353	Schmidt

Table 2: SN 2002ap : JD, magnitudes at maximum and slopes after maximum.

	<i>U</i>	<i>B</i>	<i>V</i>	<i>R</i>	<i>I</i>
JD-2452000	309.2	310.8	314.2	314.9	317.5
Magnitude	13.23	13.19	12.38	12.24	12.18
Slope [mag/day]	0.12	0.08	0.07	0.06	0.04

**Figure 1.** *UBVRI* light curves of SN 2002ap. Encircled symbols are observations from NAO Rozhen.Light curves in *U*, *R* and *I* are shifted in ordinate for better presentation.

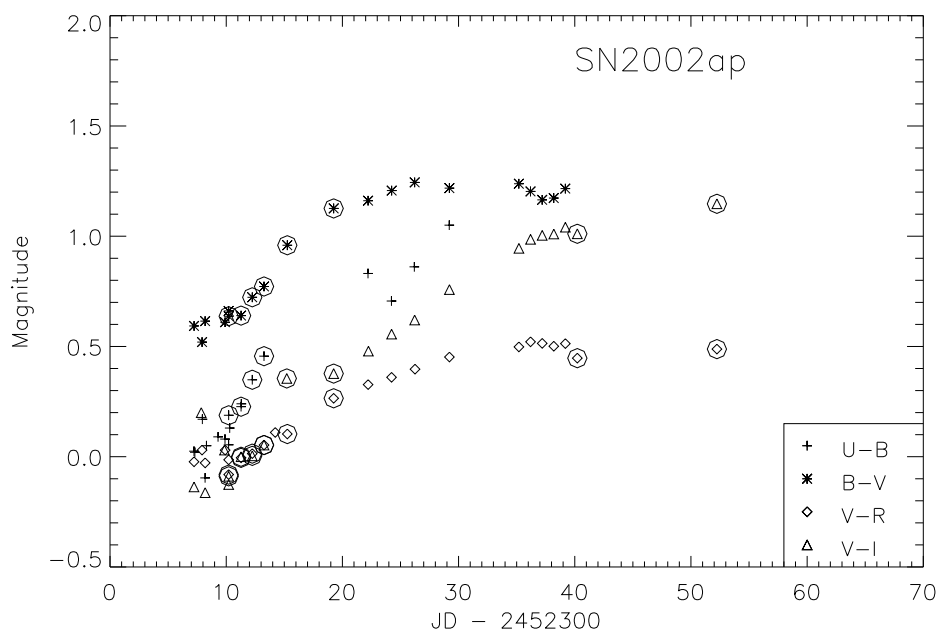


Figure 2. Colour curves of SN 2002ap. Encircled symbols are observations from NAO Rozhen.

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