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OBSERVATIONS OF THE DWARF NOVA X LEONIS

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Dwarf Novae (DN) are a type of cataclysmic variable stars that undergo recurrent outbursts during which they increase in brightness by 2-8 magnitudes. X Leo is a dwarf nova that varies from 12.4 V to 16.5 V (Downes et al., 2001), and the recurrence time of two consecutive outbursts is approximately between 8 and 38 days (Ritter & Kolb, 1998). Brun and Petit (1952) considered X Leonis the prototype of a sub-group of DN characterized by asymmetrical maximum of outbursts, frequently of brief duration. The star was studied spectroscopically by Shafter & Harkness (1986), they found an orbital period of 0.1644 days. Multi-bands photometric observations were reported by Echevarria (1984), Sherrington & Jameson (1983), and Szkody (1987). Near-infrared intra-night observations indicate possible ellipsoidal variations (Szkody & Mateo, 1986), not confirmed in the optical (Howell & Szkody, 1988). The secondary star is classified as an M2 V (Ritter & Kolb, 1998).

We observed the variable from February 22 to June 04, 2003, for a total of 36 observational nights. Observations were done with the 0.33 m and 0.24 m telescopes at the Porziano Astronomical Observatory, and with the 0.40 m Automatic Imaging Telescope at the Perugia University Observatory. The instruments used and the photometric techniques have already been described in Spogli et al. (1998, 2003). The telescopes are endowed with standard BVR_cI_c broad-band filters. Inter-comparison among results obtained with the different instruments shows no relevant systematic difference within the typical standard deviation. The data reported in Table 1 are obtained in differential photometry using the calibration stars reported by Misselt (1996). Moreover, we calibrated these comparison stars with the I_c filter by observing, on two photometric nights, several standard stars (Landolt, 1992) having $(B - V)$ from -0.2 to 1.4 , over a wide range of airmass. We followed the light curve in the R_c band, and obtained the color indices during the outburst phase.

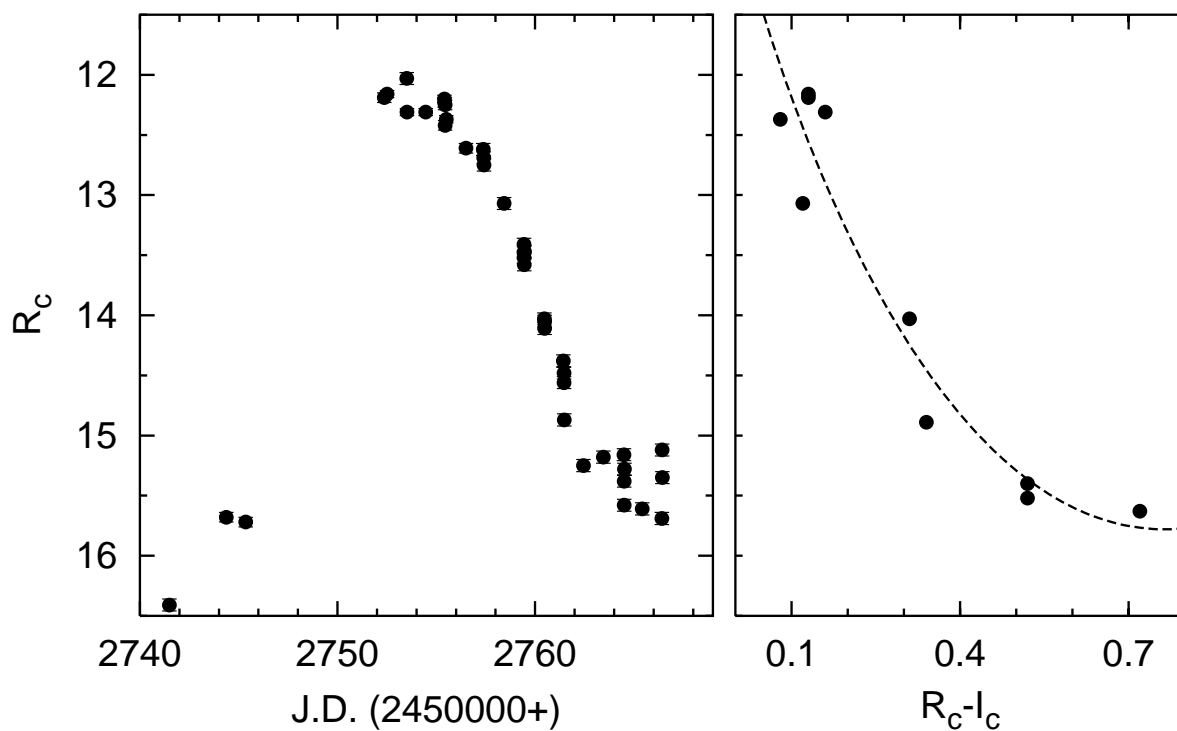
Figs. 1 and 2 show the R_c light curve. Intra-night observations indicate the presence of variations in the order of few tenths of magnitude. Analyzing the spectral energy distribution in the optical region, obtained using the same procedure described in Spogli et al. (1998), we have verified the strong contribution of the late-type secondary star to the overall emission. The $(V - I_c)$ color index follows the outburst ranging from $\simeq 1.1$ at minimum to $\simeq 0.2$ during the maximum. The same trend is evident for the $(R_c - I_c)$ color index (Fig. 1).

Table 1: BVR_cI_c magnitudes of X Leonis

Date UT	JD (2450000+)	B	V	R_c	I_c
03/02/22	2693.493			15.36±0.04	
03/03/07	2706.441			15.11±0.05	
03/03/08	2707.456			15.10±0.03	
03/03/12	2711.439			16.26±0.05	
03/03/14	2713.433			15.77±0.04	
03/03/28	2727.328	15.5±0.1	15.13±0.04	14.89±0.05	14.55±0.05
03/03/28	2727.452			15.13±0.04	
03/04/05	2734.530			15.55±0.03	
03/04/05	2735.399			15.72±0.02	
03/04/08	2738.298		15.98±0.08	15.40±0.04	14.88±0.04
03/04/11	2741.495			16.31±0.05	
03/04/14	2744.367		16.02±0.05	15.63±0.05	14.91±0.05
03/04/15	2745.358		15.88±0.08	15.52±0.04	15.00±0.04
03/04/22	2752.371		12.28±0.04	12.19±0.04	12.07±0.04
03/04/23	2752.504	12.56±0.05	12.40±0.03	12.16±0.03	12.03±0.04
03/04/24	2753.505			12.03±0.05	
03/04/24	2753.518			12.31±0.03	
03/04/24	2754.459	12.51±0.05	12.42±0.03	12.31±0.03	12.15±0.04
03/04/25	2755.416			12.20±0.03	
03/04/25	2755.425			12.23±0.04	
03/04/25	2755.443			12.25±0.04	
03/04/25	2755.453			12.42±0.04	
03/04/26	2755.505	12.80±0.05	12.55±0.05	12.37±0.03	12.29±0.04
03/04/27	2756.505			12.61±0.04	
03/04/27	2757.382			12.62±0.05	
03/04/27	2757.403			12.69±0.05	
03/04/27	2757.414			12.75±0.05	
03/04/28	2758.436	13.46±0.05	13.25±0.05	13.07±0.05	12.95±0.04
03/04/29	2759.436			13.52±0.05	
03/04/29	2759.443			13.41±0.05	
03/04/29	2759.445			13.48±0.05	
03/04/29	2759.451			13.58±0.05	
03/04/29	2759.467			13.47±0.05	
03/04/30	2760.474	14.6±0.1	14.33±0.04	14.03±0.05	13.72±0.04
03/04/30	2760.477			14.05±0.05	
03/04/30	2760.482			14.11±0.05	
03/05/01	2761.436			14.38±0.05	
03/05/01	2761.465			14.48±0.05	
03/05/01	2761.470			14.56±0.05	
03/05/01	2761.481			14.87±0.05	
03/05/02	2762.452			15.25±0.05	
03/05/03	2763.454			15.18±0.05	
03/05/04	2764.499			15.16±0.05	
03/05/05	2764.506			15.38±0.05	
03/05/05	2764.512			15.58±0.05	
03/05/05	2764.522			15.28±0.05	

Table 1: BVR_cI_c magnitudes of X Leonis (continued)

Date UT	JD (2450000+)	B	V	R_c	I_c
03/05/05	2765.428			15.61 ± 0.05	
03/05/06	2766.427			15.12 ± 0.05	
03/05/06	2766.445			15.35 ± 0.05	
03/05/13	2773.415			12.74 ± 0.05	
03/05/15	2775.431			13.32 ± 0.05	
03/05/15	2775.442			13.24 ± 0.05	
03/05/15	2775.449			13.39 ± 0.05	
03/05/15	2775.457			13.29 ± 0.05	
03/05/16	2776.467			13.52 ± 0.05	
03/05/19	2779.438			15.14 ± 0.05	
03/05/22	2782.433			15.12 ± 0.05	
03/05/23	2783.457			15.35 ± 0.05	
03/05/28	2788.438			15.11 ± 0.04	
03/05/28	2788.447			15.42 ± 0.04	
03/05/31	2791.459			15.45 ± 0.04	
03/06/04	2795.445			12.99 ± 0.06	

**Figure 1.** R_c light curve of X Leonis in April-May, 2003 (left panel). The $R_c - I_c$ color index ranges from $\simeq 0.1$ to $\simeq 0.7$ mag (right panel).

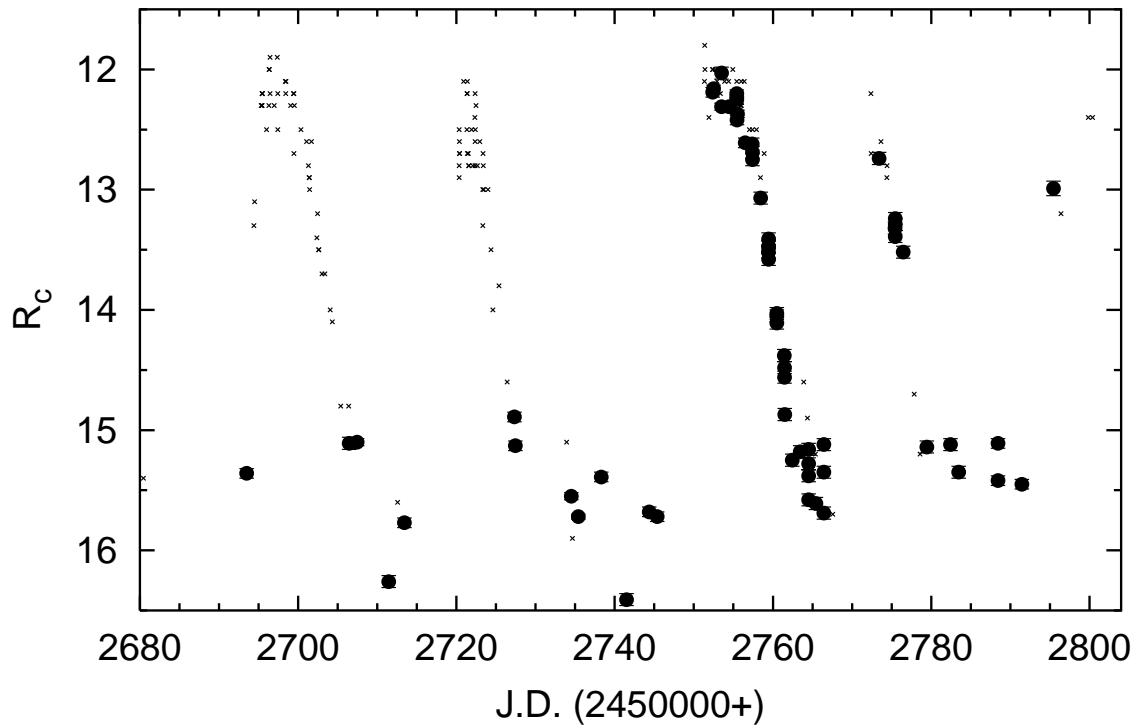


Figure 2. Overall R_c light curve of X Leonis. The small crosses represent visual estimates available in the VSNET web site <http://vsnet.kusastro.kyoto-u.ac.jp/vsnet/>.

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