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BVRI PHOTOMETRY OF DX And: THE AUTUMN 2005 OUTBURST

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DX And is a well-known dwarf nova with a long outburst recurrence time (270–330 days, Šimon 2000) and a long orbital period ($P = 10.6$ hours, Bruch et al. 1997). Only few known cataclysmic variables have similar characteristics, and for this reason it has been extensively studied by many astronomers. Spectroscopic observation were made by Bruch (1989) who reports that DX And exhibits a considerable contribution of the secondary star to the continuum energy distribution as well as the line spectrum. During the years 1981–1999, the brightest outbursts reach up to about 11.5 $\mathrm{mag_{vis}}$ from a typical quiescent level of 14–14.7 $\mathrm{mag_{vis}}$ (Šimon 2000). Ritter and Kolb (1998) report a wider range: DX And varies from $V = 16.5$ at minimum to $V = 10.9$ at the maximum of brightness.

In this brief paper we present the results of our observations made in the years 2003 and 2005 at the Porziano Astronomical Observatory, Monte Subasio Astronomical Association. We used the 0.30-m Schmidt–Cassegrain f/6.5 telescope, equipped with an AP-32ME CCD camera (Kodak 3200-ME, 2184×1470 pixels) and Johnson–Cousins BVR_cI_c photometric filters. The exposure time was 60–300 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat-fielding, and then processed by a PC-based aperture photometry package developed by one of the authors. The magnitudes were determined relative to the calibration stars reported by Spogli et al. (1998). Calibrations done with standard Landolt stars show negligible color effects in the V, R_c and I_c bands, while B data have been corrected and the reported standard deviations take into account this effect. Heliocentric corrections to observed times were applied before the following analysis.

During the year 2003, DX And was observed for a total of 40 photometric nights only with the R_c filter and it was always in quiescence (Table 1). The variable oscillates between $R_c \simeq 14.4$ and $R_c \simeq 15.0$, with an average of $R_c \simeq 14.63$. In quiescence and at these wavelengths the system is dominated by the late-type secondary and its ellipsoidal variations: this is a familiar pattern for long-period cataclysmic binaries. Hilditch (1995) studied R and I variations of DX And during five consecutive nights, ten orbital cycles, and he found an ellipsoidal variation of amplitude 0.13 mag, superimposed to additional variability. We have already analyzed intra-night data to verify the ellipsoidal variation (Spogli, Fiorucci & Tosti 1998), so we collected data with a longer time-scale with the aim to obtain information about the additional variability. However, periodograms and other statistical tools are not able to find evidence of strict periodicity with the data reported

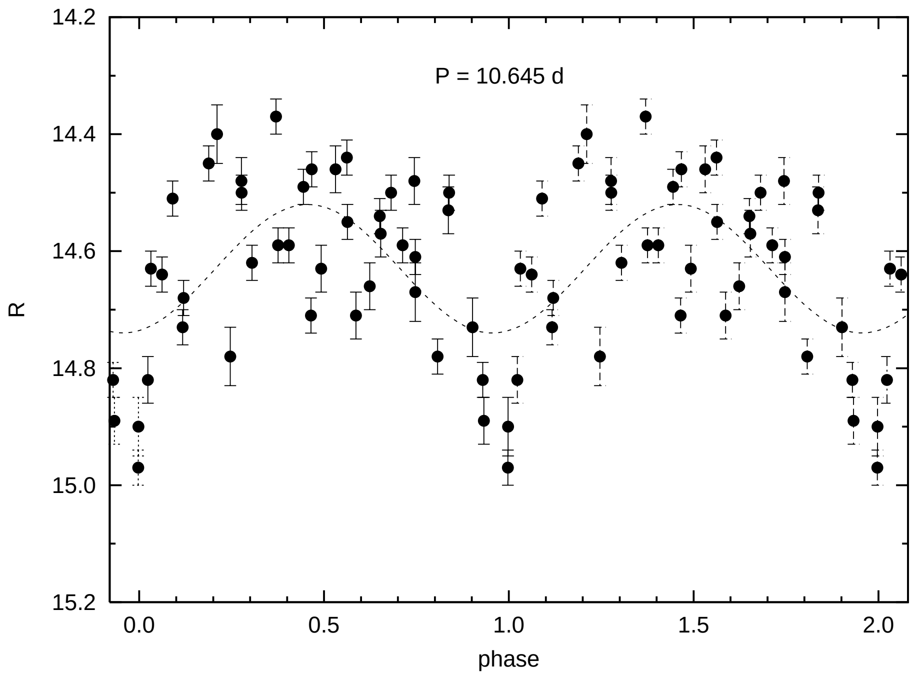

Figure 1. Phase-diagram of DX And in quiescence considering an hypothetical period of 10.645 days. Dotted line is the sinusoidal best fit. This variation is superimposed to an ellipsoidal variation well defined by Hilditch (1995).

Table 1

UT Date	HJD (2452000+)	R_c	UT Date	HJD (2452000+)	R_c
18/07/2003	839.387	14.67 ± 0.05	11/08/2003	863.346	14.90 ± 0.05
19/07/2003	840.339	14.53 ± 0.04	12/08/2003	864.391	14.70 ± 0.10
20/07/2003	841.329	14.82 ± 0.03	13/08/2003	865.373	14.45 ± 0.03
21/07/2003	842.326	14.82 ± 0.04	14/08/2003	866.320	14.50 ± 0.03
22/07/2003	843.329	14.73 ± 0.03	15/08/2003	867.311	14.37 ± 0.03
23/07/2003	844.322	14.40 ± 0.05	16/08/2003	868.316	14.74 ± 0.03
24/07/2003	845.326	14.62 ± 0.03	17/08/2003	869.366	14.55 ± 0.03
25/07/2003	846.388	14.59 ± 0.03	18/08/2003	870.299	14.54 ± 0.03
26/07/2003	847.322	14.63 ± 0.04	19/08/2003	871.293	14.48 ± 0.04
27/07/2003	848.323	14.71 ± 0.04	20/08/2003	872.294	14.47 ± 0.03
28/07/2003	849.333	14.50 ± 0.03	21/08/2003	873.297	14.89 ± 0.04
01/08/2003	853.381	14.64 ± 0.03	22/08/2003	874.349	14.63 ± 0.03
03/08/2003	855.349	14.78 ± 0.05	23/08/2003	875.293	14.68 ± 0.03
05/08/2003	857.453	14.49 ± 0.03	13/09/2003	896.265	14.51 ± 0.03
06/08/2003	858.381	14.46 ± 0.04	15/09/2003	898.248	14.48 ± 0.04
07/08/2003	859.361	14.66 ± 0.04	16/09/2003	899.301	14.59 ± 0.03
08/08/2003	860.312	14.59 ± 0.03	17/09/2003	900.274	14.46 ± 0.03
09/08/2003	861.319	14.78 ± 0.03	18/09/2003	901.295	14.44 ± 0.03
10/08/2003	862.323	14.73 ± 0.05	19/09/2003	902.261	14.57 ± 0.05
11/08/2003	863.342	14.97 ± 0.03	20/09/2003	903.258	14.61 ± 0.03

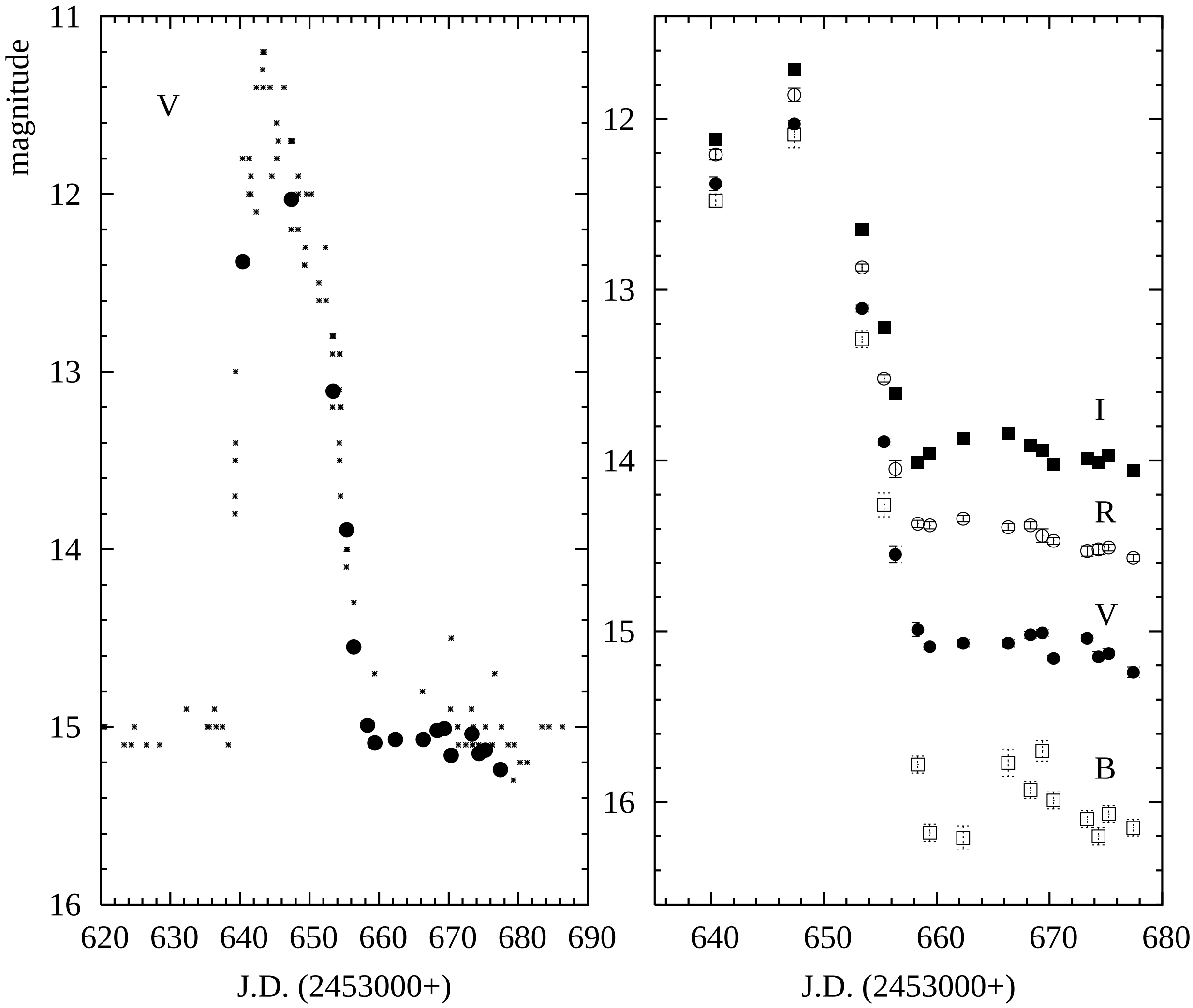

Figure 2. *V* light curve of DX And during Autumn 2005 (left panel), filled circles represent our data, while small crosses are visual estimates available from AFOEV (cdsweb.u-strasbg.fr/afoev/). The right panel shows our BVRI data only: it is evident the different color indices from the outburst to the minimum, and the internal variability during quiescence.

Table 2

UT Date	HJD (2453000+)	B	V	R_c	I_c
26/09/2005	640.414	12.48 ± 0.04	12.38 ± 0.04	12.21 ± 0.03	12.12 ± 0.02
03/10/2005	647.386	12.09 ± 0.08	12.03 ± 0.02	11.86 ± 0.04	11.71 ± 0.02
09/10/2005	653.393	13.29 ± 0.05	13.11 ± 0.02	12.87 ± 0.02	12.65 ± 0.02
11/10/2005	655.341	14.26 ± 0.07	13.89 ± 0.02	13.52 ± 0.02	13.22 ± 0.02
12/10/2005	656.342		14.55 ± 0.05	14.05 ± 0.05	13.61 ± 0.03
14/10/2005	658.324	15.78 ± 0.05	14.99 ± 0.04	14.37 ± 0.02	14.01 ± 0.02
15/10/2005	659.399	16.18 ± 0.05	15.09 ± 0.02	14.38 ± 0.02	13.96 ± 0.03
18/10/2005	662.351	16.21 ± 0.07	15.07 ± 0.02	14.34 ± 0.02	13.87 ± 0.02
22/10/2005	666.344	15.77 ± 0.08	15.07 ± 0.02	14.39 ± 0.02	13.84 ± 0.02
24/10/2005	668.325	15.93 ± 0.05	15.02 ± 0.02	14.38 ± 0.02	13.91 ± 0.02
25/10/2005	669.365	15.70 ± 0.06	15.01 ± 0.02	14.44 ± 0.04	13.94 ± 0.03
26/10/2005	670.364	15.99 ± 0.05	15.16 ± 0.02	14.47 ± 0.02	14.02 ± 0.02
29/10/2005	673.333	16.10 ± 0.05	15.04 ± 0.02	14.53 ± 0.03	13.99 ± 0.02
30/10/2005	674.349	16.20 ± 0.05	15.15 ± 0.03	14.52 ± 0.03	14.01 ± 0.02
31/10/2005	675.263	16.07 ± 0.05	15.13 ± 0.03	14.51 ± 0.02	13.97 ± 0.03
02/11/2005	677.435	16.15 ± 0.05	15.24 ± 0.03	14.57 ± 0.02	14.06 ± 0.03
27/11/2005	702.361	16.11 ± 0.05	15.20 ± 0.02	14.56 ± 0.02	14.04 ± 0.02

in Table 1. The analysis is seriously biased by the data sampling (±1, ±2 c/d alias frequencies) that makes correct identification of the frequency components ambiguous. The most probable results are obtained for $P = 10.645$ days (65 %, Fig. 1), $P = 0.912$ day (58 %), $P = 0.47625$ day (55 %), and $P = 0.4482$ day (50 %). Probably the latter can be identified with the actual value of the orbital period, while the additional variability showed by DX And during quiescence is of an unknown origin.

In the year 2005, DX And was monitored from September 26 to November 11 with the BVR_cI_c photometric bands, for a total of 17 photometric nights (see Table 2). It was in outburst and we followed part of the rise and the decline (Fig. 2). The profile and the time-scales confirm the results obtained by Šimon (2000). Also the color indices are in substantial agreement with our previous BVR_cI_c observations (Spogli et al. 1998). However, these new data increase the historical database on this variable source and they can help to constrain theoretical models.

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