COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 3977

Konkoly Observatory
Budapest
19 January 1994

HU ISSN 0324 - 0676

PHOTOMETRY OF THE PROGENITOR OF NOVA CASSIOPEIAE 1993 ON ASIAGO SCHMIDT ARCHIVE PLATES

Nova Cassiopeiae 1993 was discovered by K. Kanatsu on Dec. 7, 1993 (*cf.* IAU Circ. 5902).

It has been well known since Kraft's (1964) paper that *classical* novae are short period binary systems (with an orbital period of a few days to a few hours). The current picture is that classical novae are semi-detached binaries in which a Roche lobe filling secondary (usually a main sequence K-M star) transfers mass to a WD companion. Pre- or post-outburst novae can then be classified among the *cataclysmic variables*, which are known to show a large variety of photometric activity, including outbursts with an amplitude of some magnitudes. So far, observations of pre-nova objects have been supplied only from general sky surveys or patrol programs. For the majority of the novae, the progenitor was fainter than plate limits. However, a modest body of data exists from which pre-nova light curves for a dozen or so objects can be reconstructed (*e.g.* Robinson 1975). Fast novae - like GK Per or V1500 Cyg - show that there was a significant rise in brightness for 1 to 5 years prior to the outburst (Warner 1989).

Nova Cas 1993 lies in a region of the Milky Way for which many plates exist in the archive of the 67/92 cm Schmidt telescope of the Asiago Astrophysical Observatory. We have gone through the archive and found 21 plates in the B,V and I bands deep enough to have the nova progenitor recorded. The plates are listed in Table 1. In order to facilitate the correct identification, we took some V band plates with the same Schmidt telescope on UT Dec. 12.85, 1993 and compared them with the archival ones. On the new plates the nova shines at $V=6.7\pm0.1$. Our identification of the progenitor is shown in Figure 1. The progenitor is a member of a very close double star (separation of the order of a very few arcsec and components of similar brightness) which on all plates but the one reproduced in Figure 1 appears as a merged pair. Skiff (1993, IAU Circ. 5904) measured the progenitor image on the POSS-I prints and concluded that the progenitor is a member of a very close double star appearing merged on the POSS-I prints (he estimated $\sim$2 arcsec separation). He indicated the northern component as the true progenitor.

With the Iris microphotometer of the Asiago Astrophysical Observatory we have measured the progenitor merged pair against a set of 16 nearby reference stars on the B and V plates listed in Table 1 (we choose such a large number of comparisons in order to reduce any influence by possible variability of any of them). We did not have a well calibrated and faint enough photometric comparison sequence around the progenitor. However, we had a known relation between image diameter and *relative* magnitudes derived from measurements made on some open cluster fields with the same equipment used for Nova Cas 1993. We applied this calibration to the 16 reference stars and set the zero point by adopting the values B=15.0 and V=14.0 for the star labelled *A* in Figure 1. When actual B,V magnitudes for this star are obtained, all the magnitudes in Table 1 can be scaled accordingly.

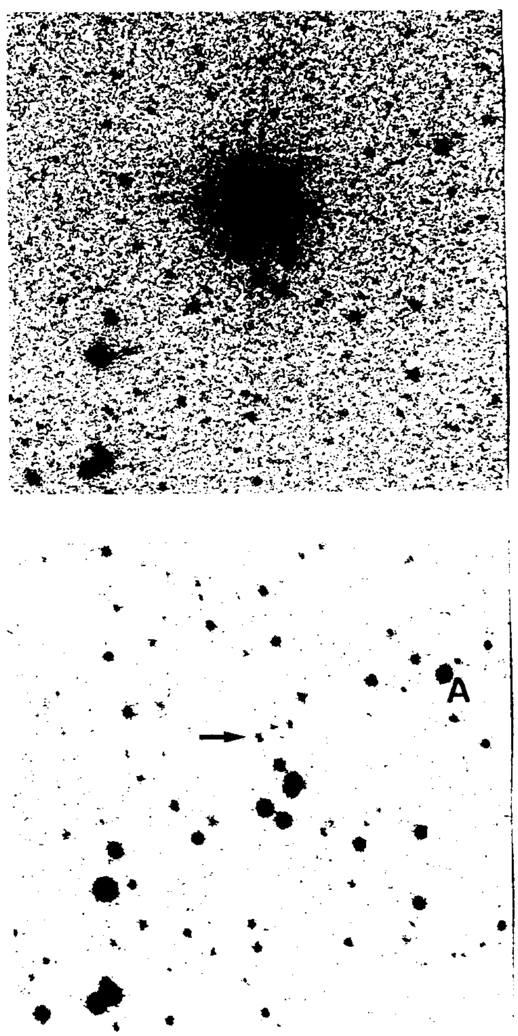

Figure 1. Comparison of the Nova Cas 1993 field as seen in V band on UT Dec. 11.85, 1993 (top panel) and on UT Oct. 11.93, 1985 with the 67/92 cm Schmidt telescope of the Asiago Astrophysical Observatory. The progenitor appears to be the northern component of a very close double star (arrowed). North is up and East is to the left. Each panel covers 6 arcmin on a side.

Table 1
List of Asiago Schmidt plates on which the progenitor of Nova Cas 1993 is recorded and that have been measured in search for brightness variations of the latter during the quiescence period. For the zero point of the magnitude scale in both B and V bands see the text. a = progenitor visible but of a brightness too close to the plate limit for meaningful measurement.

date		UT (start)	Exp. time (min)	Plate type	Filter	B	V	Notes
Nov. 4	1978	21.29	20	103a-D	GG14		17.5	
Dec. 3	1980	25.14	30	103a-D	GG14		17.1	
Dec. 23	1984	20.23	30	103a.D	GG14		17.1	
Aug. 18	1985	23.25	30	103a-D	GG14		17.4	
Oct. 11	1985	22.10	30	103a-D	GG14		17.0	
Nov. 6	1985	21.26	30	103a-D	GG14		17.1	
Oct. 5	1970	22.50	30	103a-O	GG13	18.5		
Nov. 26	1970	20.32	30	103a-O	GG13	18.4		
Nov. 4	1978	21.02	20	103a-O	GG13	18.0		
Nov. 1	1981	21.16	30	103a-O	GG13	18:5		
Nov. 20	1981	22.15	30	103a-O	GG13	18.3		
Aug. 21	1985	23.38	30	103a-O	GG13	18.1		
Oct. 5	1970	23.32	40	I-N	RG5			a
Nov. 2	1970	24.23	40	I-N	RG5			a
Nov. 4	1978	22.01	30	I-N	RG5			a
Oct. 1	1980	23.16	30	I-N	RG5			a
Nov. 1	1981	21.56	30	I-N	RG5			a
Nov. 20	1981	22.51	30	I-N	RG5			a
Jan. 2	1982	21.45	30	I-N	RG5			a
Jan. 7	1984	21.13	30	I-N	RG5			a
Dec. 23	1984	19.43	30	I-N	RG5			a

The observations reported in Table 1 started ~23 yrs and stopped ~8 yrs before the nova outburst. We can conclude from the data in Table 1 that during this time interval:

- no erratic or outburst-like variability with an amplitude larger than 0.2-0.3 mag affected the nova progenitor in quiescence
- no systematic and long-term trend in the mean brightness was observable in quiescence.

This also holds true for the I-N + RG5 infrared observations. We did not measure these plates because the progenitor was too close to the plate limit. However, eye inspection of these plates at the microscope (made in a separate and independent way by all of us) confirmed that no variability larger than 0.3 mag affected the progenitor in the infrared during the quiescence period covered by the observations reported in Table 1.

Acknowledgements. The help of I. Rigoni and S. Dalle Ave in the recovery of plates from the archives and work in the darkroom is acknowledged. T.V.T., L.H. and P.H. would like to thank the Asiago Astrophysical Observatory for the kind hospitality during the period in which this note has been prepared. Part of this research has been sponsored by the Bulgarian National Foundation for Scientific Research under contract F-35/1991.

ULISSE MUNARI
Asiago Astrophysical Observatory,
I-36012 Asiago (VI), Italy,
E-Mail 39003::munari

TOMA V. TOMOV
NAO Rozhen, P.O.Box 136,
4700 Smolyan, Bulgaria,
E-Mail ttomov@bgearn.bitnet

LADISLAV HRIC
Astron. Inst. Slovak Acad. Science,
05960 Tatranská Lomnica,
The Slovak Republic,
E-Mail astrhric@asu.savba.sk

PAVEL HAZUCHA
Hlohovec Astronomical Observatory,
92001 Hlohovec,
The Slovak Republic

References:

Kraft, R.P. 1964, *Astrophys. J.*, **139**, 457
Robinson, E.L. 1975, *Astron. J.*, **80**, 515
Warner, B. 1989, in *Classical Novae*, M.F. Bode & A. Evans eds., Wiley Publ., p.1