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NOVA Sgr 2001 NO. 2 = V4739 Sgr

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Nova Sgr 2001 No. 2 was discovered by Pereira in Portugal on 2001 Aug 26.866 at magnitude $m_V = 7.6$ (Pereira 2001). Maximum occurred a few hours later at Aug 27.10. Apart from a handful of early visual magnitude estimates around maximum, photoelectric $UBV(RI)_{\rm C}$ photometry has been obtained by Kilmartin and Gilmore at Mt John University Observatory since Aug 27.36. The visual light curve is shown in Fig. 1 and colour curves in Fig. 2 for the first week since discovery.

Nova Sgr 2001 No. 2 appears to be the fastest classical nova ever observed, with a t_2 value (time for 2 magnitude decline from maximum in visual) of only 0.70 ± 0.08 d and $t_3 = 1.60 \pm 0.12$ d. The light curve is a smooth steep decline from $m_V(\text{max}) = 6.5 \pm 0.1$ at $t_0 = \text{JD} 2452148.60 \pm 0.05$.

Other very fast novae (see Warner 1995, Table 5.2) have all had values of t_2 greater than 1 d. These include V838 Herculis in 1991 ($t_2 = 1.2$ d) and V1500 Cygni ($t_2 = 2.9$ d). To confirm these values, Ingram et al. (1992) gave t_2 as less than 3 days for V838 Her, and Young et al. (1976) stated that t_2 for V1500 Cyg was 2.4 d. According to Payne-Gaposchkin (1957) any nova with $t_2 < 10$ d is in the category of being very fast.

Photometry was done with the 0.6-m f/16 Cassegrain O.C. reflector at Mt John by photon counting with a cooled EMI 9202 (S20B) photomultiplier. The system has been standardized to the Johnson-Cousins $UBV(RI)_{\rm C}$ system by repeated measures of Cousins E-region standards (see Menzies et al. 1989 and references therein) over many years.

Using differential photometry from Cousins standards E745 and E746 Kilmartin calibrated two stars near the nova on August 27. All stars were observed at air mass less than 1.05 with a 21" aperture in a photometric sky and good seeing. The magnitudes and colours adopted for these stars, along with their HD numbers, are listed in Table 1. The standard deviation of nearly all measures was $0^{m}009$ or less except for $V - I_{\rm C}$ on the last 2 nights (where it was ± 0.2). These HD stars are noted as constant in the Hipparcos-Tycho database. All subsequent photometry was made differentially from the listed stars as comparison and check respectively.

We have calculated the absolute magnitude of V4739 Sgr at maximum from the rate of decline by extrapolating the calibration of Della Valle and Livio (1995). Fortunately M_V is not very sensitive to t_2 for very fast novae. The value obtained is $M_V = -9.07 \pm 0.17$ for V4739 Sgr, where the error bar arises almost entirely from the uncertainty in the calibration rather than in the measured t_2 value.

Comparison &	V	U - B	B - V	$V - R_{c}$	$V - I_{\alpha}$
check stars	v	U D	DV	V IU	v iC
HD169337	7.507	+0.465	+0.976	+0.669	+1.358
HD169586	6.757	+0.092	+0.535	+0.305	+0.597

Table 1: Comparison and check stars from Mt John University Observatory

The reddening can be estimated using $(B - V)_0$ at time t_2 , which is -0.02 ± 0.04 for novae, as found by van den Bergh and Younger (1987). The interpolated $(B - V)_{obs}$ colour index at t_2 is 0.44 ± 0.02 giving $E_{B-V} = 0.46 \pm 0.04$ and hence $A_V = 3.2E_{B-V} = 1.47 \pm 0.13$. A relatively high value is also suggested by the strong IS NaD line (Vanlandingham 2001).

The distance to the nova then follows and is $d = 6600 \pm 700$ pc with a distance modulus $(5 \log d - 5)$ of 14.1 ± 0.2 . Given that the star has $(l, b) = (3^{\circ}2, -8^{\circ}0)$ this distance places it near the galactic centre.

Capaccioli et al. (1989) have found that the absolute visual magnitude of classical novae 15 days after maximum is $M_{15} = -5.69 \pm 0.14$, independent of speed class. With an apparent magnitude of $m_{15} = 13.42 \pm 0.02$ (the small uncertainty is due to the small error in time of maximum) the distance modulus would be 17.6 ± 0.2 , much greater than before, and implying a distance far beyond the galactic centre. We conclude that the value of M_{15} may be substantially less luminous for very fast novae, as was also suggested by van den Bergh and Younger (1987) for V1500 Cyg. Hence for extremely fast novae ($t_2 < 2$ d) it is reasonable to suggest that the M_{15} calibration may not be valid.



Figure 1. Visual light curve of V4739 Sgr. × photoelectric photometry (MJUO); + visual estimates from IAU Circ. 7692; △ CCD photometry from IAU Circ. 7692,7702; ↓ visually estimated upper limit from IAU Circ. 7692

HJD (2450000 +)	V mag	U-B	B-V	$V - R_{\rm C}$	$V - I_{\rm C}$
2148.839	7.46	-0.71	0.55	0.53	0.99
2148.853	7.51	-0.74	0.56	0.55	1.01
2148.869	7.58	-0.75	0.55	0.56	1.04
2148.875	7.59	-0.76	0.56	0.56	1.04
2148.908	7.66	-0.78	0.55	0.60	1.10
2148.918	7.69	-0.80	0.54	0.61	1.12
2148.927	7.71	-0.81	0.55	0.61	1.11
2148.935	7.75	-0.81	0.54	0.62	1.13
2149.006	7.94	-0.86	0.53	0.68	1.22
2149.014	7.95	-0.87	0.53	0.70	1.24
2149.043	8.02	-0.87	0.52	0.72	1.26
2149.052	8.04	-0.87	0.53	0.72	1.27
2149.061	8.05	-0.88	0.53	0.73	1.28
2149.070	8.06	-0.89	0.54	0.73	1.29
2149.079	8.07	-0.89	0.54	0.74	1.29
2149.088	8.09	-0.87	0.52	0.75	1.30
2149.097	8.10	-0.87	0.52	0.75	1.31
2149.106	8.12	-0.89	0.55	0.77	1.33
2149.115	8.16	-0.90	0.53	0.77	1.33
2149.818	9.12	-0.93	0.28	1.09	1.53
2149.827	9.13	-0.89	0.27	1.09	1.56
2149.866	9.27	-0.86	0.26	1.13	1.56
2150.843	9.94	-0.84	-0.02	1.37	1.44
2150.847	9.95	-0.85	-0.04	1.39	1.46
2150.851	9.95	-0.87	-0.02	1.38	1.45
2150.856	9.94	-0.85	-0.02	1.36	1.45
2151.997	10.58	-0.68	-0.20	1.47	1.25
2152.002	10.49	-0.67	-0.11	1.43	1.23
2152.873	11.07	-0.64	-0.36	1.53	1.14
2152.878	11.06	-0.65	-0.36	1.54	1.16
2152.999	11.12	-0.65	-0.35	1.55	1.16
2153.004	11.14	-0.65	-0.38	1.56	1.15
2153.910	11.39	-0.66	-0.40	1.64	1.21
2153.914	11.37	-0.66	-0.38	1.60	1.19
2154.855		-0.71	-0.32	1.68	1.14
2154.801	11.54	-0.71	-0.32	1.00	1.15
2100.830	12.75	-0.79	-0.32	1.41	1.02
2100.830	12.70	-0.09	-0.30	1.42	1.02
2101.803 9161 of 9	12.94	-0.75	-0.32	1.3 <i>1</i>	U.10 0.64
2101.808 0160.001	12.98 12.95	-0.08	-0.37	1.42	U.04
2102.921 2162.024	10.20 19 00	-0.81 0.75	-0.43	1.39 1.95	1.12 1.01
2102.924 2162.962	13.22 19.40	-0.70	-0.39	1.50 1.45	1.01
2103.002 2162.060	10.49 19 に1	-0.82	-0.47	1.40 1.45	U.ð 1 0
4103.009 9167 q76	10.01 19 56	-0.82 0.92	-0.40 0.99	1.40 1.20	
2104.040 2164 850	10.00 12.60	-0.00 -0.78	-0.33 -0.43	1.30 1.25	0.7
2104.000	10.02	-0.10	-0.40	T.90	0.0

Table 2: Photoelectric photometry of V4739 Sgr from Mt John University Observatory



Figure 2. Photoelectric colour curves of V4739 Sgr from Mt John

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