



A twist of fate - the damage to David Moriarty's Sirius dome following the passage of a 'whirly wind' which is a small tornado. See David's story on page 13.

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From the director – *Mark Blackford*

Well 2020, with all its challenges, is behind us at last. Hopefully this year will see improvements in controlling the pandemic but it seems travel prospects will continue to be poor for some time to come.

Last year AAVSO ran a number of webinars in lieu of face-to-face meetings. These were very successful and they have now announced a series of free online webinars and how-to hours for 2021. The schedule for January/March can be found at <https://www.aavso.org/2021-webinars>. Webinars will be presentations by observing sections or prominent community leaders discussing results of AAVSO science and introducing new projects. How-to hours will be short instructional seminars on various aspects of variable star observing. These are geared mostly to beginner/intermediate observing audiences, discussing spectroscopy, CCD photometry, DSLR photometry etc.

The upcoming primary eclipse of V777 Sgr (see Stan Walker's article page 15) provides an excellent opportunity to greatly refine the orbital period and physical parameters of the stars in this long period eclipsing binary system. This will require a coordinated effort by multiple observers over a wide spread of longitude. If you can participate please contact Stan.

There have been some interesting announcements on the software front recently. Many amateur and professional astronomers use the software package Peranso for light curve plotting and analysis. A new improved version, Peranso 3, has been released by Tonny Vanmunster. Whilst I haven't had a lot of experience using it yet, I feel the EUR50 registration fee is reasonable value for money. Check the website (<https://www.cbabelgium.com/peranso/>) for new features and planned improvements.

Even better value for money is Richard Berry's registration free version of his venerable AIP4Win program which many amateurs use for CCD and DSLR photometry. The publisher Willmann-Bell has ceased operation so in Richard's words "... I created a new version of AIP4Win that does not require registration and a new installation program for the new version. I also created AIP4Win@Groups.IO to distribute the new version and support AIP4Win. The new version is called AIPv2.4.10.NonReg. The download is open to all members of AIP4Win@Groups.IO, and the group is open to all. It appears to install without problems on most computers, and that includes Win 10 computers. This version is functionally identical to AIP4Win v2.4.8 except for a few minor bug fixes."

Since last October's Newsletter I've managed only 8 nights of observing at Congarinni observatory. The Bureau of Meteorology forecast for summer was for above average rainfall in eastern and northern Australia. Well, they got that right! The drought and bush fires of 12 months ago have been replaced by drenching rain and floods this year. Dams and water tanks are now full so let's hope conditions improve for astronomy soon.

Wishing you all clear skies and good health,

Mark Blackford



A catalogue of nova outbursts in the Magellanic Clouds – *Mati Morel*

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Abstract

I present a catalogue of recorded outbursts in the Magellanic Clouds from 1897 to the end of 2020. Most of the events are due to classical novae, although spectral confirmation is often lacking.

Introduction

In the Magellanic Clouds outbursts from hitherto unknown stars have been recorded in the LMC since 1926 (58 events) and the SMC since 1897 (24 events). For most of the 20th century timely spectroscopic confirmation was often lacking, not helped by incomplete lightcurves. Reliable classification was often difficult. It would help if positions were to be determined as accurately as possible, should there be a repeat outburst in the future. As the *type* of object responsible for the outburst is sometimes only a guess, I have deemed that a better strategy should be to list the known outbursts chronologically.

The Outbursts: Table 1

All known outbursts are listed in chronological order (of maximum brightness), first for the LMC, then for the SMC. When the column “TYPE” is left blank, it is presumed that the object was a nova. In a few cases the outbursting object has subsequently been determined to be not a nova, and that entry is highlighted in yellow. In the early 20th century a few novae received regular GCVS names, such as RY Dor, VZ Tuc etc, but this practice is now avoided for *extragalactic variables* in general. Many of the LMC/SMC novae have numbers in the GCVS Vol. 5, for “Extragalactic Variables”. These are given in my column headed “GCVS v.5”, with separate numbering systems for LMC and SMC variables. In the last few decades accurate and reliable coordinates have been published with little delay after discovery. Prior to about 1952 the published positions were of low precision, and the writer has made an effort to re-examine the original discovery plates, taken by Harvard Observatory, to extract better positions. See Morel 2019a, and Morel 2019b.

Outbursts (novae) in Magellanic Clouds

Outburst Name	Type	RA J2000	DECJ2000	Max.	Fil-ter	JD	GCVS v.5	Reference	Other names / Remarks
LMC 1926-09a		05:14:57.09	-66:50:05.8	12.4	p	2424786.5	V1674	HB 847	RY Dor
LMC 1935-09a	SN	03:59:49.0	-67:38:16.5	11.0	p	2428049		HB 917	SN 1935C - NGC 1511
LMC 1936-02a		05:07:27.07	-66:39:24.9	10.8	p	2428223.5	V1102	HB 912	
LMC 1937-11a	RN	05:56:42.42	-68:54:34.8	10.6	p	2428860.5	V4622	HB 915	YY Dor,
LMC 1948-12a		05:38:11.6	-70:21:07.0	13.0	p	2432891	V3773	Harv. Reprint 387	Slow nova.
LMC 1951-01a	DN	05:12:44.89	-69:57:18.4	11.9	p	2433651	V1512	Harv. Reprint 387	ASASSN-17lo (dwarf nova).
LMC 1952	NL?	05:27:54.61	-66:05:02.4	11.4	V	2434364	V2724	IBVS 2854	14.4V star. Middle of 3. Low ampl. “flash”.
LMC 1966	N?	05:30:28	-71:45:37	11.1	V	2439230	V3080	Bamb. Ver. 6, 48, 1967	BV 908. GCVS position
LMC 1968-12a	RN	05:09:58.41	-71:39:53.2	10.4	V	2440205.01	V1341	IBVS 448	BV1261. See IAUC 4964 (N LMC 1990b).
LMC 1970-03a		05:33:16.3	-70:35:02	12.0	V	2440653.71	V3297	IAUC 2238	N LMC 1970a. [Posn. from IBVS 437 chart].
LMC 1970-11a		05:35:33.59	-70:46:21.4	11.0	V	2440972.5	V3498	1971AJ.....76..768G	Nova Men 1970b. [Publ. posn OK; accepted]

LMC 1971-03a		04:58:18.46	-68:05:49.6	11.8	V	2441039.5	V0430	1971AJ.....76..768G	Nova Dor 1971a. [My posn endfigs 18.27, 48.9].
LMC 1971-08a	RN	05:40:44.16	-66:40:11.5	13.0	V	2441079.92	V3958	IAUC 2353	N LMC 1971b
LMC 1972-08a		05:28:27.4	-68:48:51	11.0	p	2441551.5	V2814	IAUC 2445	See also IBVS 725
LMC 1973-09a		05:15:18.3	-69:39:23	11.6	p	2441640.96	V1744	IAUC 2605; -2611	See also IBVS 860.
LMC 1977-02a		06:05:55.4	-68:38:13	12.6	V	2443200.5	V4674	IAUC 3045	N LMC 1977a
LMC 1977-03a		05:05:13.3	-70:09:03.5	10.7	V	2443214.5	V0971	ApJ 216,L91 (1977)	N LMC 1977b. Precise position uncertain.
LMC 1978-03a		05:05:55.35	-65:51:53.8	9.7	V	2443596.5	V0990	1979PASP...91...79P	N LMC 1978a
LMC 1978-11a		05:01:00	-67:12:52	16	V	2443814.5	V0616	IAUC 3308	Maximum missed by months.
LMC 1981-09a		05:32:09.28	-70:22:11.6	11.8	p	2444877.88	V3204	IAUC 3641	Max. mv =8.1, mid. Sept.? AAO position.
LMC 1987-09a		05:23:50.25	-70:00:44.5	9.6	V	2447056.02	V2406	IAUC 4453	Posn by RMcN.
LMC 1988-03a		05:35:29.26	-70:21:29.2	11.0	V	2447242.0	V3479	IAUC 4568, - 4569	Posn by RMcN.
LMC 1988-10a		05:08:01.04	-68:37:37.4	10.0	V	2447448.0	V1161	IAUC 4663	Posn by RMcN.
LMC 1990-01a		05:23:21.76	-69:29:48.2	9.7	V	2447908.0	V2361	IAUC 4946	N LMC 1990a. Posn. by RMcN.
LMC 1990-02a	RN	05:09:58.41	-71:39:53.2	10.2	V	2447936.6	V1341	IAUC 4964	N LMC 1990b = N 1968 (RN)
LMC 1991-04a		05:03:44.92	-70:18:13.4	8.8	V	2448362.5	V0850	IAUC 5244	Posn. by RMcN.
LMC 1992-11a		05:19:19.78	-68:54:34.8	10.2	V	2448940.1		IAUC 5651; -5657	Posn. by RMcN.
LMC 1995-02a		05:26:50.33	-70:01:23.8	10.2	V	2449773.65		IAUC 6143; -6144	Posn. by Kilmartin & Gilmore.
LMC 1996	RN	05:13:32.71	-68:38:00.4	12.4	V			2004AS- PC..310..184S	Poor data. See LMC 2018-02a.
LMC 1997-06a		05:04:26.7	-67:38:38	13.5	V	2450615.89		IAUC 6756; -6758	
LMC 1998-12a		05:35:32.27	-69:29:52.1	16.9	R	2451176.19		IAUC 7087	Range 16.9 - 20.5R. Not a nova?
LMC 1999-09a		05:19:55.79	-70:27:53.4	12.6	I	2451431.86		Mroz et al (2016)	OGLE Atlas
LMC 2000-07a		05:25:01.60	-70:14:19.2	10.1	V	2451737.9		IAUC 7453	See Greiner et al (2003)
LMC 2001-08a		04:48:57.50	-69:55:35.7	13.3	I	2452165.89		Mroz et al (2016)	OGLE-2001-NO- VA-01
LMC 2002-02a		05:36:46.38	-71:35:34.4	10.1	V	2452332.56		Mroz et al (2016)	OGLE Atlas
LMC 2002-10a	RN	05:09:58.41	-71:39:53.2	11.2	V	2452558.76	V1341	G. Pojmanski (2002)	
LMC 2003-06a		05:08:25.59	-68:26:22.3	11.0	V	2452808.47		IAUC 8160	OGLE Atlas
LMC 2004-10a	RN	05:56:42.42	-68:54:34.8	10.9	V	2453298.69	V4622	Mroz et al (2016)	YY Dor, N LMC 1937 (RN)
LMC 2005-09a		06:06:36.44	-69:49:34.3	11.4	I	2453641.88		Read et al (2009)	XMMSLI J060636.2-694933. V. fast nova.
LMC 2005-11a		05:10:32.68	-69:12:35.7	11.5	V	2453693.73		Mroz et al (2016)	Slow nova. P. Nelson position.
LMC 2009-02a	RN	05:40:44.16	-66:40:11.5	10.6	V	2454867.57	V3958	Pietsch, W.(2010)	N LMC 1971b(RN)
LMC 2009-05a		05:31:26.37	-67:05:40.0	12.1	V	2454956.49		Mroz et al (2016)	N LMC 2009b
LMC 2010-11a	RN	05:09:58.41	-71:39:53.2	12.0	I	2455521.7	V1341	Mroz et al (2016)	N LMC 1968 (RN)
LMC 2011-08a		05:43:48.46	-69:19:31.0	13.1	I	2455787.90		Mroz et al (2016)	OGLE-2011-NO- VA-01
LMC 2012-03a		04:54:56.82	-70:26:56.3	10.7	w	2456012.53		Mroz et al (2016)	OGLE Atlas

LMC 2012-10a		05:20:21.09	-73:05:43.3	11.5	I	2456225.81		Mroz et al (2016)	OGLE-2012-NO-VA-03
LMC 2013-10a		05:57:58.38	-74:54:09.4	11.2	I	2456581.84		Mroz et al (2016)	OGLE-2013-NO-VA-02
LMC 2015-03a		05:56:41.11	-75:09:38.0	11.5	V	2457096.62		Danilet et al (2015)	ASASSN-15fd. CV? Nova?
LMC 2016-01a	RN	05:09:58.41	-71:39:53.2	11.5	I	2457408.71	V1341	Mroz et al (2016)	N LMC 1968 (RN), OGLE-2016-NOVA-01
LMC 2017-08a	DN	05:12:45.09	-69:57:20.1	15.0	V	2457994.83	V1512	Stanek et al (2017)	ASASSN-17lo (Dwarf nova) = N LMC 1951.
LMC 2017-11a		05:30:16.77	-73:16:11.3	11.8	V	2458074.76		Chomiuk et al (2018)	ASASSN-17pf
LMC 2018-02a	RN	05:13:32.71	-68:38:00.4	11.0	V	2458175.16		Mroz et al (2018)	N LMC 1996 (RN); OGLE-NO-VA-2018-01
LMC 2018-05a		06:26:20.72	-69:45:46.0	12.1	V	2458242.46		Gaia -alerts	ASASSN-18jj; AT 2018bej
LMC 2018-07a		05:41:46.46	-71:48:37.5	13.3	V	2458310.94		Shappee et al (2014)	ASASSN-18pf. See ATel 11857, 11959.
LMC 2019-07a		05:29:36.68	-70:09:57.6	11.4	V			ATel 12963	AT 2019lvm, TCP J05293666-7009566
LMC 2019-07b		05:14:53.67	-70:09:48.7	10.5	g	2458796.84		ATel 13287	AT 2019uni, PNV J05145365-7009486
LMC 2020-10a	CV	05:27:13.28	-68:53:19.2	15.7	g	2459149.54		Gaia Science Alerts	AT 2020ygt, Gaia 20eyw
LMC 2020-10b	CV	05:03:06.14	-68:52:57.7	15.6	g	2459149.54		Gaia Science Alerts	AT 2020ygw, Gaia 20eyz
SMC 1897-10a		01:02:11.40	-70:02:56.0	11.4	p	2414213.0	V1691	HA60,4,87; HB 920	N Tuc 1897, HV 849
SMC 1927-10a		00:34:00.93	-73:16:06.8	11.4	p	2425157.5	V0177	HA 111,HB 898	N Tuc 1927 = VZ Tuc
SMC 1951-06a		00:35:22.30	-72:58:11.5	11.5	V	2433810.0	V0182	IAUC 1323	N Tuc 1951. Chart ref: Henize (1956).
SMC 1952-12a		00:48:29.27	-73:30:46.4	11.0	p	2434368.5	V0491	Smith, H. G. (1954)	N Tuc 1952
SMC 1974-08a		00:26:02.1	-74:01:05	11.0	V	2442278.5	V0086	Sanduleak (1975)	N SMC 1974
SMC 1986-10a		00:36:52.46	-72:04:40.9	10.1	V	2446709.0	V0192	IAUC 4283; -4291	N SMC 1986.
SMC 1994-06a		00:51:29.70	-73:19:39.7	14.5	B	2449504.5		de Laverny et al (1998)	N SMC 1994. Re-vised position.
SMC 1996-06a		00:54:43.04	-72:32:20.8	13.5	V	2450239.3		IAUC 6713	N SMC 1996
SMC 1998-12a		01:02:21.8	-73:18:27	13.5	V	2451173.0		IAUC 7121	N SMC 1998, N SMC 1999#1
SMC 1999-07a		00:53:40.0	-72:12:32	13.6	R	2451387.6		IAUC 7239	N SMC 1999#2
SMC 1999-08a		00:48:51.7	-72:30:15	13.0	V	2451393.5		IAUC 7308	N SMC 1999#4
SMC 1999-09a		00:59:23.0	-73:07:56	12.8	R	2451439.7		IAUC 7286	N SMC 1999#3
SMC 2001-10a		00:46:27.92	-73:29:45.5	12.1	V	2452191.67		Mroz et al (2016)	
SMC 2002-10a	BE	00:56:30.44	-72:36:28.5	12.3	V	2452563.69		Mroz et al (2016)	Low ampl. outburst in Be star.
SMC 2004-06a		00:55:03.21	-73:38:03.5	14.2	I	2453037.55		Mroz et al (2016)	OGLE-2004-NO-VA-01
SMC 2005-08a		01:15:00.07	-73:25:37.6	11.6	V	2453588.9		Mroz et al (2016)	
SMC 2006-08a		00:57:03.87	-73:10:11.6	11.8	I	2453957.78		Mroz et al (2016)	OGLE-2006-NO-VA-02

SMC 2008-10a		00:55:37.74	-72:03:14.4	13.0	I	2454770.68		Mroz et al (2016)	OGLE-2008-NO-VA-02
SMC 2011-11a	BE	01:59:25.87	-74:15:28.0	14.3	I	2455876.71		Mroz et al (2016)	MAXI J0158-744; Low ampl. outburst in Be star.
SMC 2012-06a		00:32:55.06	-74:20:19.7	11.0	I	2456083.5		Mroz et al (2016)	OGLE-2012-NO-VA-02
SMC 2012-09a		00:48:07.28	-72:46:34.0	12.1	I	2456187.70		Mroz et al (2016)	OGLE-2012-NO-VA-04
SMC 2016-10a		01:06:03.27	-74:47:15.8	8.5	w	2457670.71		ATel 9621; -9628	MASTER OT J010603.18- 744715.8
SMC 2019-07a	N	01:04:30.36	-73:46:22.8	11.3	g	2457672.89		Shappee et al (2014)	ASASSN-19qv; Classical nova (ATel 12907).
SMC 2020-10a	N	00:48:44.54	-72:53:54.1	10.8	V	2459153		Stanek et al	ASASSN-20ni; Classical nova.

Table 1. Each event listed chronologically according to the YEAR and MONTH of outburst.

Letters **a** or **b** allow for more than one observed outburst in a month. Rarely does the discovery date differ from the date of maximum. The position of each object fits the ICRS reference frame (via Gaia DR2 stars) as far as possible. Some positions are still approximate.

The brightest outburst of all time was SN1987A, max =2.8V, which was recognized as being in a class of its own, from the moment of discovery, and is therefore omitted from Table 1.

Recurrent objects

There are 5 objects in the LMC, none in the SMC.

# in GCVS v.5 / Other	Outbursts
LMC V4622 = YY Dor	1937-11a, 2004-10a
LMC V1512 = ASASSN-17lo DN	1951-01a, 2017-08a
LMC V1341	1968-12a, 1990-02a, 2002-10a, 2010-11a, 2016-01a
LMC V3958	1971-08a, 2009-02a
(LMC N1996)	1996, 2018-02a

Table 2. Recurrent Objects in LMC.

References

- Chomiuk, L. et al ATel11132 (2018ATel11132....1C)
 Danilet, A.B. et al ATel 7260 (2015ATel,7260....1D)
 de Laverny et al 1998 Astron & Astrophys 335, L96
 Greiner, J., orio, M. & Schartel, N. 2003 arXiv:astro-ph/0304479v1 (2003A&A...405..703G)
 Henize, K.G. Hoffleit, D. & Nail, V. McK. 1954 Proc US Nat.Acad.Sci 40,365 [Harv Repr 387]
 Henize, K.G. 1956 Astrophys. J. Suppl. 2,315
 Liller, W., Shida, R.Y., Jones, A.F. 2004 IBVS 5582
 Morel, M. 2019a VSS Newsletter 2019-3, p3
 Morel, M. 2019b VSS Newsletter 2019-4a, p4
 Mroz, P. et al 2016 arXiv: 1511.06355v2 / ApJS 222,9 (2016)
 Mroz, P. et al 2018 ATel # 11384, 11390, 11392
 Pietsch, W. 2010 AN 331,187. List: <https://www.mpe.mpg.de/~m31novae/opt/lmc/index.php>.
 Pojmanski, G. 2002 Acta Astronomica 52,397 (2002AcA....52..397P)
 Read, A.M. et al 2009 arXiv:0908.3989v1 (X-ray obs of auroral phase)

Sanduleak, N. 1975 *Astron & Astrophys* 39,461-462
Seach, J., Liller, W., Brimacombe, J. & Pearce, A. 2012 *Cent. Bureau Electron. Telegrams* 3071,1
Shappee et al (2014) 2014ApJ...788..48S
Shida, R.Y. & Liller, W. 2004. *ASP Conf. Proceedings V. 310*,184 [IAU Colloquium 193}
Smith, Henry G. 1954 *Proc. US Nat. Acad. Sci* 40,372
Stanek, K. 2017 *ATel* 10701
Waller F. et al (2012) *PASP* 124,1057
SMARTS ATLAS : <http://www.astro.sunysb.edu/fwaller/SMARTS/NovaAtlas/atlas/html>

Untangling the light curve of CX Sculptoris – *Mark Blackford*

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The AAVSO Variable Star Index (VSX) lists the variability type of CX Sculptoris as “EA+DSCT”, which is defined as a β Persei-type (Algol) eclipsing system with one component exhibiting delta Scuti type pulsations. Apart from the discovery epoch HJD 2452069.1521 (08 Jun 2001) listed in the VSX there appear to be no published Times of Minimum.

As part of the VSS Southern Eclipsing Binaries Project CX Scl was observed over 3 nights in October and November 2020 with the aim of measuring a time of minimum of a primary eclipse. The light curve, phased using the period (0.8834334d) and epoch (2452069.1521 HJD) listed in the VSX, is shown in Figure 1.

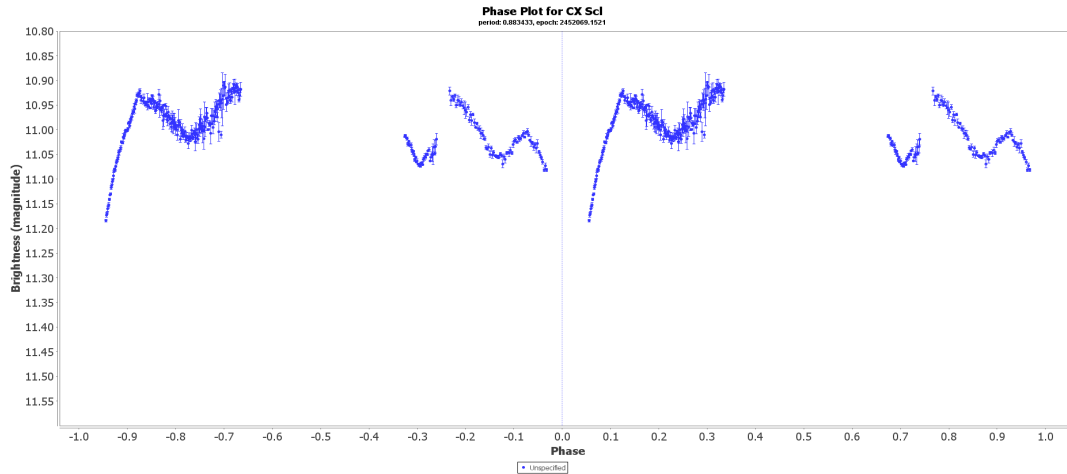


Figure 1. *Phased light curve recorded with a 14" RC telescope and SBIG STT3200ME CCD camera.*

Whilst a complete primary eclipse was not observed, these observations do show significant variation outside of eclipses. That variation, however, did not look like typical delta Scuti type pulsations. Available data and publications were examined to determine the true nature of this variable.

Background

Variability was first detected by the All Sky Automated Survey (Pojmański 2002) which assigned the designation ASAS 234520-3100.5. The General Catalogue of Variable Stars (GCVS; Samus et al., 2012) adopted the name CX Scl in the 80th Name List of Variable Stars (Kazarovets et al. 2013).

A total of 454 ASAS observations were recorded between Nov 20th, 2000 and Nov 29th, 2009. Figure 2 shows the ASAS light curve phased using the VSX period and epoch. The degree of scatter is significantly higher than similarly bright stars.

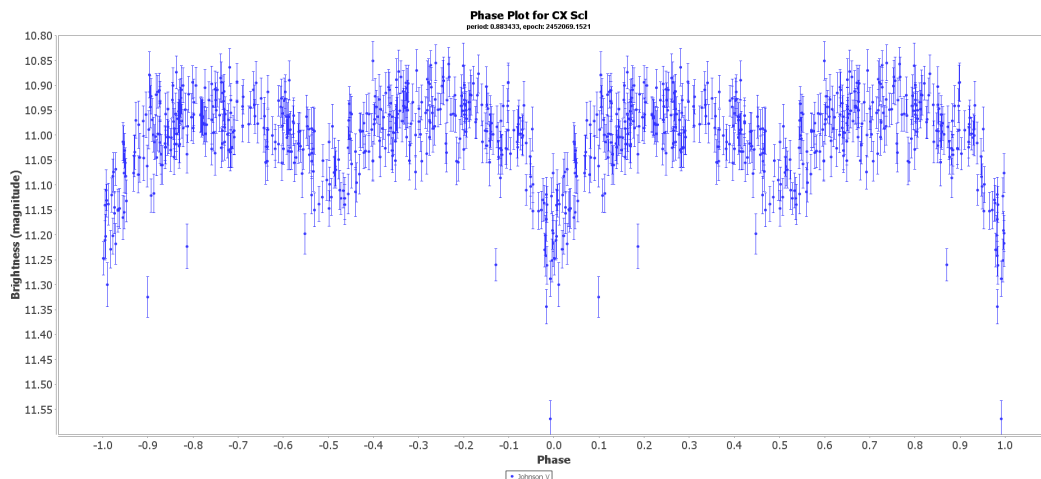


Figure 2. *ASAS phased light curve.*

Working with ASAS observation up until 2006 Pigulski & Michalska (2007a,b) determined this system to be a detached eclipsing binary with one component also exhibiting delta Scuti pulsations. Pilecki & Szczygiel (2007) analysed the same set of ASAS observations and concluded that the residual variation could be due to either pulsations in one component or possibly a second eclipsing binary in the system. The ASAS photometry was not sufficiently precise to distinguish between these scenarios.

Szczygiel et al. (2008) used the ASAS Catalog of Variable Stars (ACVS) with the ROSAT All Sky Survey (RASS) to compile a catalog of eclipsing binaries that display coronal activity. This list included ASAS 234520-3100.5. The Washington Double Star catalogue of astrometric doubles and multiples (Mason et al. 2001) identified it as a double star (11.58 mag + 11.94 mag) with a separation of 1".

TESS photometry

To investigate the nature of CX Scl further a more precise and extensive set of observations was needed. Such a data set was collected by the Transiting Exoplanet Survey Satellite (TESS) between August 26th and September 19th 2020. CX Scl is identified as TIC 169286196 in the TESS Input Catalog and these observations are readily available through the Mikulski Archive for Space Telescopes (MAST) website (<https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>).

The complete TESS light curve is shown in the top panel of Figure 3, with an expanded view of a small section in the middle panel. The light curve looks rather complicated but is suggestive of “beating” of two periodic signals, one having larger amplitude and longer period than the other. A phased light curve using VSX period and epoch is shown in the bottom panel.

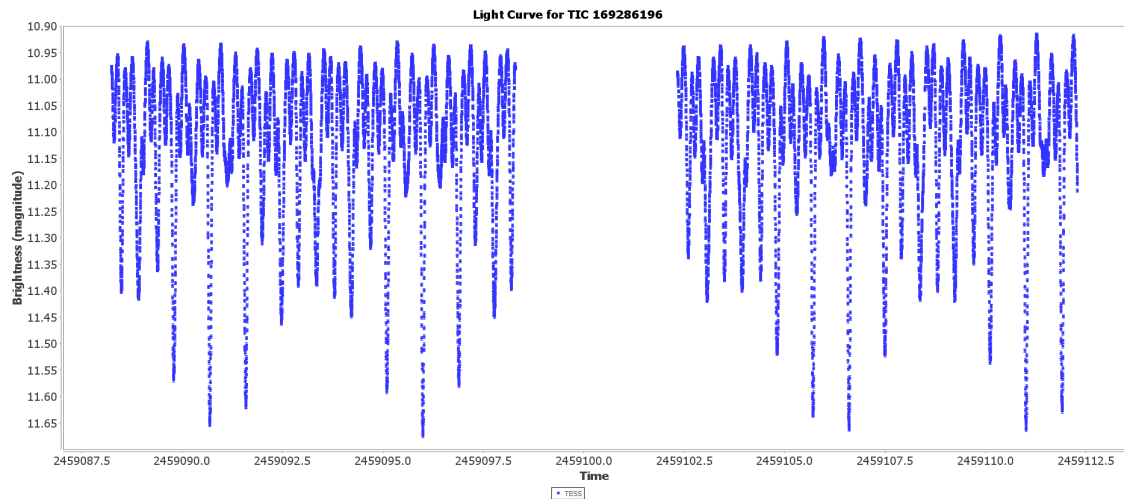


Figure 3a. *Light curve recorded by TESS at 2 minute cadence.*

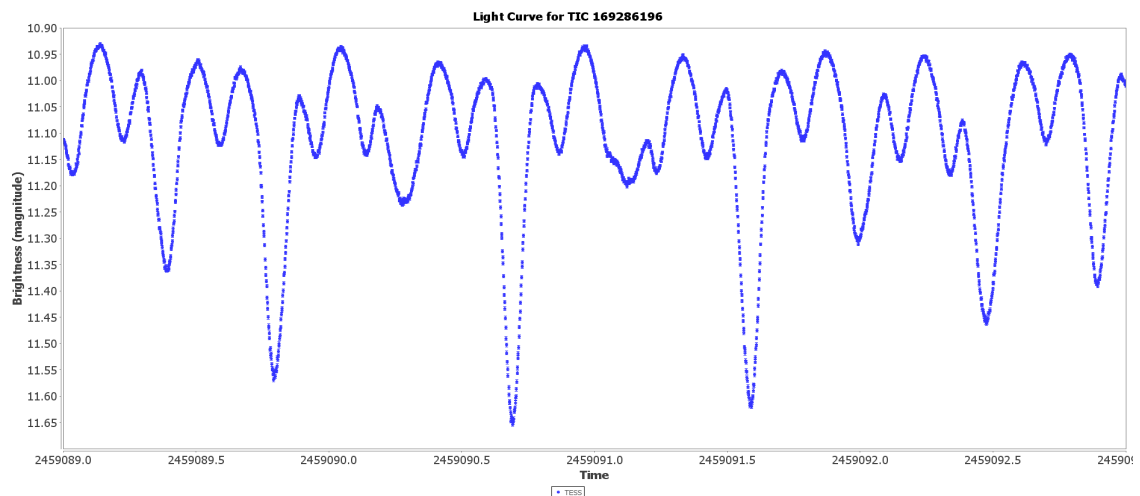


Figure 3b. *Details of TESS light curve.*

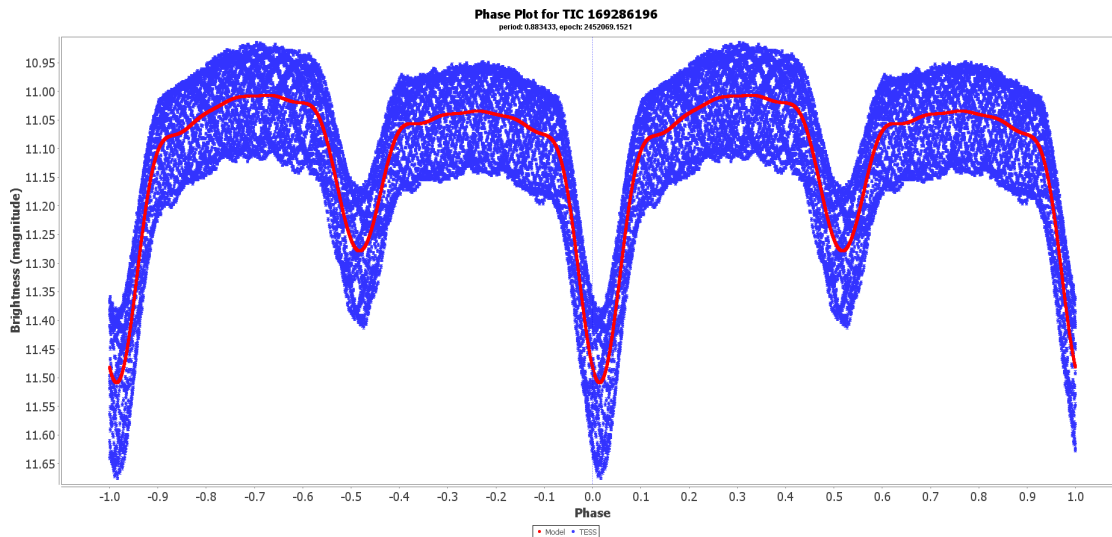


Figure 3c. *Phased light curve using VSX period and epoch with Fourier model shown in red.*

Primary eclipse occurs at phase 0.015 (approximately) or about 19 minutes later than predicted from the VSX period and epoch. The simplest explanation is that the VSX period is very slightly too short (by 0.15 sec). Alternatively, the observed phase shift could be due to a light travel time effect induced by a third body in the system. Further high quality, high cadence observations in future years will be required for a detailed O-C analysis.

Alexis Liakos performed a quick Fourier analysis on the TESS data between eclipses and concluded the CX Scl system includes a second eclipsing binary with period ~ 0.366 days. What follows is my attempt to separate the contribution of each eclipsing binary to the TESS light curve.

De-convolving the two signals

Pilecki & Szczygiel (2007) used an iterative method to de-convolute two periodic signals in ASAS light curves. In the first step the best fitting model of an eclipsing binary M1 with orbital period P1 was removed from the original light curve. The residual light curve was searched for secondary period P2, which was used to construct the model M2 of additional variability. The M2 model was then subtracted from the original light curve and the residual was again investigated to find a refined M1. After subtracting the new M1 from the raw light curve, the new M2 was once again determined. In some cases one more step was performed to get a better model M1.

I adopted a similar strategy to de-convolute the CX Scl TESS light curve, except instead of a physical eclipsing binary model (such as the Wilson-Devinney code) I used Fourier series models for both M1 and M2. A 12 harmonic Fourier model (M1) of the phased light curve is shown as a solid red line in Figure 3c.

Analysis of Variance (AoV) of the residuals (i.e. observed data points minus M1 model values) found the best estimate of the second period, P2, to be 0.366032 d. Figure 4 shows the phase plot of residuals using this period and VSX epoch. The solid red line is a 12 harmonic Fourier model (M2) of the residual light curve. After subtracting the M2 model from the original TESS light curve we obtain the phased light curve and refined M1 model shown in Figure 5. A further iteration did not appear to significantly change the M1 and M2 models.

Discussion and conclusion

All light curves shown in this article are plotted with the same vertical range, i.e. 0.8 magnitudes, to help visualize the relative scale of variation in each Figure. The complex light curve recorded by TESS (Figure 3) can be attributed to the superposition of two relatively simple periodic signals (Figures 4 and 5).

The light curve in Figure 4 is typical of EW (W UMa type) eclipsing binaries. According to AAVSO VSX Variability Type document (<https://www.aavso.org/vsx/index.php?view=about.vartypes>) “these are eclipsers with periods usually shorter than 1 day, consisting of ellipsoidal components almost in contact

and having light curves for which it is impossible to specify the exact times of onset and end of eclipses. The depths of the primary and secondary minima are almost equal or differ insignificantly. Light amplitudes are usually <0.8 mag. in V. The components generally belong to spectral types F-G and later.”

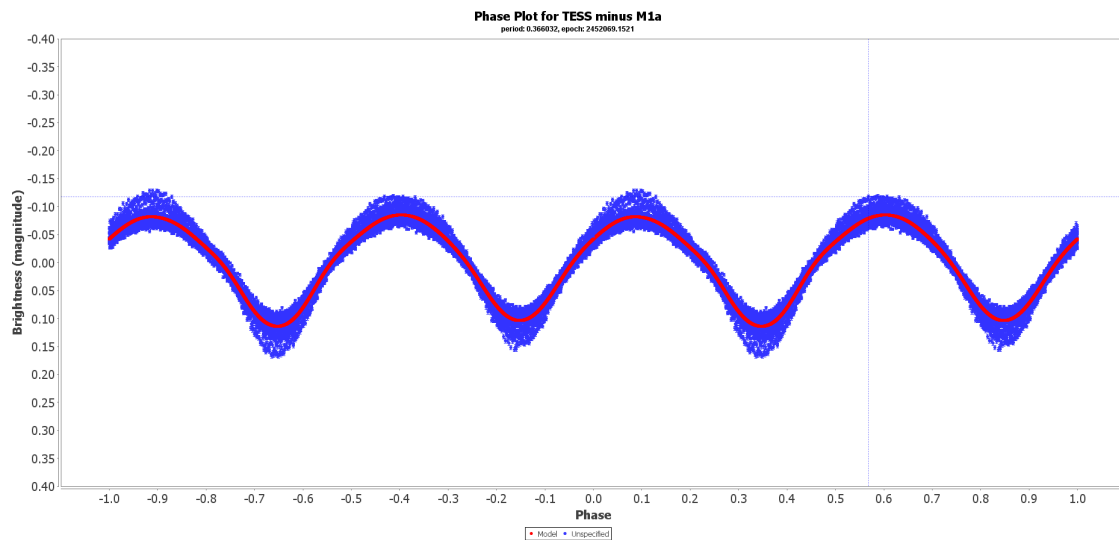


Figure 4. Phased light curve of TESS observations minus M1 model using P2 period 0.366032 d.

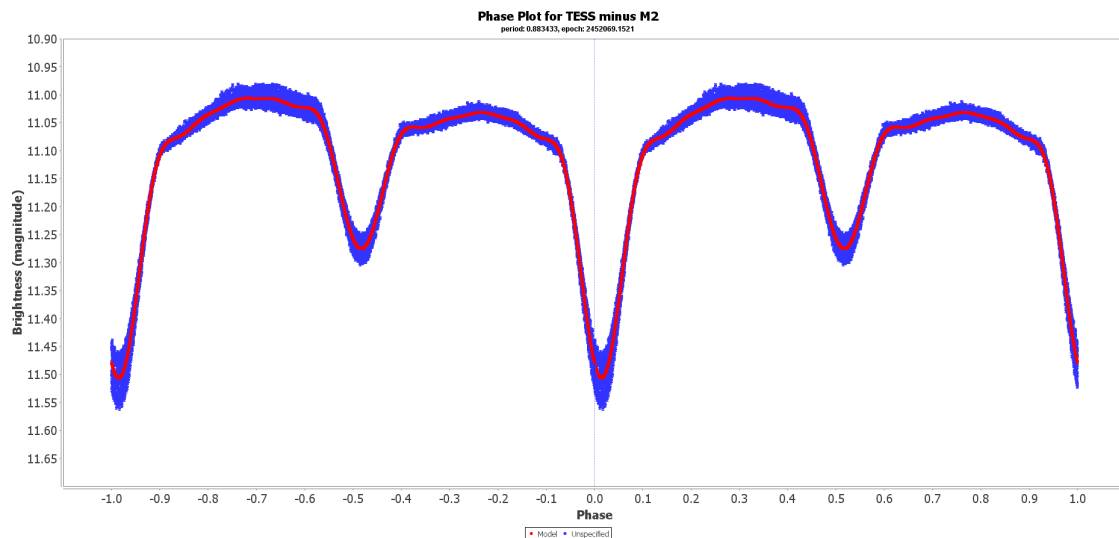


Figure 5. Phased light curve of TESS observations minus M2 model using VSX period and epoch.

The light curve in Figure 5 is typical of EA (Algol type) eclipsing binaries. According to AAVSO these are “binaries with spherical or slightly ellipsoidal components. It is possible to specify, for their light curves, the moments of the beginning and end of the eclipses. Between eclipses the light remains almost constant or varies insignificantly because of reflection effects, slight ellipsoidality of the components, or physical variations. Secondary minima may be absent. An extremely wide range of periods is observed, from 0.2 to ≥ 10000 days. Light amplitudes are also quite different and may reach several magnitudes.”

The EA period is close to 0.8834334 d with primary and secondary eclipse depths of 0.50 and 0.20 mag, respectively. There is a small difference (0.03 mag) between the two maxima, the so called O’Connell effect (cf. Wilsey & Beaky 2009). There also appears to be slightly more scatter in the first maximum after primary eclipses than the second maximum, possibly due to hot or cool spots.

The EW component has period close to 0.366032 d with the average primary eclipse depth of 0.20 mag, just 0.01 mag deeper than the average secondary eclipse. There appears to be significantly higher scatter throughout the EW light curve compared with the EA component. This could be attributed to variation in the reported coronal activity (Szczygiel et al. 2008).

The two visual components of CX Scl have a separation of 1" and are therefore not resolved by the

TESS CCD camera which has pixel resolution of 21". It is not clear if one component of the visual pair is the EA eclipsing binary and the other is the EW system. To settle that question photometry at much higher spatial resolution would be required.

The obvious next step is to use physical eclipsing binary models instead of Fourier series to de-convolute the TESS light curve. This would yield valuable insights into the physical properties of individual stars in this interesting quadruple system.

Acknowledgements

VStar (Benn 2012) was used to generate all figures in this article. This research has made use of the SIMBAD and VIZIER databases, operated at CDS, Strasbourg, France and of NASA Astrophysics Data System Bibliographic Services. I gratefully acknowledge the use of the ASAS-3 data base. This paper includes data collected by the TESS mission, which are publicly available from the Mikulski Archive for Space Telescopes (MAST).

References

- Benn, D. 2012, JAAVSO, 40, 852
- Kazarovets, E. V., Samus, N. N., Durlevich, O. V., Kireeva, N. N., and Pastukhova, E. N. 2013, IBVS, 6052, 1.
- Mason, B. D., Wycoff, G. L., Hartkopf, W. I., Douglass, G. G. & Worley, C. E. 2001, AJ, 122, 3466
- Pigulski, A., Michalska, G., 2007a, IBVS, 5757
- Pigulski, A., Michalska, G., 2007b, AcA, 57, 61
- Pilecki B. & Szczygieł D. M. 2007, IBVS, No.5768
- Pojmański, G. 2002, Acta Astron., 52, 397.
- Samus, N.N., Durlevich, O.V., Kazarovets, E.V., Kireeva, N.N., Pastukhova, E.N., et al. 2012, General Catalogue of Variable Stars (GCVS database, version April 2012), VizieR On-line Data Catalog: B/gcvs
- Szczygieł, D. M., Socrates, A., Paczyński, B., Pojmański, G., & Pilecki, B. 2008, AcA, 58, 405.
- Wilsey, N. J., & Beaky, M. M. 2009, SASS, 28, 107

Sirius observatory damaged by a ‘dust devil’ – *David Moriarty*

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An extremely violent dust devil — whirly wind — tore the dome off my Sirius observatory at Glen Aplin, south of Stanthorpe on the Granite Belt. That was a hot morning after a dry period. The Bureau of Meteorology describe a dust devil as “a column of whirling dust that looks like a small tornado, but occurs exclusively on fine, dry days and is usually harmless, but can sometimes cause minor structural damage to property”. The damage to the dome was not minor! The steel driving track for dome rotation was twisted and the fibreglass was cracked in several places.

John Salini, on whose farm the observatory is situated, watched incredulously from the balcony of his house 100 m to the south as the dome was lifted into view above the tractor shed roof.

In 2013, I purchased the observatory from Jackie Powell, the widow of Harold who was the first president of the Astronomical Association of Queensland. John Salini was given Harold’s original roll-off roof observatory in 2004. It is the blue observatory in the background.



David (right) discussing with John Salini how to proceed.



Left. The steel track for dome rotation was twisted in several places. **Right.** The dome slit cover track was partly torn off at the base.

Christine, my wife, and I drove up to Glen Aplin that day (10th November, 2020) and first checked the telescope which, fortunately, was not damaged. When not in use, I keep it wrapped with a cloth cover and several layers of plastic. Despite the damage, it was fortunate that the dome driving motor and the telescope mount were not damaged. We removed the CCD camera and brought it and the telescope optical tube assembly back to Brisbane.

One of the fibreglass security mouldings, which are screwed to the walls and overlap the dome wheels to hold the dome in place, was cracked and partly torn from the wall. The aluminium track on which the slit cover slides was partly torn from the dome. The combination of the violent rotating wind and very low air pressure in the centre of the dust devil must then have allowed the high pressure of air trapped in the dome to lift it above and away from the telescope.

I removed all the security mouldings and, with the help of a colleague, we lifted the dome back onto the walls. The dome is now tied down securely to the anchor bolts in the concrete base while we wait for fine weather to return before proceeding with repairs.

The security mouldings in the early Sirius Observatories were screwed to the walls. Nut rivets (nutserts) are now recommended, and we will use those when repairing the observatory. I am now replacing the screws in the security covers in my Wellington Point observatory, which I purchased in 1986. It was the second Sirius Observatory manufactured by Sabre Yachts Aust. Pty. Ltd., the forerunner of Sirius Observatories Australia Pty. Ltd.



David's observatory in happier times.

Introduction

Finally we have an eclipse occurring at a reasonably convenient time. However I overlooked one thing - the Moon! More about this below.

The 2018 campaign was very successful except we could only measure half the eclipse curve. Using previous measures we were able to construct a full eclipse curve where the second half was a mirror image of the first half. This is shown in Figure 1. The derived orbital and physical values for the two stars, however, did not entirely match the data so we held back on publication of the proposed paper.

We had hoped that 2021 would allow us to make an exact picture of the ingress and egress, each of which lasts about 1.4 days. As well, with these stars where a non-variable supergiant is paired with a main sequence or not too evolved hot star it is possible to measure the atmospheric structure of the cool supergiant star.

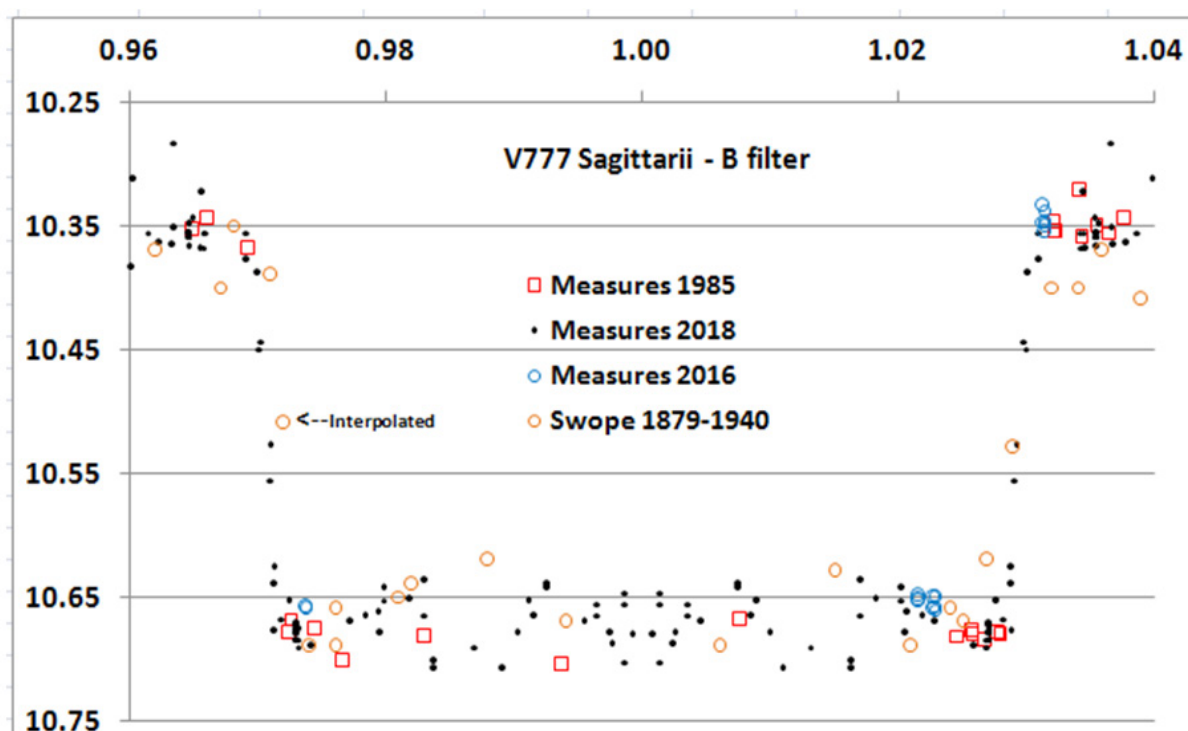


Figure 1. The composite eclipse light curve of V777 Sagittarii as discussed above. ASAS3 measures were also used to assist in the fitting but they are through a V filter with much less amplitude and more scatter.

The Moon during the V777 Sagittarii eclipse:

Being a non-observer these days I've lost the ability to consider projects from all angles and it was only a few days ago when I realised that the coordinates of the target star were very close to the ecliptic and the Moon's inclination to that could create problems. The duration of the eclipses of ~56 days is also close to two lunar months.

A search of the internet revealed a tremendous amount about how the Moon looked in the sky but little about its position in RA and Dec. However, an item called 'Heaven's Above' provided useful coordinates. I've long since lost my copy of the USNO software predicting positions of Solar System objects. The 'Heavens Above' values have been used in compiling Table 1.

Event	Date	Time UT	Moon RA	Moon Dec	Delta RA	Delta Dec
Eclipse Start	Apr 29	17:32:12	16:55:06	-23:25:01	-00:51:32	+3:14:08
Total Start	Apr 30	19:12:34	18:03:49	-25:39:19	+00:17:11	+0:59:50
Total End	Jun 23	15:03:53	16:56:29	-23:30:58	-00:50:09	+3:08:11
Eclipse End	Jun 25	1:40:22	18:29:18	-26:33:05	+00:42:40	+0:06:04

Table 1. Relative positions of the Moon and V777 Sagittarii (RA = 17:46:38.5 Dec = -26:39:09).

I'm uncertain how much this will affect the measures, particularly as the Moon is about 3/4 illuminated at these times. It should be possible, however, to improve the values for length of ingress, egress and the total duration of the eclipse - thus allowing publication of the long awaited paper.

Atmospheric eclipse

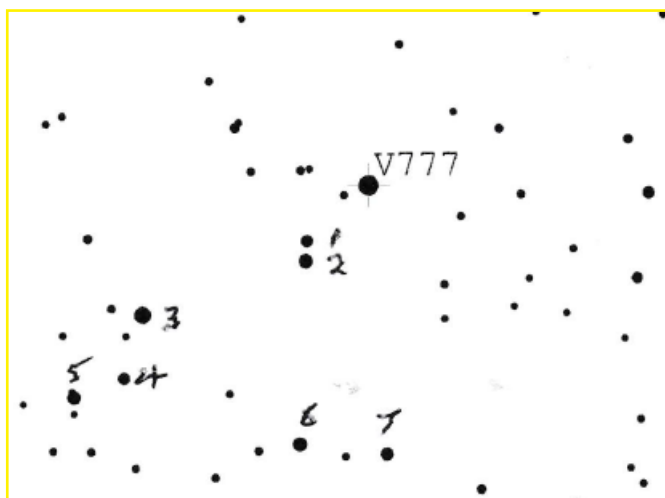
Were it not for the Moon this year's eclipse would be close to ideally place for measures of this. Most of you have seen the Sun's atmosphere during solar eclipses (the internet has been a tremendous help in this) and this supergiant's atmosphere is much more extensive due to the lower surface gravity - 8 solar masses with a radius of perhaps 160 times that of the Sun - so the effects may be visible 10 to 20 days before the 'true' eclipse begins.

The wavelength is important - the eclipse depth varies from 0.080 in the V filter to 0.333 in B and 1.105 in U. Observers with SSP3 or SSP5 photometers may be able to measure the last if they have access to a U filter. Each observer's measures will require separate treatment due to the true wavelengths of the filter detector combinations. Thus we would appreciate access to the untransformed observations from all participants.

Comparison stars

V777 is located in a region which comprises mainly slightly reddened stars of late B to early F. The only red star is No 1 on the plot of the immediate area as shown below. This chart is about half a degree in height.

In the past we have been troubled by the need to use different zero points to match the various datasets. For this eclipse whilst we would welcome fully transformed results we would also wish that you provide us with the untransformed magnitudes of the observations of all stars in v and b-v, also the air mass although this latter has little effect. All datasets should include both stars 1 and 2 on each night to take advantage of the B-V difference of close to one magnitude. They should also include instrumental magnitudes of V777 and for as many of the comparisons stars 1-7 as possible so that we can analyse all measures in a consistent manner.



Star	V Mag	B-V
1	10.159	0.446
2	9.666	1.418
3	9.075	0.195
4	10.205	0.407
5	Uncertain	
6	9.711	0.297
7	9.938	0.604

Observations should start at least 20 days before the predicted ingress on 29 April and continue until at least 20 days after predicted egress on 25 June. Hourly measures during ingress and egress, and one or

two measures per night at other times would be appreciated

Further ideas

At the time of writing the event is more than three months in the future. But in an interesting email Ed Budding suggested that we develop our thoughts further - perhaps by participation in a 'WASRAG' meeting which is, I imagine, an interesting discussion using Zoom or something similar. So maybe Ed, Mark and I should organise something similar to give far more background to this particular event and the zeta Aurigae stars generally?

Mark has also expressed some concern about the possibility of internal reflections and maybe other effects caused by the Moon's proximity. This could be checked at an earlier date when the V777-Moon relationship will be similar - perhaps a month earlier?

It's fair to say that the group of amateurs operating the Auckland Observatory in the late 1960s and 1970s introduced many amateurs across NZ and Australia to professional level research. The strongest feature of that were the group discussions on what we were trying to do, often involving up to a dozen people including some in other parts of NZ. But today such groups do not meet together which is a considerable disadvantage. Are any of the observers of V777 in the same city?

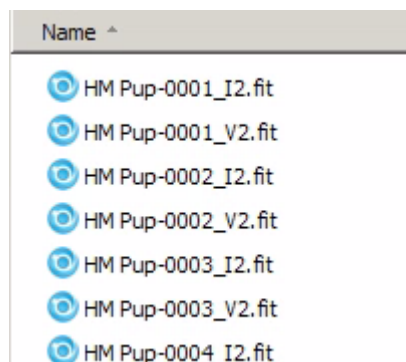
We all participated in a series of Zoom meetings in 2020, both under compulsion by Covid-19 and from the growing popularity of Zoom. But the best use was not made of most of these - they sadly lacked a strong observational input. So let's apply this experience to improving the measures of the V777 eclipse. We have almost three months to do so. Ed's idea seems to be a way of recreating the very effective Auckland approach - so perhaps we could develop this a little further - any ideas from participants in the observing of earlier eclipses?

Sorting alternate filter filenames – *Phil Evans*

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Users of Maxim who alternate filters during a photometry session are faced with a problem of how to sort the resulting filenames by filter. Maxim will only add a suffix not a prefix and Windows will only sort on the first character. I recall that Maxim were asked in their forum if they could also add a prefix but they said they could not. I cannot recall the reason why.

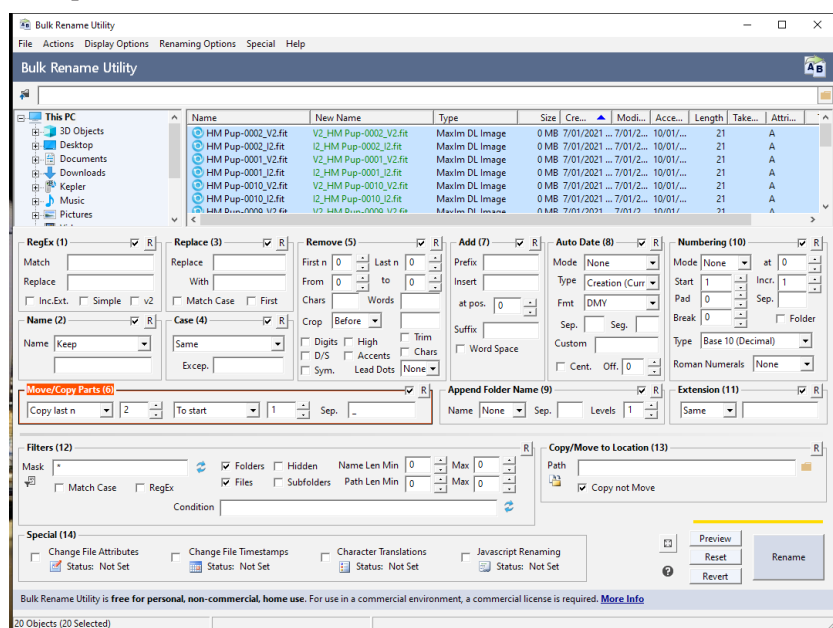
So, you are left with possibly hundreds of files in a folder such as:



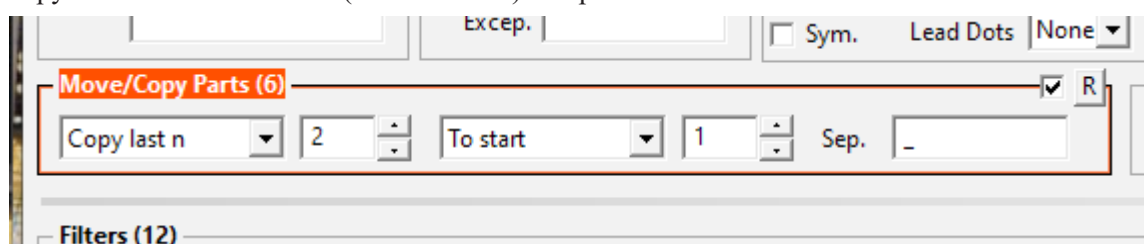
I'd looked on the internet in vain for a simple way of sorting on the nth character but never found a method.

A few days ago I was idly looking at a small renaming utility that I have and realised that it could move characters from the back to the front of a filename. The app is "Bulk Rename Utility" and is available free from <https://www.bulkrenameutility.co.uk/>

It opens like this:

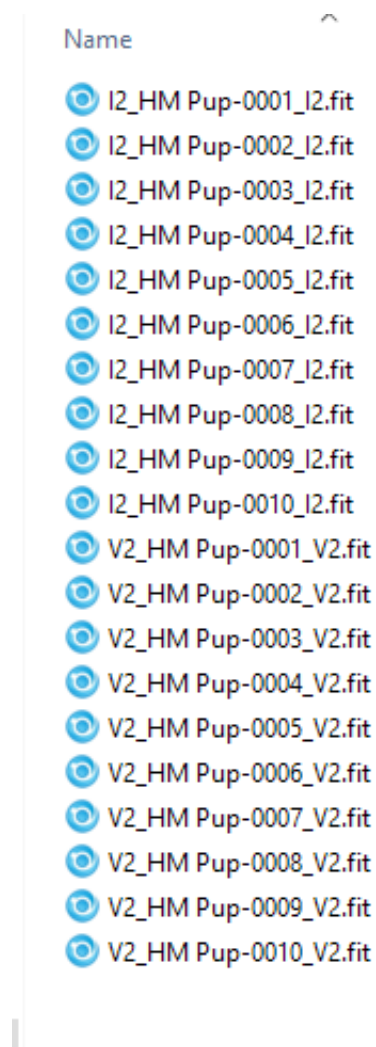


Drag the files you want to alter to the app and then make the changes you want. In my case I wanted to copy the last two characters (the I2 and V2) and paste them at the start of the file name.



Check the preview and then press Rename.

Now look at File Explorer and see that they have all been neatly sorted on the first character which was the filter letter.



If any VSS member has a trick they'd like to share please let me know for the next newsletter.

Tom Richards gave an invited presentation (by Zoom plus PowerPoint) to the Annual Meeting of the AAVSO in Boston. Title ‘**Researching Eclipsing Binaries “Down Under”: Illustrating the Methods and Results of Variable Stars South**’.

Roy Axelsen and Tim Napier-Munn published a paper in AAVSO journal

Roy A. Axelsen, Tim Napier-Munn. *Expansion and Reinterpretation of the O–C Diagram of the High Amplitude δ Scuti Star RS Gruis.* JAAVSO Vol 48 No 2.

Abstract. Photometry obtained with a digital single lens reflex (DSLR) camera and a CMOS astronomical camera from 2016 to 2020 expands the O–C diagram of RS Gru to cover a span of nearly 68 years. Analysis of the data reveals that a previous report of a constant rate of increase of the period between October 2003 and July 2013 may not be correct. Instead, evidence is presented that there was a constant rate of increase of the period from October 2003 to October 2010 followed by a constant but slower rate of increase from July 2011 to July 2020, with the latter described by the expression $dP / dt = 2.99 (0.96) \times 10^{-8} \text{ d yr}^{-1}$ or $dP / Pdt = 2.04 (0.65) \times 10^{-7} \text{ yr}^{-1}$. A new quadratic ephemeris derived from the 2011 to 2020 observations is $\text{TOM (HJD)} = 2459045.1247 (0.0002) + 0.14701221 (0.00000004) E + 6.0 \times 10^{-12} (1.9 \times 10^{-12}) E^2$ for which zero time occurred on 14 July 2020 UTC.

Bob Nelson continued his series of reports on EB minima in the same issue of JAAVSO.

Robert H Nelson. *CCD Minima for Selected Eclipsing Binaries in 2019.* JAAVSO Vol 48 No 2.

Abstract. 204 CCD-based times of minima of eclipsing binary stars are presented.

Phil Evans was a co-author of two exoplanet papers and one eclipsing binary paper during the last three months.

Dreizler, S. et al. *The CARMENES search for exoplanets around M dwarfs -- LP 714-47b (TOI 442.01): Populating the Neptune desert.* arXiv:2011.01716

Abstract. We report the discovery of a Neptune-like planet (LP 714-47 b, $P = 4.05204 \text{ d}$, $m_b = 30.8 \pm 1.5 M_{\text{earth}}$, $R_b = 4.7 \pm 0.3 R_{\text{earth}}$) located in the ‘hot Neptune desert’. Confirmation of the TESS Object of Interest (TOI 442.01) was achieved with radial-velocity follow-up using CARMENES, ESPRESSO, HIRES, iSHELL, and PFS, as well as from photometric data using TESS, Spitzer, and ground-based photometry from MuSCAT2, TRAPPIST-South, MONET-South, the George Mason University telescope, the Las Cumbres Observatory Global Telescope network, the El Sauce telescope, the TUBITAK National Observatory, the University of Louisville Manner Telescope, and WASP-South. We also present high-spatial resolution adaptive optics imaging with the Gemini Near-Infrared Imager. The low uncertainties in the mass and radius determination place LP 714-47 b among physically well-characterised planets, allowing for a meaningful comparison with planet structure models. The host star LP 714-47 is a slowly rotating early M dwarf ($T_{\text{eff}} = 3950 \pm 51 \text{ K}$) with a mass of $0.59 \pm 0.02 M_{\text{sun}}$ and a radius of $0.58 \pm 0.02 R_{\text{sun}}$. From long-term photometric monitoring and spectroscopic activity indicators, we determine a stellar rotation period of about 33 d. The stellar activity is also manifested as correlated noise in the radial-velocity data. In the power spectrum of the radial-velocity data, we detect a second signal with a period of 16 days in addition to the four-day signal of the planet. This could be shown to be a harmonic of the stellar rotation period or the signal of a second planet. It may be possible to tell the difference once more TESS data and radial-velocity data are obtained.

Kokori, A. et al. *ExoClock Project: An open platform for monitoring the ephemerides of Ariel targets with contributions from the public.* arxiv.org/abs/2012.07478.

Abstract. The Ariel mission will observe spectroscopically around 1000 exoplanets to further characterise their atmospheres. For the mission to be as efficient as possible, a good knowledge of the planets' ephemerides is needed before its launch in 2028. While ephemerides for some planets are being refined on a per-case basis, an organised effort to collectively verify or update them when necessary does not exist. In this study, we introduce the ExoClock project, an open, integrated and interactive platform with the purpose of producing a confirmed list of ephemerides for the planets that will be observed by Ariel. The project has been developed in a manner to make the best use of all available resources: observations reported in the literature, observations from space instruments and, mainly, observations from ground-based telescopes, including both professional and amateur observatories. To facilitate inexperienced observers and at the same time achieve homogeneity in the results, we created data collection and validation protocols, educational material and easy to use interfaces, open to everyone. ExoClock was launched in September 2019 and now counts over 140 participants from more than 15 countries around the world. In this release, we report the results of observations obtained until the 15h of April 2020 for 119 Ariel candidate targets. In total, 632 observations were used to either verify or update the ephemerides of 83 planets. Additionally, we developed the Exoplanet Characterisation Catalogue (ECC), a catalogue built in a consistent way to assist the ephemeris refinement process. So far, the collaborative open framework of the ExoClock project has proven to be highly efficient in coordinating scientific efforts involving diverse audiences. Therefore, we believe that it is a paradigm that can be applied in the future for other research purposes, too.

Powell, B. P. et al. *TIC 168789840: A Sextuply-Eclipsing Sextuple Star System.* arxiv.org/abs/2101.03433

Abstract. We report the discovery of a sextuply-eclipsing sextuple star system from TESS data, TIC 168789840, also known as TYC 7037-89-1, the first known sextuple system consisting of three eclipsing binaries. The target was observed in Sectors 4 and 5 during Cycle 1, with lightcurves extracted from TESS Full Frame Image data. It was also previously observed by the WASP survey and ASAS-SN. The system consists of three gravitationally-bound eclipsing binaries in a hierarchical structure of an inner quadruple system with an outer binary subsystem. Follow-up observations from several different observatories were conducted as a means of determining additional parameters. The system was resolved by speckle interferometry with a 0."42 separation between the inner quadruple and outer binary, inferring an estimated outer period of ~ 2 kyr. It was determined that the fainter of the two resolved components is an 8.217 day eclipsing binary, which orbits the inner quadruple that contains two eclipsing binaries with periods of 1.570 days and 1.306 days. MCMC analysis of the stellar parameters has shown that the three binaries of TIC 168789840 are “triplets”, as each binary is quite similar to the others in terms of mass, radius, and T_{eff} . As a consequence of its rare composition, structure, and orientation, this object can provide important new insight into the formation, dynamics, and evolution of multiple star systems. Future observations could reveal if the intermediate and outer orbital planes are all aligned with the planes of the three inner eclipsing binaries.

About

Variable Stars South is an international association of astronomers, mainly amateur, interested in researching the rich and under-explored myriad of southern variable stars.

Renamed from the Variable Star Section of the Royal Astronomical Society of New Zealand, it was founded in 1927 by the late Dr Frank Bateson, OBE, and became the recognised centre for Southern Hemisphere variable star research.

VSS covers many areas and techniques of variable star research, organised into projects such as Beginners' Visual Observations and Dual-Maxima Miras. The goal of each project is to obtain scientifically useful data and results. These may be published in recognised journals, or supplied to international specialist data collection organisations.

VSS is entirely an internet based organisation, working through our website <http://www.VariableStars-South.org> and its e-group <http://groups.google.com/group/vss-members>. It also encourages members to work in with major international organisations such as the British Astronomical Association, the Center for Backyard Astrophysics and the American Association for Variable Star Observers.

To find out more, please visit our website, where, incidentally, you will find PDF copies of all our newsletters. Our website has a great deal of information for VSS members, and for anyone interested in southern hemisphere variable star research. All VSS project information and data is kept here too.

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Newsletter items

These are welcomed and should be sent to the Editor (phil@astrofizz.com). I'd prefer Microsoft Word (or compatible) files with graphics sent separately. Don't use elaborate formatting or fancy fonts and please do not send your contribution as a fully formatted PDF file.

Publication dates are January, April, July and October, nominally on the twentieth day of these months and the copy deadline is the thirteenth of the month though earlier would always be appreciated.

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