The Variable Star V Sculptoris

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Received April 13, 2016; accepted April 21, 2016

Abstract Multicolor photometry is presented for V Scl and six nearby sequence stars.

1. Introduction

The star V Sculptoris (V Scl) is a variable star of the Mira type. It is star 254-000149 in the UCAC4 catalogue (Zacharias *et al.* 2012), with coordinates R.A. = $00^h\ 08^m\ 37.362^s$, and Dec. = –39º 13' 04.91" (2000). V Scl also has been known as HD 409, HV 67, and AAVSO AUID 000-BBB-200. This long period variable star varies something like $8.7 \leq V \leq 15$th magnitude with a period on the order of 296.1 days (Watson *et al.* 2014).

Introductory comments concerning Mira variables are given in Percy (2007). Sample light curves are illustrated in Sterken (1996).

2. Observations

Data for V Scl were obtained by the author intermittantly over a period of fifteen years during his standard star program work. The CTIO 1.5-m telescope together with a photoelectric photometer and *UBVRI* filters were used to acquire the data on 1983 September 21, 1986 December 14, 1988 October 23, and 1998 September 26, all Universal Time (UT) dates. The data were reduced following procedures discussed in Landolt (2007), and were tied into *UBVRI* photometric standard stars current at the time of the data acquisition (Landolt 1983, 1992).

3. Discussion

The finding chart for V Scl and the stars which were observed near it are identified in Figure 1. The chart is based on a digitized version of the Palomar Observatory Sky Survey I (POSS I) blue survey (Palomar Observatory 1950–1957). The size of the field as presented in the chart is just under twenty arc minutes on a side. The sequence stars' identifications are listed in Table 1. The first column gives identification as used in Figure 1 and Table 1. The AAVSO AUID identifications are given in the second column. The third column lists the UCAC4 identification numbers (Zacharias *et al.* 2013), whose coordinates are in columns four and five.

The reduction process included the recovery of the magnitudes and color indices of the standard stars used in the observational program. These errors, as a function of UT observed date and for the magnitude and color indices, are given in Table 2. All nights were photometric. However, the observing window for the night 1998 September 26 UT ended with incoming fog.

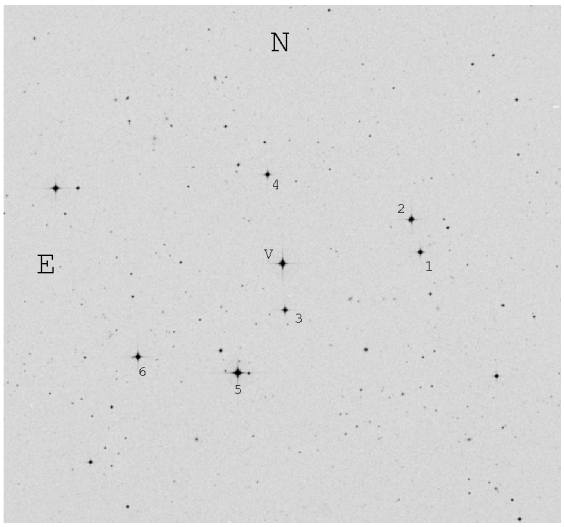

Figure 1. Chart for V Scl and neighboring stars.

Table 1. Sequence star name inter-comparison.

This Paper Star Name	*AUID*	*UCAC4*	*R.A. (J2000.0) h m s*	*Dec. (J2000.0) º ′ ″*
1	000–BJZ–991	254–000146	00 08 12.412	–39 12 47.83
2	000–BJZ–990	255–000151	00 08 13.883	–39 11 38.06
3	000–BJJ–803	254–000148	00 08 37.153	–39 14 42.52
4	000–BJJ–805	255–000156	00 08 39.793	–39 09 57.58
5	—	254–000152	00 08 45.891	–39 16 52.22
6	000–BBB–208	254–000154	00 09 03.866	–39 16 13.55

Table 2. RMS photometric errors for each night.

UT (mmddyy)	*V m*	*(B–V) m*	*(U–B) m*	*(V–R) m*	*(R–I) m*	*(V–I) m*
092183	0.012	0.014	0.029	0.006	0.012	0.012
121486	0.009	0.008	0.022	0.004	0.011	0.011
102388	0.009	0.010	0.042	0.008	0.006	0.009
092698	0.005	0.014	0.043	0.010	0.003	0.008

The observed magnitudes and color indices for V Scl and for the stars in its vicinity are located in Table 3 and Table 4, respectively. The number of decimals carried for the photometry in Table 3 was dictated by the accuracy of the original data. At its faintest, V Scl was too faint at the shorter wavelengths to obtain the highest accuracy given the equipment then available. In fact, although a very small signal was measured through the

Table 3. UBVRI photometry of V Scl.

UT (mmddyy)	*HJD*	*V m*	*(B–V) m*	*(U–B) m*	*(V–R) m*	*(R–I) m*	*(V–I) m*
092183	2445598.71595	15.07	+2.4	—	+3.085	+2.569	+5.667
092183	2445598.73077	15.08	+1.6	—	+3.065	+2.566	+5.643
121486	2446778.58947	13.864	+1.440	+0.203	—	—	—
121486	2446778.59206	13.856	+1.534	+0.440	+2.754	+2.525	+5.284
102388	2447457.65698	13.098	+1.544	+0.510	+2.536	+2.433	+5.005
092698	2451082.79679	10.020	+1.311	+0.508	—	—	—
092698	2451082.79890	10.014	+1.313	+0.474	—	—	—
092698	2451082.80034	10.022	+1.314	+0.509	—	—	—

Table 4. UBVRI photometry of stars near V Scl.

								Mean Error of Single Observation					
This Paper Star Name	*V m*	*(B–V) m*	*(U–B) m*	*(V–R) m*	*(R–I) m*	*(V–I) m*	*n*	*V m*	*(B–V) m*	*(U–B) m*	*(V–R) m*	*(R–I) m*	*(V–I) m*
1	12.991	+0.458	-0.023	+0.304	+0.292	+0.596	3	0.005	0.018	0.024	0.013	0.015	0.002
2	12.317	+0.598	+0.070	+0.345	+0.357	+0.703	3	0.001	0.018	0.009	0.005	0.006	0.005
3	12.790	+0.544	+0.043	+0.322	+0.311	+0.633	5	0.007	0.002	0.018	0.002	0.013	0.012
4	13.158	+0.379	-0.220	+0.264	+0.305	+0.568	4	0.007	0.017	0.015	0.005	0.009	0.014
5	11.561	-0.041	-0.090	-0.019	-0.026	-0.045	6	0.004	0.007	0.018	0.007	0.006	0.008
6	12.194	+0.638	+0.161	+0.360	+0.344	+0.705	3	0.003	0.005	0.036	0.003	0.003	0.001

U filter on 1983 September 21 UT, the reduced (*U–B*) value was deemed not credible, and hence was not retained.

Well determined photoelectric photometry should be useful in setting the zero point for visual and photographic photometry. Hence the data points for V Scl in Table 3 were compared to the photometry of V Scl in the AAVSO International Database (Kafka 2015), when such photometry existed. The comparison indicated that AAVSO database data near 1983 September 21 UT were on the order of 0.5 magnitude brighter than in Table 3. AAVSO database data reported near the dates 1986 December 14 UT, 1988 October 23 UT, and 1998 September 26 UT appear something like 0.4 magnitude fainter than photometry in Table 3. An AAVSO chart of 1950 equinox vintage of V Scl included a star labelled 13.3, near V Scl, as the faintest sequence star then available in the field. On the most recent AAVSO chart for V Scl, that same star is labelled 12.8. Similarly, a star labelled 12.6 on the 1950s chart currently is listed as 12.2. The older archived data need a zero point adjustment when the need arises for a more robust comparison to modern data.

Current photometry of stars in the vicinity of V Scl is given in Table 4. Star identifications which correspond to those identified in Figure 1 appear in the first column. Columns two through seven provide new photometry for these stars. The eighth column gives the total number of measures obtained. The last six columns present the mean error of a single magnitude and color index observation for these stars near V Scl.

Comparison of current sequence star photometry was made with APASS photometry, Data Release 6 (DR 6) in the UCAC4 catalogue, in the sense APASS photometry minus photometry in Table 4. The *V* magnitude comparsion was found to be –0.019 ± 0.014, and the (*B–V*) color index comparison was +0.020 ± 0.024.

4. Acknowledgements

It is a pleasure to thank the staff of CTIO for their help in making the observing runs a success, and to James L. Clem and Krista Romita for reminders in turning the manuscript into the appropriate format.

This work has been funded by AFOSR grants 77-3218 and 82-0192, STScI CW-0004-85 and NSF grants AST-9528177 and AST-0803158.

This research has made use of the VizieR catalogue access service and of the SIMBAD database, both at CDS, Strasbourg, France.

References

Kafka, S. 2015, variable star observations from the AAVSO International Database (https://www.aavso.org/aavso-international-database).

Landolt, A. U. 1983, Astron. J., 88, 439.

Landolt, A. U. 1992, Astron. J., 104, 340.

Landolt, A. U. 2007, in *The Future of Photometric, Spectrophotometric, and Polarimetric Standardization*, ed. C. Sterken, ASP Conf. Ser. 364, Astronomical Society of the Pacific, San Francisco, 27.

Palomar Observatory Sky Survey I (POSS I). 1950–1957 (http://stdatu.stsci.edu/cgi-bin/dss_form).

Percy, J. R. 2007, *Understanding Variable Stars*, Cambridge University Press, Cambridge, 209.

Sterken, C. 1996, in *Light Curves of Variable Stars*, eds., C. Sterken, C. Jaschek, Cambridge University Press, Cambridge, 106.

Watson, C., Henden, A. A., and Price, C. A. 2014, AAVSO International Variable Star Index VSX (Watson+, 2006–2014; http://www.aavso.org/vsx).

Zacharias, N., Finch, C. T., Girard, T. M., Henden, A., Bartlett, J. L., Monet, D. G., and Zacharias, M. I. 2012, The Fourth U.S. Naval Observatory CCD Astrograph Catalog (UCAC4), VizieR On-line Data Catalog (http://cdsarc.u-strasbg.fr/viz-bin/Cat?I/322).

Zacharias, N., Finch, C. T., Girard, T. M., Henden, A., Bartlett, J. L., Monet, D. G., and Zacharias, M. I. 2013, *Astron. J.*, **145**, 44.