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New Variable Stars in the Field of V651 Oph

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#	Name	Other	Coord (J2000)	Type	Max	Min	System	Period	Epoch (JD)	type	Sp	Comment	L.Curve	Find.Chart	Data
1		USNO-A2.0 0975-12361977	18 36 57.47, +09 34 17.6	EW	13.90	14.31		0.44152	2455450.3047	Min		Comm. 1	01_PC-R.png	01_chart.jpg	01_data.txt
2		USNO-A2.0 0975-12368478	18 37 03.55, +09 42 26.3	RRAB	16.30	17.34		0.51311	2455358.8692	Max			02_PC-R.png	02_chart.jpg	02_data.txt
3		2MASS 18370480+0914472	18 37 04.81, +09 14 47.3	EW	16.62	17.15		0.27854	2455358.5714	Min		Comm. 3	03_PC-R.png	03_chart.jpg	03_data.txt
4		2MASS 18370524+0930382	18 37 05.24, +09 30 38.3	EW	15.20	15.46		0.43506	2455438.5643	Min		Comm. 4	04_PC-R.png	04_chart.jpg	04_data.txt
5		2MASS 18371322+0945131	18 37 13.22, +09 45 13.2	EW	16.22	16.45		0.30005	2455438.315	Min		Comm. 5	05_PC-R.png	05_chart.jpg	05_data.txt
6		USNO-A2.0 0975-12380870	18 37 14.71, +10 02 54.2	EW	16.70	17.10		0.44820	2455358.5154	Min		Comm. 6	06_PC-R.png	06_chart.jpg	06_data.txt
7		USNO-A2.0 0975-12391541	18 37 23.95, +09 16 09.5	EW	16.06	16.34		0.3631	2455358.7060	Min		Comm. 7	07_PC-R.png	07_chart.jpg	07_data.txt
8		USNO-A2.0 0975-12392737	18 37 24.99, +09 29 06.0	EB	17.35	17.82		0.5224	2455358.8680	Min		Comm. 8	08_PC-R.png	08_chart.jpg	08_data.txt
9		USNO-A2.0 0975-12393204	18 37 25.40, +09 18 05.2	EA	15.54	15.76		0.8191	2455358.8360	Min		Comm. 9	09_PC-R.png	09_chart.jpg	09_data.txt
10		USNO-A2.0 0975-12396195	18 37 28.10, +09 44 16.7	EW	18.47	19.27		0.36599	2455358.4701	Min		Comm. 10	10_PC-R.png	10_chart.jpg	10_data.txt
11		USNO-A2.0 0975-12406263	18 37 37.10, +09 59 21.2	EW	16.51	17.03		0.41586	2455496.1676	Min		Comm. 11	11_PC-R.png	11_chart.jpg	11_data.txt
12		USNO-A2.0 0975-12412212	18 37 42.31, +10 00 13.3	EW	15.54	15.91		0.42139	2455439.3367	Min		Comm. 12	12_PC-R.png	12_chart.jpg	12_data.txt
13		USNO-A2.0 0975-12414757	18 37 44.52, +09 55 59.1	EB	15.01	15.23		1.1191	2455358.7908	Min		Comm. 13	13_PC-R.png	13_chart.jpg	13_data.txt
14		USNO-A2.0 0975-12418093	18 37 47.44, +09 34 30.4	EW	13.83	14.12		0.5491	2455358.4261	Min		Comm. 14	14_PC-R.png	14_chart.jpg	14_data.txt
15		USNO-A2.0 0975-12424250	18 37 52.83, +09 13 06.8	SR:	13.86	13.97		23.4	2455370.1	Max		Comm. 15	15_PC-R.png	15_chart.jpg	15_data.txt
16		USNO-A2.0 0975-12425913	18 37 54.25, +09 22 36.2	SR:	16.38	16.61		65.6:	2455382.0	Max		Comm. 16	16_PC-R.png	16_chart.jpg	16_data.txt
17		USNO-A2.0 0975-12446810	18 38 13.08, +09 49 08.4	EW	14.38	14.49		0.48683	2455495.1669	Min		Comm. 17	17_PC-R.png	17_chart.jpg	17_data.txt
18		USNO-A2.0 0975-12450169	18 38 16.13, +09 31 13.0	EW	13.85	14.18		0.58826	2455358.5618	Min			18_PC-R.png	18_chart.jpg	18_data.txt
19		USNO-A2.0 0975-12454494	18 38 20.04, +09 23 51.3	SXPHE	14.12	14.23		0.16781	2455358.6490	Max		Comm. 19	19_PC-R.png	19_chart.jpg	19_data.txt
20		USNO-A2.0 0975-12466796	18 38 30.67, +09 42 04.4	EW	17.05	17.35		0.31475	2455358.6435	Min		Comm. 20	20_PC-R.png	20_chart.jpg	20_data.txt
21		2MASS 18383967+0931561	18 38 39.67, +09 31 56.1	EB	13.92	14.35		0.61163	2455358.4792	Min		Comm. 21	21_PC-R.png	21_chart.jpg	21_data.txt

22		2MASS 18384578+0941543	18 38 45.79, +09 41 54.4	EW	16.14	16.56		0.34290	2455439.321	Min		Comm. 22	22_PC-R.png	22_chart.jpg	22_data.txt
23		USNO-A2.0 0975-12494265	18 38 54.63, +10 03 37.0	EW	16.42	16.67		0.35638	2455496.1764	Min		Comm. 23	23_PC-R.png	23_chart.jpg	23_data.txt
24		USNO-A2.0 0975-12497348	18 38 57.19, +09 13 27.2	RRAB	15.28	16.14		0.72508	2455359.6493	Max			24_PC-R.png	24_chart.jpg	24_data.txt
25		USNO-A2.0 0975-12498154	18 38 57.98, +10 02 48.4	EW	13.54	13.63		0.37333	2455440.3650	Min		Comm. 25	25_PC-R.png	25_chart.jpg	25_data.txt
26		USNO-A2.0 0975-12498985	18 38 58.69, +09 24 17.5	RRAB	16.43	17.43		0.52696	2455360.627	Max			26_PC-R.png	26_chart.jpg	26_data.txt
27		USNO-A2.0 0975-12500769	18 39 00.23, +09 57 32.5	EW	16.54	16.92		0.36804	2455358.7175	Min		Comm. 27	27_PC-R.png	27_chart.jpg	27_data.txt
28		USNO-A2.0 0975-12507485	18 39 05.85, +09 34 30.3	EW	17.78	18.34		0.36996	2455358.4812	Min		Comm. 28	28_PC-R.png	28_chart.jpg	28_data.txt
29		USNO-A2.0 0975-12516216	18 39 13.63, +09 45 07.5	EB	15.99	16.47		0.5704	2455358.4390	Min		Comm. 29	29_PC-R.png	29_chart.jpg	29_data.txt
30		USNO-A2.0 0975-12518361	18 39 15.57, +09 46 49.0	EW	15.24	15.78:		0.39775	2455358.4672	Min			30_PC-R.png	30_chart.jpg	30_data.txt
31		2MASS 18391835+0956282	18 39 18.36, +09 56 28.2	EB	15.69	15.87		0.56365	2455358.8273	Min		Comm. 31	31_PC-R.png	31_chart.jpg	31_data.txt
32		USNO-A2.0 0975-12523929	18 39 20.59, +09 44 01.2	BY:	15.22	15.34		5.33	2455362.9718	Max		Comm. 32	32_PC-R.png	32_chart.jpg	32_data.txt
33		USNO-A2.0 0975-12534678	18 39 30.90, +10 03 50.3	EB	15.60	16.08		0.51409	2455358.8265	Min		Comm. 33	33_PC-R.png	33_chart.jpg	33_data.txt
34		2MASS 18393235+0933031	18 39 32.36, +09 33 03.2	RRAB	17.30	18.48		0.61353	2455495.1908	Max		Comm. 34	34_PC-R.png	34_chart.jpg	34_data.txt
35		USNO-A2.0 0975-12541894	18 39 38.07, +10 02 09.2	SXPHE	15.59	15.79		0.116531	2455438.3228	Max		Comm. 35	35_PC-R.png	35_chart.jpg	35_data.txt
36		USNO-A2.0 0975-12544695	18 39 40.65, +09 48 18.3	RRC	14.36	14.77		0.32865	2455358.5947	Max			36_PC-R.png	36_chart.jpg	36_data.txt
37		USNO-A2.0 0975-12549291	18 39 44.95, +09 54 19.9	EW	15.05	15.35		0.27150	2455358.7514	Min		Comm. 37	37_PC-R.png	37_chart.jpg	37_data.txt
38		USNO-A2.0 0975-12549456	18 39 45.03, +09 51 24.0	EW	18.29	19.33		0.25894	2455358.5663	Min		Comm. 38	38_PC-R.png	38_chart.jpg	38_data.txt
39		2MASS 18394918+1003154	18 39 49.19, +10 03 15.4	EW	16.78	17.05		0.46354	2455358.6147	Min		Comm. 39	39_PC-R.png	39_chart.jpg	39_data.txt
40		2MASS 18395488+0913386	18 39 54.88, +09 13 38.6	SXPHE	13.40	13.59		0.115325	2455439.3290	Max		Comm. 40	40_PC-R.png	40_chart.jpg	40_data.txt
41		USNO-A2.0 0975-12561702	18 39 56.66, +09 22 13.6	EW	14.91	15.28		0.32553	2455439.3525	Min		Comm. 41	41_PC-R.png	41_chart.jpg	41_data.txt
42		USNO-A2.0 0975-12573813	18 40 07.86, +09 36 58.0	EW	16.26	16.52		0.29085	2455439.3205	Min		Comm. 42	42_PC-R.png	42_chart.jpg	42_data.txt
43		USNO-A2.0 0975-12576522	18 40 10.24, +09 59 45.1	EB	15.98	16.37		0.50996	2455358.5865	Min		Comm. 43	43_PC-R.png	43_chart.jpg	43_data.txt
44		2MASS 18401586+0919466	18 40 15.86, +09 19 46.6	EW	15.41	15.75		0.35451	2455439.3408	Min		Comm. 44	44_PC-R.png	44_chart.jpg	44_data.txt
45		USNO-A2.0 0975-12590654	18 40 23.22, +10 02 46.1	HADS	14.81	15.47		0.074142	2455439.3188	Max		Comm. 45	45_PC-R.png	45_chart.jpg	45_data.txt
46		USNO-A2.0 0975-12598810	18 40 30.79, +09 12 39.4	EW	16.95	17.31		0.37688	2455358.7080	Min		Comm. 46	46_PC-R.png	46_chart.jpg	46_data.txt

Comments:

1. Primary minimum: HJD(TT) 2455450.3047 ± 0.0001. $Min_{II} = 14^{m}.29$.

3. A close pair of stars: 2MASS 18370480+0914472 and 2MASS 18370454+0914489; 2MASS 18370480+0914472 varies. $Min_{II} = 17^{m}.15$.

4. A close pair of stars: 2MASS 18370536+0930434 and 2MASS 18370524+0930382; 2MASS 18370524+0930382 varies. Type RRC and period $0^{d}.21753$ are also possible. $Min_{II} = 15^{m}.46$.

5. A close pair of stars: 2MASS 18371343+0945095 and 2MASS 18371322+0945131; 2MASS 18371322+0945131 varies. Primary minimum: HJD(TT) 2455438.315 ± 0.001. $Min_{II} = 16^{m}.41$.

6. Min_{II} is fainter than $17^m.03$.

7. $Min_{II} = 16^m.34$:.

8. $Min_{II} = 17^m.54$.

9. A close triplet of stars: USNO-A2.0 0975-12393204 and two faint stars, not present in any catalogues separately; USNO-A2.0 0975-12393204 varies. $Min_{II} = 15^m.74$.

10. $Min_{II} = 19^m.09$:.

11. Primary minimum: HJD(TT) 2455496.1676 ± 0.0008. $Min_{II} = 16^m.98$.

12. O'Connell effect. Primary minima:

HJD(TT)	±
2455439.3367	0.0005
2455450.2928	0.0007

$Min_{II} = 15^m.90$.

13. $Min_{II} = 15^m.09$.

14. A close pair of stars with equal brightness not found in any catalogues separately. The light curve shape varies, presumably because of spot activity. Type RRC and period $0^d.2746$ are also possible. $Min_{II} = 14^m.09$.

15. Infrared colors J–H = 0.960, H–K = 0.269 and J–K = 1.229 (2MASS) are consistent with the M spectral type (Bessell and Brett 1988) and SR: classification.

16. Infrared colors J–H = 0.990, H–K = 0.315 and J–K = 1.305 (2MASS) are consistent with the M spectral type (Bessell and Brett 1988) and SR: classification.

17. Primary minimum: HJD(TT) 2455495.1669 ± 0.0004. $Min_{II} = 14^m.49$.

19. A close pair of stars with equal brightness not found in any catalogues separately.

20. $Min_{II} = 17^m.35$.

21. $Min_{II} = 14^m.14$.

22. Primary minimum: HJD(TT) 2455439.321 ± 0.001. $Min_{II} = 16^m.41$.

23. Primary minimum: HJD(TT) 2455496.1764 ± 0.0006. $Min_{II} = 16^m.63$.

25. O'Connell effect. Primary minimum: HJD(TT) 2455440.3649 ± 0.0008. $Min_{II} = 13^m.62$.

27. A close triplet of stars: USNO-A2.0 0975-12500769, 2MASS 18390008+0957365 and a faint star, not found in any catalogues. $Min_{II} = 16^m.80$.

28. $Min_{II} = 18^m.27$.

29. O'Connell effect. $Min_{II} = 16^m.23$.

31. A close pair of stars: 2MASS 18391835+0956282 and 2MASS 18391860+0956266; 2MASS 18391835+0956282 varies.

32. Infrared colors J–H = 0.627, H–K = 0.262 and J–K = 0.889 (2MASS) are consistent with the K spectral type (Bessell and Brett 1988) and BY: classification.

33. Min_{II} is fainter than $16^m.01$.

34. Maxima:

HJD(TT)	±
2455439.356	0.001
2455495.1908	0.0002

35. Maxima:

HJD(TT)	±
2455438.3228	0.0006
2455495.1886	0.0006

37. A close pair of stars with equal brightness not found in any catalogues separately. $Min_{II} = 15^m.28$.

38. $Min_{II} = 19^m.05$.

39. A close pair of stars: 2MASS 18394906+1003199 and 2MASS 18394918+1003154; 2MASS 18394918+1003154 varies. $Min_{II} = 17^m.00$:.

40. A close pair of stars: 2MASS 18395488+0913386 and 2MASS 18395504+0913431; 2MASS 18395488+0913386 varies.

41. A close pair of stars: USNO-A2.0-0975-12561702 and a faint star, not found in any catalogues. Primary minimum: HJD(TT) 2455439.3525 ± 0.0006. $Min_{II} = 15^m.27$.

42. O'Connell effect. Primary minimum: HJD(TT) 2455439.317 ± 0.001. $Min_{II} = 16^m.51$.

43. O'Connell effect. $Min_{II} = 16^m.20$.

44. A close pair of stars: 2MASS-18401586+0919466 and 2MASS 18401591+0919409; 2MASS 18401586+0919466 varies. Primary minimum: HJD(TT) 2455439.3408 ± 0.0008. $Min_{II} = 15^m.70$.

45. Maxima:

HJD(TT)	±
2455439.3188	0.0008
2455450.2929	0.0006

46. $Min_{II} = 17^m.28$.

Remarks:

During observations of the field of variable star V651 Oph, we discovered 46 new variable stars. Our observations were carried out at the Astrotel-Caucasus observatory using the 300-mm Ritchey-Chretien telescope, equipped with an unfiltered Apogee Alta U9000 CCD camera. A total of 191 images with 5-minute exposures were obtained on JD 2455360–2455496. For basic reductions for dark current, flat fields, bias, and for removing cosmic rays hits we used IRAF routines. For search and photometry of new variable stars, we applied VaST software by Sokolovsky and Lebedev (2005). The comparison star was USNO-A2.0 0975-12485272 = USNO-B1.0 0995-0376789 ($\alpha=18^h38^m46^s.81$, $\delta=+09°34'\,38''.8$, J2000; 2MASS), $R_1 = 14^m.26$, $R_2 = 13^m.74$ (USNO-B1.0). Unfiltered magnitudes were calibrated using the comparison star, assuming $R_{comp} = 14^m.00$. The coordinates of the variable stars in the table were drawn from the 2MASS catalogue (Skrutskie et al. 2006). For search for periods and epochs of extrema, we use Peranso software.

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