

## New Variable Stars in Lacerta: Area of $2^{\circ}.3 \times 2^{\circ}.3$ , Centered at $\alpha=22^{\text{h}}50^{\text{m}}$ , $\delta=50^{\circ}00'$ (2000.0). Part I

[E. G. Lapukhin](#)<sup>#1</sup>, [S. A. Veselkov](#)<sup>#1</sup>, [A. M. Zubareva](#)<sup>#2,3</sup>, [E. D. Starovoi](#)<sup>#1</sup>, [I. V. Kolbasina](#)<sup>#1</sup>

#1. Siberian State Aerospace University, Krasnoyarsk, Russia;

#2. Institute of Astronomy, Russian Academy of Sciences, Moscow, Russia;

#3. Sternberg Astronomical Institute, Lomonosov Moscow State University, Moscow, Russia

Received: 5.06.2013; accepted: 24.04.2014

(E-mail for contact: [slovoktk@mail.ru](mailto:slovoktk@mail.ru))

#	Name	Other	Coord (J2000)	Type	Max	Min	System	Period	Epoch (JD)	type	Sp	Comment	L.Curve	Find.Chart	Data
1		USNO-A2.0 1350-17188705	22 42 42.16, +50 11 11.2	EW	14.27	< 15		0.31981	2455833.401	Min			<a href="#">lc24723.png</a>	<a href="#">ch_24723.png</a>	<a href="#">out24723.txt</a>
2		USNO-A2.0 1350-17196881	22 42 57.90, +50 04 59.0	EW	13.47	14.01		0.38601	2455831.237	Min			<a href="#">lc16487.png</a>	<a href="#">ch_16487.png</a>	<a href="#">out16487.txt</a>
3		USNO-A2.0 1350-17197447	22 42 59.02, +50 04 24.7	ELL:	12.87	12.94		0.7984	2455802.468	Min			<a href="#">lc16322.png</a>	<a href="#">ch_16322.png</a>	<a href="#">out16322.txt</a>
4		USNO-A2.0 1350-17199494	22 43 03.04, +50 26 33.4	EA	12.54	12.63:		1.08916	2455790.025	Min			<a href="#">lc31446.png</a>	<a href="#">ch_31446.png</a>	<a href="#">out31446.txt</a>
5		USNO-A2.0 1350-17203448	22 43 10.61, +50 32 56.4	EW	15.96	16.35		0.4514	2455825.251	Min			<a href="#">lc29979.png</a>	<a href="#">ch_29979.png</a>	<a href="#">out29979.txt</a>
6		USNO-A2.0 1350-17204990	22 43 13.60, +50 30 51.5	EA	14.81	15.19		3.526	2455796.39	Min			<a href="#">lc30446.png</a>	<a href="#">ch_30446.png</a>	<a href="#">out30446.txt</a>
7		2MASS J22431499+5028244	22 43 14.999, +50 28 24.43	BY:	13.41	13.47		1.5733	2455789.883	Max		<a href="#">Comm. 7</a>	<a href="#">lc30950.png</a>	<a href="#">ch_30950.png</a>	<a href="#">out30950.txt</a>
8		USNO-A2.0 1350-17211981	22 43 27.04, +50 19 36.4	LB:	12.18	12.39				other		<a href="#">Comm. 8</a>	<a href="#">lc22923.png</a>	<a href="#">ch_22923.png</a>	<a href="#">out22923.txt</a>
9		USNO-A2.0 1350-17213786	22 43 30.48, +49 59 59.1	EW	15.35	15.48		0.35027	2455823.193	Min		<a href="#">Comm. 9</a>	<a href="#">lc15312.png</a>	<a href="#">ch_15312.png</a>	<a href="#">out15312.txt</a>
10		USNO-A2.0 1350-17214555	22 43 31.98, +49 38 29.5	EW	13.70	13.93		0.410807	2455819.243	Min			<a href="#">lc10366.png</a>	<a href="#">ch_10366.png</a>	<a href="#">out10366.txt</a>
11		USNO-A2.0 1350-17214997	22 43 32.80, +49 26 01.1	EW	16.89	17.60		0.36329	2455824.067	Min			<a href="#">lc1111.png</a>	<a href="#">ch_1111.png</a>	<a href="#">out01111.txt</a>
12		USNO-A2.0 1350-17215450	22 43 33.66, +49 03 49.2	EW	15.55	15.76		0.3836	2455821.401	Min		<a href="#">Comm. 12</a>	<a href="#">lc02819.png</a>	<a href="#">ch_02819.png</a>	<a href="#">out02819.txt</a>
13		USNO-A2.0 1350-17215928	22 43 34.62, +50 02 40.8	EW	16.40	16.78		0.27245	2455823.242	Min			<a href="#">lc15969.png</a>	<a href="#">ch_15969.png</a>	<a href="#">out15969.txt</a>
14		USNO-A2.0 1350-17216219	22 43 35.15, +50 21 01.0	EW	16.26	17.00:		0.35523	2455825.084	Min			<a href="#">lc22745.png</a>	<a href="#">ch_22745.png</a>	<a href="#">out22745.txt</a>
15		USNO-A2.0 1350-17224773	22 43 51.72, +50 15 16.5	EW	16.66	17.30		0.38427	2455824.090	Min			<a href="#">lc2113.png</a>	<a href="#">ch_2113.png</a>	<a href="#">out02113.txt</a>
16		USNO-A2.0 1350-17224894	22 43 51.95, +49 04 05.4	LB:	13.30	13.40				other		<a href="#">Comm. 16</a>	<a href="#">lc02652.png</a>	<a href="#">ch_02652.png</a>	<a href="#">out02652.txt</a>
17		USNO-A2.0 1350-17229561	22 44 01.20, +49 03 02.8	EW	15.50	16.12		0.42546	2455834.040	Min		<a href="#">Comm. 17</a>	<a href="#">lc02551.png</a>	<a href="#">ch_02551.png</a>	<a href="#">out02551.txt</a>
18		USNO-A2.0 1350-17233266	22 44 08.36, +49 58 58.8	BY:	14.55	14.67		0.81681	2455829.336	Max			<a href="#">lc14939.png</a>	<a href="#">ch_14939.png</a>	<a href="#">out14939.txt</a>
19		USNO-A2.0 1350-17237214	22 44 16.18, +49 21 35.0	EW	13.92	14.15		0.35319	2455823.123	Min			<a href="#">lc06496.png</a>	<a href="#">ch_06496.png</a>	<a href="#">out06496.txt</a>
20		USNO-A2.0 1350-17240547	22 44 22.76, +50 39 18.2	EA	15.17	15.51		5.920	2455817.251	Min		<a href="#">Comm. 20</a>	<a href="#">lc21559.png</a>	<a href="#">ch_21559.png</a>	<a href="#">out21559.txt</a>
21		USNO-A2.0 1350-17241811	22 44 25.21, +50 45 34.6	EW	16.29	16.55		0.38370	2455823.238	Min			<a href="#">lc3132.png</a>	<a href="#">ch_3132.png</a>	<a href="#">out03132.txt</a>
22		USNO-A2.0 1350-17243174	22 44 27.97, +49 45 08.2	EW	15.08	15.35		0.41399	2455823.177	Min			<a href="#">lc11702.png</a>	<a href="#">ch_11702.png</a>	<a href="#">out11702.txt</a>

23	USNO-A2.0 1350-17244488	22 44 30.55, +48 51 35.8	EW	14.54	14.68		0.38771	2455820.147	Min			<a href="#">lc49347.png</a>	<a href="#">ch_49347.png</a>	<a href="#">out49347.txt</a>
24	USNO-A2.0 1350-17244906	22 44 31.34, +49 08 02.5	EA	15.71	16.45		2.917	2455820.26	Min			<a href="#">lc03584.png</a>	<a href="#">ch_03584.png</a>	<a href="#">out03584.txt</a>
25	USNO-A2.0 1350-17244918	22 44 31.38, +50 45 24.5	DSCTC	13.12	13.14		0.097798	2455790.308	Max			<a href="#">lc27479.png</a>	<a href="#">ch_27479.png</a>	<a href="#">out27479.txt</a>
26	USNO-A2.0 1350-17245566	22 44 32.66, +49 43 55.6	EA	14.93	15.86		4.754	2455823.763	Min		<a href="#">Comm. 26</a>	<a href="#">lc11440.png</a>	<a href="#">ch_11440.png</a>	<a href="#">out11440.txt</a>
27	USNO-A2.0 1350-17245893	22 44 33.30, +50 06 59.9	EW	13.40	13.53		0.29450	2455790.228	Min			<a href="#">lc16748.png</a>	<a href="#">ch_16748.png</a>	<a href="#">out16748.txt</a>
28	USNO-A2.0 1350-17247376	22 44 36.27, +49 33 07.2	EB	14.21	14.54		5.308	2455829.76	Min			<a href="#">lc08702.png</a>	<a href="#">ch_08702.png</a>	<a href="#">out08702.txt</a>
29	USNO-A2.0 1350-17248166	22 44 37.92, +50 04 34.4	BY:	13.58	13.61		0.46900	2455790.533	Max			<a href="#">lc16134.png</a>	<a href="#">ch_16134.png</a>	<a href="#">out16134.txt</a>
30	USNO-A2.0 1350-17248275	22 44 38.12, +49 57 11.8	EW	16.07	16.39		0.3331	2455802.281	Min			<a href="#">lc14593.png</a>	<a href="#">ch_14593.png</a>	<a href="#">out14593.txt</a>
31	USNO-A2.0 1350-17248400	22 44 38.38, +50 34 27.0	EA	13.92	14.58		2.637	2455790.014	Min			<a href="#">lc29770.png</a>	<a href="#">ch_29770.png</a>	<a href="#">out29770.txt</a>
32	USNO-A2.0 1350-17250667	22 44 42.83, +49 03 09.8	BY	15.35	15.49		6.15	2455825.1	Max		<a href="#">Comm. 32</a>	<a href="#">lc02484.png</a>	<a href="#">ch_02484.png</a>	<a href="#">out02484.txt</a>
33	USNO-A2.0 1350-17252302	22 44 46.29, +48 57 18.5	EA	15.14	15.85		1.165	2455795.877	Min		<a href="#">Comm. 33</a>	<a href="#">lc1121.png</a>	<a href="#">ch_1121.png</a>	<a href="#">out01121.txt</a>
34	USNO-A2.0 1350-17257358	22 44 56.36, +50 12 13.9	EA	12.92	12.96		2.651	2455790.945	Min			<a href="#">lc24752.png</a>	<a href="#">ch_24752.png</a>	<a href="#">out24752.txt</a>
35	USNO-A2.0 1350-17258939	22 44 59.54, +49 49 45.2	LB:	11.79:	11.94:				other		<a href="#">Comm. 35</a>	<a href="#">lc50226.png</a>	<a href="#">ch_50226.png</a>	<a href="#">out50226.txt</a>
36	USNO-A2.0 1350-17259488	22 45 00.61, +49 37 43.5	BY:	15.20	15.33		1.344	2455821.419	Max			<a href="#">lc10061.png</a>	<a href="#">ch_10061.png</a>	<a href="#">out10061.txt</a>
37	USNO-A2.0 1350-17259815	22 45 01.25, +49 56 57.5	LB:	12.82	12.99				other		<a href="#">Comm. 37</a>	<a href="#">lc14329.png</a>	<a href="#">ch_14329.png</a>	<a href="#">out14329.txt</a>
38	USNO-A2.0 1350-17260048	22 45 01.71, +50 22 17.3	EW	17.09	17.90		0.33241	2455825.206	Min			<a href="#">lc3113.png</a>	<a href="#">ch_3113.png</a>	<a href="#">out03113.txt</a>
39	USNO-A2.0 1350-17262414	22 45 06.40, +48 55 59.3	EW	14.66	14.88		0.4816	2455819.206	Min			<a href="#">lc00838.png</a>	<a href="#">ch_00838.png</a>	<a href="#">out00838.txt</a>
40	USNO-A2.0 1350-17262597	22 45 06.75, +50 53 14.8	LB:	13.09	13.36				other		<a href="#">Comm. 40</a>	<a href="#">lc42398.png</a>	<a href="#">ch_42398.png</a>	<a href="#">out42398.txt</a>
41	USNO-A2.0 1350-17263064	22 45 07.59, +49 37 58.9	DSCTC	13.28	13.30		0.047526	2455790.286	Max			<a href="#">lc10018.png</a>	<a href="#">ch_10018.png</a>	<a href="#">out10018.txt</a>
42	USNO-A2.0 1350-17264794	22 45 11.03, +49 06 43.8	EW	16.26	16.63		0.33091	2455819.250	Min			<a href="#">lc44098.png</a>	<a href="#">ch_44098.png</a>	<a href="#">out44098.txt</a>
43	2MASS J22451517+4904573	22 45 15.173, +49 04 57.33	EW	13.03	13.10		0.40138	2455800.103	Min		<a href="#">Comm. 43</a>	<a href="#">lc02577.png</a>	<a href="#">ch_02577.png</a>	<a href="#">out02577.txt</a>
44	USNO-A2.0 1350-17271530	22 45 24.04, +49 44 29.8	EA	14.16	14.58		0.75661	2455800.443	Min			<a href="#">lc43673.png</a>	<a href="#">ch_43673.png</a>	<a href="#">out43673.txt</a>
45	USNO-A2.0 1350-17271622	22 45 24.23, +49 35 30.7	EW	13.79	13.84		0.35401	2455790.408	Min		<a href="#">Comm. 45</a>	<a href="#">lc09431.png</a>	<a href="#">ch_09431.png</a>	<a href="#">out09431.txt</a>
46	USNO-A2.0 1350-17272895	22 45 26.72, +50 37 51.8	EW	15.04	15.32		0.29994	2455825.075	Min			<a href="#">lc29135.png</a>	<a href="#">ch_29135.png</a>	<a href="#">out29135.txt</a>
47	USNO-A2.0 1350-17274441	22 45 29.64, +50 45 27.6	EA	17.03	17.91		0.24862	2455819.371	Min			<a href="#">lc3121.png</a>	<a href="#">ch_3121.png</a>	<a href="#">out03121.txt</a>
48	USNO-A2.0 1350-17274829	22 45 30.43, +49 18 20.0	EW	16.16	16.44		0.36348	2455821.482	Min			<a href="#">lc05677.png</a>	<a href="#">ch_05677.png</a>	<a href="#">out05677.txt</a>
49	USNO-A2.0 1350-17275322	22 45 31.38, +49 07 57.8	DSCT:	16.52	16.77		0.17934	2455823.215	Max			<a href="#">lc45322.png</a>	<a href="#">ch_45322.png</a>	<a href="#">out45322.txt</a>
50	USNO-A2.0 1350-17276142	22 45 33.00, +49 35 27.3	EW	13.40	13.79		0.64007	2455831.999	Min		<a href="#">Comm. 50</a>	<a href="#">lc09326.png</a>	<a href="#">ch_09326.png</a>	<a href="#">out09326.txt</a>
51	2MASS J22453398+4906590	22 45 33.983, +49 06 59.07	EW	14.02	14.09		0.34845	2455822.504	Min		<a href="#">Comm. 51</a>	<a href="#">lc03167.png</a>	<a href="#">ch_03167.png</a>	<a href="#">out03167.txt</a>
52	USNO-A2.0 1350-17281771	22 45 44.28, +49 04 14.0	LB:	13.61	13.76				other		<a href="#">Comm. 52</a>	<a href="#">lc1131.png</a>	<a href="#">ch_1131.png</a>	<a href="#">out01131.txt</a>
53	2MASS J22454859+4916322	22 45 48.596, +49 16 32.29	EW	13.71	13.79		0.6259	2455833.419	Min		<a href="#">Comm. 53</a>	<a href="#">lc05196.png</a>	<a href="#">ch_05196.png</a>	<a href="#">out05196.txt</a>
54	USNO-A2.0 1350-17287839	22 45 56.45, +50 53 16.3	BY:	12.33	12.45		15	2455824.2	Max			<a href="#">lc25850.png</a>	<a href="#">ch_25850.png</a>	<a href="#">out25850.txt</a>
55	USNO-A2.0 1350-17289062	22 45 58.86, +49 52 44.3	EW	15.32	15.50		0.35925	2455823.367	Min			<a href="#">lc13336.png</a>	<a href="#">ch_13336.png</a>	<a href="#">out13336.txt</a>
56	USNO-A2.0 1350-17294911	22 46 10.83, +50 43 45.4	EW	16.47	16.67		0.37158	2455823.267	Min			<a href="#">lc3114.png</a>	<a href="#">ch_3114.png</a>	<a href="#">out03114.txt</a>
57	USNO-A2.0 1350-17296584	22 46 14.36, +50 48 28.9	EW	15.95	16.63		0.29723	2455820.246	Min			<a href="#">lc3123.png</a>	<a href="#">ch_3123.png</a>	<a href="#">out03123.txt</a>

58	USNO-A2.0 1350-17303918	22 46 29.36, +48 59 55.3	LB:	12.43	12.65					other		<a href="#">Comm. 58</a>	<a href="#">lc1141.png</a>	<a href="#">ch_1141.png</a>	<a href="#">out01141.txt</a>
59	USNO-A2.0 1350-17305872	22 46 33.39, +49 10 00.3	EA/RS	13.56	13.63		5.17:	2455822.928	Min				<a href="#">lc03718.png</a>	<a href="#">ch_03718.png</a>	<a href="#">out03718.txt</a>
60	USNO-A2.0 1350-17307384	22 46 36.42, +49 53 55.9	EW	16.93	17.41		0.2668	2455822.489	Min				<a href="#">lc2116.png</a>	<a href="#">ch_2116.png</a>	<a href="#">out02116.txt</a>
61	USNO-A2.0 1350-17309600	22 46 41.09, +50 12 49.6	BY:	13.42	13.47		18.5	2455824.0	Max				<a href="#">lc17760.png</a>	<a href="#">ch_17760.png</a>	<a href="#">out17760.txt</a>
62	USNO-A2.0 1350-17309889	22 46 41.65, +50 46 48.8	EA	13.83	14.06		1.371:	2455820.263	Min		<a href="#">Comm. 62</a>	<a href="#">lc27325.png</a>	<a href="#">ch_27325.png</a>	<a href="#">out27325.txt</a>	

### Comments:

7. Combined brightness of two close stars, 2MASS J22431530+5028249 (J = 13.413, H = 13.470, K = 13.470) and 2MASS J22431499+5028244 (J = 13.907, H = 13.582, K = 13.487), was measured. The second one probably varies.

8. J = 8.182, H = 7.206, K = 6.851 (2MASS).

9. Combined brightness of two close stars, 2MASS J22433052+5000002 (J = 14.922, H = 14.580, K = 14.514) and 2MASS J22433029+4959576 (J = 14.906, H = 14.551, K = 14.323), was measured.

12. P = 0<sup>d</sup>.19176 is also possible with DSCT type.

16. J = 10.550, H = 9.639, K = 9.390 (2MASS).

17. Min<sub>II</sub> = 15<sup>m</sup>.88.

20. Twice shorter period is also possible.

26. O'Connell effect.

32. J = 13.408, H = 12.793, K = 12.616 (2MASS).

33. O'Connell effect.

35. J = 9.655, H = 9.081, K = 8.900 (2MASS).

37. J = 9.613, H = 8.622, K = 8.358 (2MASS).

40. J = 9.189, H = 8.198, K = 7.897 (2MASS).

43. Combined brightness of two close stars, 2MASS J22451536+4904507 (J = 11.902, H = 11.554, K = 11.459) and 2MASS J22451517+4904573 (J = 13.525, H = 13.325, K = 13.276), was measured. The first one probably varies.

45. Combined brightness of two close stars, 2MASS J22452406+4935318 (J = 13.393, H = 13.038, K = 13.028) and 2MASS J22451517+4904573 (J = 13.525, H = 13.325, K = 13.276), was measured.

50. Min<sub>II</sub> = 13<sup>m</sup>.74.

51. Min<sub>II</sub> = 14<sup>m</sup>.07.

Combined brightness of two close stars, 2MASS J22453398+4906590 (J = 14.300, H = 13.834, K = 13.785) and 2MASS J22453405+4907033 (J = 13.100, H = 12.910, K = 12.819), was measured. The first one probably varies.

52. J = 10.539, H = 9.570, K = 9.166 (2MASS).

53.  $\text{Min}_{\text{II}} = 13^{\text{m}}.77$ .

Combined brightness of two close stars, 2MASS J22454829+4916265 (J = 12.929, H = 12.761, K = 12.716) and 2MASS J22454858+4916322 (J = 14.979, H = 14.552, K = 14.433), was measured. The second one probably varies.

58. J = 9.417, H = 8.478, K = 8.213 (2MASS).

62. Only one minimum was observed.

### Remarks:

On August 16 – October 30, 2011, we obtained about 1600 images with 30-second exposures of a field in Lacerta for discovery and investigation of new variables stars.

The field center has the coordinates  $\alpha = 22^{\text{h}}50^{\text{m}}$ ,  $\delta = +50^{\circ}00'$ , and the size of our frames is  $2^{\circ}.3 \times 2^{\circ}.3$ . In this paper, we present the first part of our results.

Our observations were performed in the city of Krasnoyarsk with a Hamilton telescope (D = 400 mm, F = 915 mm) equipped with an unfiltered FLI ML-9000 CCD camera (3056 × 3056 pixels, pixel size 12  $\mu\text{m}$ ).

For basic reductions for dark current, flat fields, bias, and for removing cosmic-ray hits, we used MaxImDL software.

The magnitudes were referred to red magnitudes of comparison stars from the USNO-A2.0 catalog (Monet et al. 1998).

For search and photometry of the majority of the new variable stars, we applied [VaST](#) software (developed by K. Sokolovsky and A. Lebedev, described by Kolesnikova et al. 2008). Several variable stars were found with the [C-Munipack](#) package.

To search for periods, we applied [WinEfk software](#) provided by Dr. V.P. Goranskij.

Acknowledgements: The authors wish to thank Dr. V.P. Goranskij for providing his efficient period-search software, Dr. K. Sokolovsky and A. Lebedev for their fine VaST software.

### References:

Monet, D., Bird, A., Canzian, B., et al., 1998, USNO-A2.0, A Catalog of Astrometric Standards (U.S. Naval Observatory, Washington, DC), Centre de Données Astronomiques de Strasbourg, I/252  
Kolesnikova, D.M., Sat, L.A., Sokolovsky, K.V., et al., 2008, Acta Astron., 58, 279