The Red Dwarf Stars of the UV Ceti-Type in the Neighbourhood of the Sun

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The intensive patrol observations of red dwarf stars during last years, carried out in the Crimea, Chile, Catania, South Africa, Armenia, Japan and other observatories led to appreciable increase of number of known UV Ceti-type objects. It permits us to complete the known lists of the variables (1—4). At the same time it is worth-while to define more precisely the criteria to consider a star as the UV Ceti-type variable, and to carry out strong selection of the certain UV Cet-type variables from the objects suspected to be this type variables.

The following definition of the UV Cet-type variables was given in (5): „dMe stars, sometimes subjected to flares with the amplitude from 1^m to 6^m. Maximum brightness is attained in seconds or dozens of seconds after the commencement of the flare, the star returns to the its normal brightness after several minutes, or dozens of minutes. A typical representative is UV Ceti." Now it is impossible to consider this definition as a quite right because: 1) There are a number of M-dwarf stars affected by the flares similar to the UV Ceti flares, but in their quiet state spectra no emission lines are observed. For example, BD+43°44 A, BD+43°44 B and SZ UMa, the flare activity of these stars were detected in Crimea; and probably, BD−4°4048 B suspected as the flare star by HERBIG. 2) The lower limit of flare amplitude cited in (5) corresponds to visual observations, but the modern photoelectric observations register flares with amplitudes to 0^m02—0^m05. Therefore we suppose, that UV Cet-type variables are K-M dwarfs, which show quick flares with amplitudes exceeding the observational errors, and duration of the flares are from a few seconds up to a few hundred minutes.

Table 1 includes only such variable K-M dwarf stars, for which existing observations allow to construct flare light curves. All stars in Table 1, except V 371 Ori, have photoelectric flare light curves. The strong flare of V 371 Ori was observed in radio region, but simultaneous optical observations were carried out photographically and visually only.

Table 1 contains following data: 1) the number from the catalogue (6); 2) names from (5); 3) the designations from the other catalogues; 4—5) Right ascention and declination for 1950.0; 6) spectral type; 7—8) V, B-V — the apparent magnitude and the colour; 9) the absolute magnitude M_V. All data in the columns 1—9 were taken from (5—7). In two last columns bibliography of original investigations or surveys is given: in the column 10 for the flares photometric observations and in the column 11 for the flares spectral observations. For close double stars a symbol J in columns 7—10 denotes that the published photometry and the flare observations were carried out for the combined light. An asterisk in the column 1 means that there is a note after the Table 1.

https://doi.org/10.1017/S0252921100032863 Published online by Cambridge University Press

Table 1: The red dwarf stars of the UV Cet-type in the neighbourhood of the Sun

Gliese's numbers	Names of stars		α_{1950}	δ_{1950}	Sp	V	B-V	M_V	References ph	ds
1	2	3	4	5	6	7	8	9	10	11
15A*		BD+43°44A	$0^h15^m31^s$	+43°44'.4	M1V	$8^m.07$	$1^m.56$	$10^m.32$	8	
15B*		BD+43°44B	0 15 34	+43°44.7	M6Ve	11.04	1.80	13.29	8	4
51	V388 Cas	Wolf 47	1 00 08	+62 05.8	dM7e	13.66	1.68	13.81	9	
54.1		LP M 63	1 09.9	−17 16	dM5e	11.6		12.4	10	
65A*		L 726-8A	1 36 25	−18 12.7	dM5.5e	12.45		15.27	4J	4
65B*	UV Cet	L726-8B			dM5.5e	12.95		15.8		
83.1		G 3-33	1 57 28	+12 50.1	dM8e	12.27	1.80	13.91	11	
166C		40 Eri C	4 13 04	− 7 44.1	dM4.5e	11.17	1.58	12.73	12	
207.1	V 371 Ori		5 31 09	+ 1 54.8	dM3e	11.7		10.8	4	
234A*		Ross 614	6 26 51	− 2 46.2	dM4e	11.07J	1.47J	13.08J	4J	
234B*						14.4		16.4		
285	YZ CMI	Ross 882	7 42 04	+ 3 40.8	dM4.5e	11.20	1.59	12.31	4	4, 5, 14
388	AD Leo	BD+20°2465	10 16 54	+20 07.3	M4 Ve	9.43	1.54	10.98	4	4, 15
406		Wolf 359	10 54 05	+ 7 19.0	dM6e	13.53	2.01	16.69	4	16
412	WX UMa	BD+44°2051B	11 03 02	+43 46.7	dM5e	14.53		15.95	4	
424	SZ UMa	BD+66°717	11 17 29	+66 07.0	M1V	9.32	1.42	9.70	17	
473A*		Wolf 424A	12 30 51	+ 9 17.7	dM4e	13.16	1.80J	14.98	4J	
473B		Wolf 424B			M7	13.4		15.2		
494		BD+13°2618	12 58 19	+12 38.7	dM2e	9.79	1.43	9.1	18	
516A*	VW Com	AC+18°1204—96	13 30 18	+17 04.2	dM4e	12.00	1.53J	11.0	4J	

Gliese's numbers	Names of stars		α_{1950}	δ_{1950}	Sp	V	B-V	M_V	References ph	ds
1	2	3	4	5	6	7	8	9	10	11
516B					dM4e	$12^m.3$		$11^m.3$		
551	V645 Cen	α Cen C	$14^h26^m19^s$	−62°28′.1	dM5e	11.05	$1^m.97$	15.45	4	
569		BD+16°2708	14 42 08	+16 18.3	dM0e	10.20	1.48	10.1	19	
644A*	V1054 Oph	BD-8°4352	16 52 48	− 8 14.7	dM4.5e	9.76	1.62J	10.79	4J	
644B					dM4.5e	9.8		10.8		
669B		Ross 867	17 17 53	+26 32.8	dM5e	12.92	1.58	12.81	4	
719*	BY Dra	BD+51°2402	18 32 45	+51 41.0	K6Ve	8.6		7.6	4, 5, 34	
729	V1216 Sgr		18 46 45	−23 53.2	dM4.5e	10.6		13.3		
735		AC+8°142—393	18 53 03	+ 8 20.3	dM2e	10.07	1.75	9.9	20	
791.2		G 25—16	20 27 21	+ 9 31.2	dM6e	13.06	1.71	13.2	11	
799A*		CoD—32°16135	20 38 44	−32 36.6	dM4.5e	10.83	1.44J	11.09	10J	
799B					dM4.5e	10.9		11.2		
803		CoD—31°17815	20 42 04	−31 31.1	MoVe	8.61	1.44	8.87	21	
815A*		AC+39°1214—608	20 42 04	−31 31.1	MoVe	10.26	1.49J	9.8	13J	
815B						12.3		11.8		
860A*		BD+56°2783	22 26 13	+57 26.8	dM4	9.85	1.62	11.87		
860B	DO Cep				dM4.5e	11.3	1.8	13.3	4J	
873	EV Lac	BD+43°4305	22 44 40	+44 04.6	dM4.5e	10.2	1.6	11.65	4	
896A		BD+19°5116A	23 29 20	+19 39.7	dM4e	10.38J	1.56J	11.33	4J	
896B	EQ Peg	BD+19°5116B			dM6e	12.4		13.4		

Notes to Table 1.

15 AB: P = 3020y, a = 43″94 (7).

15A is SB, the hydrogen emission was not observed, the Ca II emission is very weak (8).

15B: the hydrogen emission was not observed in the quiet state spectra, the Ca II emission is very weak and variable.

65AB: P = 200y.0, a = 5″570 (7).

234AB: P = 16y.50, a = 0″980 (7).

475 AB: $\varrho = 1''.0$, $\Theta = 132°.1$ (1938); $\varrho = 0''.8$ (1960), $\Theta = 169°$ (1960) (7).

516 AB: $\varrho = 3''.0$, $\Theta = 22°$ (7).

644 AB: P = 1y.72, a = 0″218 (7).

719 is SB: P = 5d981. Except the flare activity, the periodical light variability was observed with P = 3d836 (5).

799 AB: $\varrho = 2''$, $\Theta = 231°$ (7).

815 AB: $\varrho = 0''.1$, $\Theta = 81°.0$ (7).

860 AB: P = 44y46: a = 2″386 (7). The flares of B component were observed photographically, during photoelectrical patrol the components were observed together.

896AB: P = 177y.90, a = 2″386 (7).

Several stars included in previous lists of UV Ceti-type objects do not fit our determination of this kinds of variables because photometric observations of brightness variations of the K-M dwarfs do not permit to construct the flare light curves, and we do not consider observations of emission line variability as features which allow to attribute the variable to UV Ceti-type. These stars were included in Table II as the suspected UV Ceti-type variables. The stars from Table II show the brightness or spectral variability which may be explained by the flare activity. The most of stars in this list have no precise spectral classification. The most of the brightness variability observations was made photographically, and there are no data to construct the flare light curves. The spectral variability consists of appearance or strengthening of the emission lines on some spectrograms.

It is possible that all K-M drawfs with emission lines in quiet spectra are UV Ceti-type variables. In present time only 35 stars of 65 M-type known dwarfs with hydrogen emission (25) have shown the flare activity and the brightness or spectral variability. The special observations of remaining stars from the list (25) are desirable to check their membership to UV Cet-type variables. But red dwarfs with emission in spectra and without brightness or spectral variability are not included in Table II.

It is possible that a part of stars in Table II belongs to UVn-type variables (flash stars) — the flare stars of stellar aggregates similar to those in Taurus and Orion. The flare star belonging to such aggregates certainly were not included in Table II.

The Table II includes the following data on the suspected UV Cet-type stars: 1) the number; 2) the designation from (5, 6); 3) the number from other catalogues; 4—5) Right ascension and declination for 1950.0; 6) spectral type; 7) m - the magnitudes: V - visual in the UBV-system and p - photographic. All data in the columns 4—7 are taken from (5—7) or from the original investigation. In two last columns the bibliographic information is given. An asterisk in the column 1 means that there is a note at the end of the Table II.

Table II: The suspected UV-type variable stars

N	GCVS or Gl.	Other catalogues	RA(1950.0)	Decl.	Sp.	m	Bibliography ph	Bibliography sp
1	V Psc		0h12m49s	+ 6°23'.8	M1V	12mp	5	
2		SPZ 1729	0 40 02	+40 14.2		16.8p	23	
3	QZ Per		3 14 45	+37 23.2		17.5p	5	
4*	II Tau	HII 2411	3 46 43	+24 10.0	M4e	15.5p	5, 24	
5*	IN Tau		4 21 06	+14 50	M3e	15.3p	5	
6*	IO Tau		4 21 24	+14 58	M	16.7p	5	
7*	PZ Mon	BD+1°1522	6 45 46	+ 1 16.6	K2Ve	10.8p	5, 34	
8*		BD+33°1646B	8 05 41	+32 56	dMe	11p		25
9	DH Car		11 12 45	−61 29.3		14.9p	4, 5	
10*	Gl 451B	BD+38°3385B	11 50 06	+38 04.6			26	
11		G177.4	12 53 42	+51 12.1		16.1p	27	
12*			12 55 12	−65 33		14.7p		28
13*			13 02 30	−61 56		12.7p		28
14*			13 30 08	−61 58		15.5p		28
15*	Gl 526	BD+15°2620	13 43 12	+15 09.7	dM4e	8.50V		29
16*	Gl 616.2	BD+55°1823	16 15 59	+55 23.8	dM1e	9.96V	4	
17	V475Her		17 18 04	+25 15		15.8p	5	
18		G258-7	17 27 25	+67 01.0		16.3p	30	
19	V2354 Sgr		18 27 04	−24 53.5		13.2p	5	
20*	Gl752	BD+4°4048B	19 14 32	+ 5 04.7	dM5e	17.38V	4, 31	
21	FV Vul		19 36 39	+27 29.0	M:	14.1p	5	
22	KO Vul		19 55 19	+28 57		17.5p	5	
23	Gl 781	Wolf 1130	20 03 55	+54 18.2	dM3e	11.9V	4	
24*			20 04.9	+66 27		17.9p	32	
25*			20 13.0	+67 47		17.7p	32	
26*			20 41.4	+66 59		18.0p	32	
27*			20 41.7	+67 01		18.0p	32	
28*			20 44.5	+66 43		18.0p	32	
29*			20 46	+66 59.7		18.0p	32	
30*			20 46	+67 10		20.5p	32	
31*			20 49	+67 39.5		17.1p	33	
32*			20 54.9	+68 15		18.2	32	
33	AK Mic		21 03 28	−40 14.0		16.2p	5	
34*	Gl 867B	BD-21°6267B	22 36 01	−20 52.8	dM4e	11.45V		25
35	FZ And		23 03 19	+52 51.4		15.5	5	

Notes to Table II.

4. 61 flares were observed photographically. A possible member of Hyades cluster (24).

5. A possible member of Hyades cluster (5).

6. A possible member of Hyades cluster (5).

7. The flare was observed photographically in B-photometric system ($\Delta m_B = 0^m.11$) (34). Possible UVn-type (flash) star (4).

8. Dyer suspects the variability of this star (25).

10. The star BD+38°2285 has a flare component, which is normally unseen. The flare was observed photographically (26).

12.—14. SANDULEAK observed the strengthening of emission lines. The possible UVn-type stars.

15. The variability of CaII emission was detected in (29). The hydrogen emission was not observed.

16. The light variability was detected photographically, the star was monitored for 17^h5 in B system with no flares detected (34).

20. HERBIG has observed the appearance of the hydrogen and Ca II emission at one of three spectrograms (31).

24—32. The flares were observed by photographical search for the UVn-type variables in the nebula NGC 7023. All these stars dispose far off the nebula and are the background stars (32).

34. This star is about 8″ distance from its primary. Very strong hydrogen and Ca II emission lines are present on spectrograms taken at Mount Wilson by DYER (25).

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