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OBSERVATIONS OF SOUTHERN FLARE STARS

During the past five years several dMe stars were monitored for flare activity, and some findings have been reported earlier (Kunkel 1968a). This communication presents a second list of stars in which flare activity was noted. Candidates were drawn from Gliese's (1969) catalog of nearby stars, and lists of emission line dwarfs (Bidelman 1954, Haro 1954).

Objects found since 1970 were selected on the basis of Hβ photometry which discriminates effectively between flare active and non-active red dwarfs.

Flares were considered real if peak U-light (after subtracting the quiescent component), measured in magnitudes, was stronger than faint event detection threshold (Kunkel 1973) given by

$$U_{lim} = U_\sigma + 1.25 \log_{10}(T_{.5}/\Delta t) - 2.03,$$

where U_σ is the U-magnitude of one standard deviation, Δt is the time-constant of the data system, and was one second in all cases. The constant corresponds to a detection criterion of five standard deviations, so that the probability of spuriously detecting an event in 30 hours of monitoring should be less than one percent. Reduction methods have been described elsewhere (Kunkel 1968b, 1973).

Table 1. Data Summary

Gliese No.	Star Name	M_v	Aperture cm	Sample Duration	U_σ	No. of flares	Chart
206	Ross 42	10.7	90	$1^h.34$	16.5	3	G97-47
398	LFT 725	11.7	90	3.68	16.7	1	G44-27
493.1	Wolf 461	13.1:	90	2.16	16.8	3	G60-55
540.2	Ross 845	12.8	150	1.76	18.4	3	A
852A	Wolf 1561A	13.6	90	3.04	17.8	2	B
866	L 789-6	14.6	90	3.22	17.5	7	G156-31
871.1B	L 574-61	12.5	90	2.03	17.8	1	C

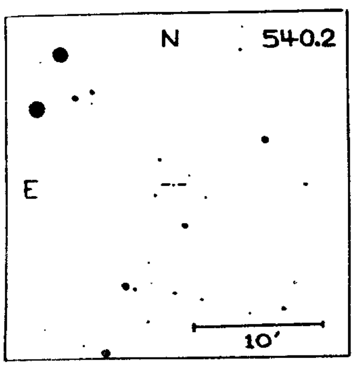

Chart A

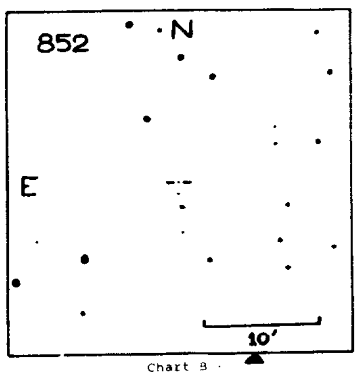

Chart B

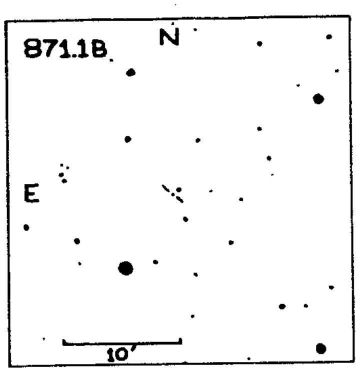

Chart C

Details of individual observations are given in Table 2, following precepts used earlier (Kunkel 1968b, 1973). It should be noted that the photometer used for the first three of these objects was not as sensitive as that employed with the other objects in the table, as the values of $\underline{U_\sigma}$ indicate. The activity of the first three stars in Table 1 is therefore greater than the number of flares observed might indicate. Had a better detection threshold been achieved, as in the last three objects, the number of detected events would have been double that obtained.

Table 2. Flare Abstract

Ross 42, Gliese 206

25 Nov. 1967,
$6^h51^m.6$ - $7^h46^m.5$ and $7^h49^m.4$ - $8^h14^m.9$ 3 events k_u= 0.56

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$7^h03^m.4$	1.34	15.53	0.19			-		
7 26.7	1.38	16.2	1.3	4.:		-		
7 36.7	1.42	14.22	0.46	1.5	3.1	+.23	-.34	

LFT 725, Gliese 398

7 Feb. 1969

$5^h09^m.1 - 6^h24^m.7$ no events $k_u = 0.52$

8 Feb. 1969

$3^h45^m.5 - 6^h10^m.5$ 1 event $k_u = 0.50$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
4^h56^m	1.29	16.23	2.4	-		-		

Wolf 461, Gliese 493.1

9 Feb. 1969

$7^h44^m.0 - 8^h57^m.8$ 2 events $k_u = 0.65$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$7^h43^m.35$	1.25	15.70	.17	.8:		-		
8 30.20	1.24	16.16	.28			-		

11 Feb. 1969

$8^h10^m.8 - 9^h06^m.6$ 1 event $k_u = 0.63$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$8^h26^m.20$	1.24	15.81	0.10	0.35		-		

Ross 845, Gliese 540.2

22 Mar. 1969

$6^h37^m.7 - 8^h23^m.5$ 3 events $k_u = 0.5$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$7^h13^m.1$	1.00	17.45	0.17			-		
8 07.3	1.02	17.38	0.65	2.4:		-		
7 38.7	1.00	17.9:	1.8			-		

Wolf 1561A, Gliese 852A

29 Sep. 1971

$1^h02^m.0 - 4^h04^m.6$ 2 events $k_u = 0.46$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$3^h00^m.9$	1.08	16.79	1.30	2.8:		-		
3 45.90	1.11	15.51	.24	.47	.90	+.69		

<u>L 789-6, Gliese 866</u>

30 Sep. 1971

$1^h10^m.0 - 1^h44^m.9$ and $1^h46^m.8 - 4^h19^m.2$ 7 events $k_u = 0.55$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$1^h26^m.60$	1.09	14.62	.085	.13	.17	+1.41	+1.30	$T_{0.05}=.4$
1 40.31	1.08	16.13	.5	1.7		-		
2 38.65	1.04	16.58c	.08	.15c		-		Double
3 11.13	1.04	16.66	.18			-		
3 23.55	1.05	16.44	.4	2.2		-		
4 00.1:	1.08	$<$13.34	$<$.3			-		lost peak
4 11.58	1.10	15.68	.05	.11		-		

<u>L 574-61, Gliese 871.1B</u>

29 Sept. 1971

$4^h41^m.0 - 6^h43^m.8$ 1 event $k_u = 0.46$

Event U.T.	Air-mass	U_{peak}	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	τ_1	τ_2	Notes
$4^h57^m.02$	1.11	16.34	0.44	1.7	3.7	-.36		

At the luminosity of Ross 42 few flare stars are known of comparable activity. The present data are insufficient to form a reliable incidence statistic. However, an estimate based on the three recorded events points to an activity of $M_{u,o} \approx 14.6$, greater than that of any flare star of similar luminosity. As the star is a spectroscopic binary, an assumption of activity divided equally between like components yields a level of activity similar to that of CoD-32°16135, with $M_{u,o} \approx 15.3$ per component. The space motion of Ross 42 is similar to that of YZ CMi, CoD-32°16135 and CoD-31°17815, the stars that define the upper envelope of flare activity in the solar neighborhood. Thus a possibly common origin for these stars appears likely.

Gliese gives space motions for five of the stars in Table 1. The largest space motion is that of Number 866, with U = -67, V = -2, and W = +41 km/s. Numbers 493.1 and 852 likewise have large motions with components perpendicular to the plane significantly greater than those commonly associated with solar neighborhood flare stars. It is becoming clear that flare activity is far more common among stars of the old disk population than had once been belived.

Lastly, Shakhovskaya and Sofina (1972) have recently reported flare activity on Ross 868 (Gliese 669A), of which the fainter companion is known as a flare star (Kunkel 1967). Wolf 1561A is a second example of a situation in which the brighter component of a binary flares. No flare activity has been reported on the fainter component, which is one magnitude fainter. The conclusion, implicit in Kunkel's (1973) discussion of flare visibility, is that the preponderence of observed flare activity in the fainter components of binaries is likely to be a selection effect.

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