SKY SURVEY OF FLARE STARS AND VARIABLE STARS – A SUMMARY OF TWELVE YEARS' COOPERATIVE OBSERVATION

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ABSTRACTS

We have been observing in the Sco-Oph dark cloud region for 12 years. We have only reduced a small part of the plates. Nevertheless, 12 new flare stars and more than 40 new variables stars have been found. Besides, we have discovered a new subgroup of RR stars in the globular cluster M4.

TEXT

At present, it is well Known that compact IR sources, T Tau stars, flare stars and Orion population variables etc. are young stars. Observations have shown that they are always born in groups and have close relations with clusters, associations and the surrounding nebulosities where tyey were born. Both theory and observation have shown they are pre-main sequence stars and still in the process of gravitational contraction. So, it is meaningful to do a systematic survey for these stars. This is the observational approach to the problem of star formation and evolution.

In 1975, the Purple Mountain Observatory began to search for new flare stars and variable stars in the Sco-Oph region. Later, a cooperative group consisting of members from Shanghai, Beijing and Purple Mountain Observatories was formed. Using mainly the 60/90 cm Schmidt, the 40cm double astrograph as well as other reflectors, we have been observing in the Sco-Oph, NGC 7000, W3 and Tau dark cloud regions for 12 years. By now more than 2000 plates have been obtained (the total exposure time > 1200 hours). We have only reduced a small part of the plates owing to lack of an advanced measuring machine and a computer in the past. Nevertheless, 12 new flare stars and more than 40 new variable stars have been found. However, more new variable stars are waiting to be measured, and even more plates are waiting to be reduced. Besides, using the UK Schmidt, we have found 62 new H_α emission-line stars in the ρ Oph region. We have also observed the slit spectra of more than 30 known T Tau stars.

Owing to the fact that the globular cluster M4 was used by us as the calibration cluster, it was blinked and measured frequently. In this process, as a by-product, 5 new normal RR Lyrae variables were found. Even more Important, a new subgroup of low amplitude variable stars which are located around the horizontal branch (HB) were discovered. Their amplitudes are less than $0^m.1$ and main period ⟨ 0.2d. According to their characteristics of light variation, we can classify them as RRd–- a new subgroup of RR Lyrae stars. Besides, some periodic variables which are located in the middle part of the red giant branch (RGB) and at the intersection of HB and RGB were found. They are remarkable in having a 98- minute period. It is very likely that all of them are indeed cluster members.

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Table 1 New Flare Stars

	ZB No.	α 1950	δ 1950	Amplitude	Date
Tau	7	16^h 25^m 36^s	-24° 09'.4	$> 6.5\ \Delta\ m_B$	1975 08 03
NGC 7000	12	30 18	−25 42.3	4.6 Δ U	1976 06 01
Sco-Oph	13	22 02	−23 14.9	3.2 Δ U	1976 06 03
	15	30 54	−26 28.1	> 4.9 Δ U	1977 04
	16	24 42	−26 05.0	$\sim 3.5\ \Delta\ m_B$	1977 06 19
	21	15 37	−24 05.5	> 2.2	
	17	20 55 30	+40 32.0	> 2.7 Δ U	1977 07 09
	45	58 39	+44 19.2	> 3.0 Δ U	1977 07 11
	46	52 52	+43 47.8	> 2.8 Δ U	1978 03 01
	34	04 $21^m_.4$	+26 44	$\approx 3.9\ \Delta m_B$	1975 12 31
	35	26 . 3	+24 57	$1.2\ \Delta m_B$	0977 12 05
	36	33 . 6	+22 56	$1.0\ \Delta m_B$	1978 01 03

Table 2 New Variable Stars

ZB No.	α 1950	δ 1950	Ampl. max min	Epoch Period Type
1	16^h 18^m 44^s	-25° 26' 59"	2^m33	UVn?
2	18 47	−25 27 04	0 . 55	In?
3	24 41	−22 51 15	1 . 89	Ins
4	24 48	−22 45 48	0 . 89	In?
5	24 54	−24 19 40	0 . 82	In T
6	25 34	−25 04 50	0 . 54	In
8	25 36	−24 58 50	0 . 68	In?
9	25 59	−24 48 54	0 . 60	In?
10	27 22	−24 48 46	0 . 86	In
11	30 15	−24 57 44	0 . 64	In
20	13 59	−26 16'.4	15.7 16.6	
22	17 51	−23 55. 4	14.4 16.0	
23	18 52	−25 55. 9	15.3 > 17.0	JD 2443281: 190^d : M
24	19 19	−23 14. 7	14.0 > 15.6	In T
25	20 18	−25 55. 8	14.8 16.3	JD 2443251 152^d M
26	20 35	−26 59. 0	13.2 14.1	
27	24 10	−24 57. 3	16.0 17.0	
28	28 27	−26 04. 0	14.3 > 16.7	JD 2443270 195^d M
29	28 29	−24 18. 3	15.2 16.2	In
30	31 08	−26 37. 5	15.3 16.3	Ins
31	32 58	−25 01. 2	13.45 14.45	JD 2443252.29 0.114373^d RRs
32	34 19	−25 06. 2	14.8 > 16	JD 2443340 108^d M