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SPECTRAL INFORMATION ON NEW AND KNOWN LONG-PERIOD AND RELATED
VARIABLES AND SOME NEW LATE-TYPE EMISSION-LINE STARS

The stars discussed in this Bulletin were all found in the course of the Cleveland objective prism surveys for luminous stars in the Milky Way. Nearly all were found in our recent survey of the southern Milky Way, using plates taken with the Curtis Schmidt at Cerro Tololo in 1967 and 1968. Spectral dispersions were 580 A/mm at H γ and 1000 A/mm at H α .

The stars in Table 1 are all classifiable as M-type long-period variables, in that they show, besides TiO bands, strong hydrogen emission with Balmer decrement highly distorted (H δ much the strongest line, etc.) that characterizes Mira-type variables near maximum light. Since the spectra of certain semiregular variable stars grade into those of the Mira stars, a few of the stars of Table 1 may not in fact be true Mira variables, especially in the case of stars previously classified SR variables; nevertheless we feel that the variability classification of such SR stars deserves further attention. The magnitudes quoted are photographic, derived from eye estimates of spectral image densities calibrated by magnitude sequences for each plate, or (with the letter v) visual ones from Kodak 103a-F plates, based on a mean calibration for all plates; the probable error for the former is $\pm \frac{1}{3}$ mag. and for the latter ± 1 mag. or so. When both kinds of magnitude are given at rather different phases the blue magnitude, for clarity, also carries the letter p, meaning photographic. Where indicated, these are named variables or have been listed in the Catalogue of Stars Suspected of Variability (CSV); but none are classified, if at all, as Mira-type in the variable star catalogue (GCVS). The quoted coordinates are

independent re-determinations, and in general agree very well with the published ones. An asterisk in the Remarks column of all tables denotes additional notes on a star following the table.

The format for Table 2 (see heading for contents description) is as for Table 1. In a few cases we have not re-measured the coordinates. Besides providing spectral types (all are M stars), our Balmer-line observations independently confirm these stars as Mira-type.

Table 3 is arranged like the others, except that the magnitudes are visual and as described above, unless carrying the letter p, since most of these stars were observed only on H α plates. Apart from the already-named variables, most of these stars (especially the first two) will probably turn out to be variable stars. In the "H α " column we give the H α emission strength as strong, moderate, or weak.

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TABLE 1.

Stars Not Classified (if listed at all) by the Variable Star Catalogue, Third Edition through Third Supplement, as Mira-Type, but so classified by Us Spectroscopically.

GCVS	α (1900)	δ	Spec	Mag.	Remarks
	6 29 26.5	-10 12 26	M5	13.9	
	6 29 52.1	-13 37 04	M4	13.9	
CSV 792	6 31 48.6	-16 49 53	M4	14.4	
	7 09 52.8	-30 24 26	M6e!	13.1	
	7 10 49.0	-32 49 15	M7	13.1	
	7 17 18.2	-29 06 35	M7	13.3	*
CSV 1084	7 29 50.7	-28 10 40	M8:	13.8	
YZ Pup, SR	7 39 58.4	-21 37 30	M5-7	11.7-12.5	
	7 43 06.8	-38 23 40	M8:	13.7	
CSV 1218	8 02 28.0	-37 00 25	M	14.5	
	8 05 04.9	-45 26 42	M	14.0	
	8 16 56.2	-26 21 32	M2	12.1	*
	8 24 30.8	-29 13 32	M	14.8	
CSV 1405	9 00 00.3	-42 06 27	M8	13.3	
	9 00 30.6	-36 27 13	M	14.2	
	9 05 32.2	-56 25 07	M3	13.4	
	9 34 31.7	-44 43 51	M6:	13.4	
	9 45 27.4	-54 25 47	M6	14.7	
CSV 1530	9 50 25.1	-59 53	M5	13.5	
	10 04 09.4	-60 03 38	M5	13.6	*
	10 05.9	-64 17	M	13	
	10 09 17.7	-49 47 22	M5:	13.5	*
CSV 1609	10 20 57.3	-50 44 27	M5	12.9-14.1	
VZ Vel, SRa	10 24 09.9	-50 40 25	M6	10.3p-14V	HD 298126
	10 24 28.7	-49 35 00	M5-6	13.3p-11V	*
	10 39 11.2	-53 01 49	M5	13.4	*
	10 45 42.4	-52 14 18	M5-7e!	14.3, 13.1V	
CSV 1669?	10 49 41.0	-48 49 18	M7e!	12.5, 11.4p	*
	11 07 44.1	-53 42 08	M2	12.4	
	11 52 25.9	-68 17 00	M6	12.3	
	12 16 53.3	-55 10 35	M7	13.4	
	12 21.3	-59 28	M8:	13	
	12 23 01.1	-68 01 56	M5	13.2:	
CSV 1889	12 29.7	-60 10	M5:	13	*
AL Cen, SRa	12 30 32.8	-53 03 03	M3-4	10.3	HD 109576*
RW Cru	12 34 15.5	-60 52 21	M8	13.5	*
DW Mus, Cep	13 01 06.8	-68 21 27	M5	12.2	*
	13 45.4	-63 58	M	13	
CSV 2278	15 04 23.8	-68 21 54	M4	12.4	
CSV 2301	15 09 39.6	-70 50 59	M4	11.1	C.P.D. -70 ^c 2005
	15 19 28.9	-65 16 24	M5	12.4	
	15 31 40.1	-59 42 54	M4	12.2	
	15 36.0	-64 49	M	13	
SY TrA	15 37.0	-66 22	M	14	
	15 42.4	-66 37	M8:	13	
	16 04 03.7	-58 32 29	M5	12.7	

Table 1, continued

GCVS	α (1900)	δ	Spec	Mag.	Remarks
CSV 2591	16 04.8	-59 29	M	13	
	16 27 52.1	-52 01 49	M6	13.3	
	16 31 21.6	-53 52 37	M4-5	12.9	
CSV 2791	16 36 57.3	-56 57 23	M	13.9	
V503 Oph, SR	16 47 16.9	- 5 17 23	M3	12.7	
CSV 2862	16 52 12.0	-44 41 20	M	12.4	
NX Oph, M?	16 53 21.1	-27 50 25	M	13.6	
FR Oph, L	16 57 01.6	-28 42 17	M	13.6	
GP Oph	16 58 47.2	-27 04 39	M6	13.3	
	17 01 52.4	-51 33 07	M3	12.4	
CSV 3218	17 24 43.2	-16 25 40	M	12.4	
	17 35 41.3	-15 49 37	M2:	12.4	
UV Ser	17 38 28.4	-14 53 30	M	12.9	
PU Sco, SRa	17 38 43.8	-43 04 23	M3	12.3	
CSV 3420	17 40 00.0	-13 46 21	M	13.2	
V1278 Sgr, M?	18 02 02.3	-34 02 35	M5	13.1	*
	18 09 14.2	-29 36 19	M1:	13.2	*
	18 15 27.9	-30 21 20	M	13.2	
	18 16 11.9	-29 09 35	M2	13.2	
	18 17 26.3	-28 10 28	M	13.2	
	18 18 31.4	-29 06 59	M	12.8	
	18 19 15.6	-29 04 17	M	13.2	

Notes to Table 1.

- 07^h17^m. Detected in the two-micron survey, therein -30086; type M6 by Hansen and Blanco, *Astron. J.* 80, 1011, 1975.
- 08^h16^m CaI λ 4227 is markedly weak.
- 10^h 04^m CSV 1563, which has no published identification chart, has a published position differing by 2½' - 3½' from ours. Our position is only a single determination.
- 10^h09^m Near, but different from, the planetary nebula PK 278 + 5^o1.
- 10^h24^m One of the few cases in which, at 1000 Å/mm, we have been able to see H α emission in a long-period variable. Ca I λ 4227 weak.
- 10^h39^m H δ \sim H γ emission on the blue plate, but H β and H α (plate taken 2 days later) are absent so the star should be a long-period variable.
- 10^h49^m The CSV star has no published identification chart; the published position is 5^s west of us. Our position is the result of two accordant plates. A 12th-mag. F star lies about 1.5^s west of our star, and a 10th-mag. early A star is about 4.0 west of us.
- 12^h29^m.7 CSV 1889 has no identification chart, and a published r.a. different from ours by 0^m.2. Ours is uncertain by about this amount.
- AL Cen Spectrum already quoted as Me in the 2nd supplement to the GCVS, and by Houk and Cowley (*Mich. Spectral Survey*, Vol. 1).
- RW Cru Spectrum given as M6-7e by Loden (no 8765), *Astr. & Ap. Suppl.* 23, 1976.
- DW Mus Our identification of the variable is confirmed by the chart published by Van Hoof in *IBVS* No. 233, 1967. In this paper the author identifies the star as having a one-day period, on the basis of seven hours' unquoted observations plus scattered observations which previously had indicated a much longer period.
- V1278 Sgr Our position, derived from only one plate measure, differs from the GCVS by about 1/2' in decl. The GCVS already has the spectral type Me.
- 18^h09^m V1582 Sgr, which has a published identification chart in the paper following the one cited in the GCVS, is about 2' away.

TABLE 2.

Named Variables, Classified in GCVS as Mira-Type, But Lacking Published Spectral Types or Observations of Emission. All Show Emission of the LPV Type on Our Plates.

GCVS	α (1900)	δ	Spec	Mag	Remarks
DL CMa	6 47 26.7	-18 55 00	M6-8	11.8-12.7	*
BI CMa	6 58 33.6	-23 43 41	M5	13.5	
UV CMa	7 01 08.9	-28 09 20	M5-8	12.0	
SY CMa	7 06 12.1	-19 40 16	M4-6	11.4-12.3	*
EG Pup	7 32 01.8	-26 16 49	M8:	13.4-15.0	
CN Pup	8 00 30.3	-48 10 38	>M5	13.5	
BK Vel	8 05 20.3	-43 41 57	M	14.2	
FP Pup	8 11 39.5	-23 00 45	M4	14.3	
CC Vel	9 34 14.5	-44 56 35	M7	12.5	
DW Vel	9 46 28.9	-51 31 56	M8:	14.1 p,13.5V	
DY Vel	9 48 31.9	-49 03 13	M7	13.1	
AF Car			M8	13:	*
TT Car	10 17 17.6	-61 14 34	M6	13.6	
BQ Mus	11 25 16.7	-69 16 38	M6	12.9	
Y Cru			M6:	13:	
UU Cen			M8	14:	
QU Cen			M	13	
UU Cir	14 03 25.4	-66 35 25	M6	13.1	
VX Cir	14 14 34.2	-69 30 13	M7	11.1-12.4	
AA Lup	15 02 00.9	-48 30 35	M5	12.8	
AU Lup	14 17 18.5	-44 02 48	M5:	13.0	
BN Lup	15 27 24.1	-47 37 12	M2	14.0	
AS Nor	15 49 00.8	-44 20 53	M6	11.8-13.6	
BM Nor	15 57 51.7	-59 28 34	M6	12.7	
CD Nor	16 02 42.5	-57 17 06	M4	12.7	
CC TrA	16 14 11.7	-61 31 28:	M	13.2	
RY Nor	16 23 38.3	-58 08 17	M7	12.7	
CR Oph	16 49 02.3	-28 44 32	M	13.5	
DU Oph	16 51 48.6	-27 51 12	M	14.0	
HR Oph	17 01 02.1	-28 03 47	M	14.0	
AK Ara	17 12 42.4	-47 16 02	M5:	12.9	
KZ Sco	17 14 54.0	-45 28 39:	M4	13.3p,10.5V	
LO Sco	17 18 23.9	-44 22 27	>M5	11.9	
V439 Sco	17 50 36.6	-37 16 05:	M0	13.2	
FY Sgr	18 04 39.7	-33 06 54	M4	13.1	
LP Sgr	18 21 43.9	-27 44 08	M	12.9	
V3876 Sgr	18 27 17.3	-20 10 19	M8	14.3	*
BI Aql	19 16 45.5	- 8 34 32	M0	13.4	
V497 Aql	19 44 25.4	+ 6 36 04	M1	13.3	
V427 Aql	19 52 39.5	+ 8 26 23	M4	12.6	*
EK Aql	20 08 42.5	- 5 28 21	M3-4	11.8-12.3	
V519 Aql	20 09 29.9	- 1 28 47	M	13.3	

Notes to Table 2.

- DL CMa Already classified M7 by Hansen and Blanco, Astron. J. 80, 1011.
Identified in the two-micron survey, -20110 therein.
- SY CMa Spectrum washed out.
- AF Car H α emission seen by Henize, Astrophys. J. Suppl. 30, 491.
- BQ Mus Our position, based on only one measured plate but confirmed
(to about 0!2) by computer overlay, differs from the GCVS
position by 0!7 in decl. and 0!3 in r.a.
- V3876 Sgr Found in the two-micron survey; there numbered - 20494. Also
classified M8 by Hansen and Blanco, Astron. J. 80, 1011.
Emission outstanding on our plate.
- V427 Aql The published identification chart makes our star the variable,
but our position, checked by computer overlay, disagrees with
the GCVS one.

TABLE 3.

Definite or Suspected Late-Type Stars Showing H α or Other Emission

α	δ	Spec	H α	Mag.	Remarks
8 08 49.4	-33 56 09	?	s	13.5:	*
8 10 10.0	-35 49 50		m	13.5:	Wray 18. *
8 52 25.7	-48 07 11	M4	w	12.5	
8 57 43.9	-49 22 05	M4:	m	12.5	
10 50 36.4	-50 10 59	M6:	m	12.5	
11 02 08.6	-48 45 35	M5	w	12.1	
12 34 08.2	-61 47 47	M2	m	9.7	
14 19 51.7	-57 52 20	M1	s	11.7	
17 04 32.5	-27 33 20	Red	m	12.5	*
17 16 32.9	-29 06 28	M5	-	11.7p	V520 Oph, SRd. *
17 19 04.5	-47 12 48	M1	-	12.9p	AN Ara, SR. *
17 21 18.7	-44 19 36	M1	s	11.4	
18 35 48.1	- 4 50 06	M1:	m	12.5	
19 10 50.0	- 8 28 16	M?	m	13.0	
19 15 56.4	- 6 57 56	M?	s	12.8	BH Aql, L.

Notes to Table 3.

- 8^h08^m A deep blue plate shows a weak continuum without absorption features at 580 Å/mm, with Balmer series and H and K emission.
- 8^h10^m Our declination, based on only one plate, is 27" north of Wray's (table XV of his Ph.D. thesis, unpublished). A blue plate shows, at the plate limit, no absorption features, with Ca H and K and probably Hβ, in emission.
- 17^h04^m May be early M-type. On the boundary of a dark cloud.
- V520 Oph. GCVS spectrum K0? The blue-region hydrogen emission is suggestive, but inconclusively, of a Mira variable.
- AN Ara Blue-region emission inconclusively suggestive of a Mira variable.