THE ITA SURVEY ON RED DWARF VARIABLE STARS - FINAL REPORT

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From 1971 to 1973, an observational survey on red dwarf stars to search for possible periodic photometric variations was carried out at ITA Observatory - Brazil. Two observing runs at Cerro Tololo in 1974 and 1975 were used as an extension of this survey. We observed a total of 90 stars, as shown in Table I, and almost all stars were measured at least five times during the same season.

TABLE I

Class	Stars Surveyed	Variables	Suspected
H emission	20	11	5
CaII emission	30	2	2
Non-emission	40	0	0

The main conclusions of such survey are:

(a) The hydrogen emission line stars showed a great incidence of variables, with periods in the range of 1.5-8 days. There are some variables that have no detected variation during one season, although they were found to vary on another season. Nevertheless, it is hard to conclude by now that all stars of this class will be periodic variables. As an example, V1054 Oph has shown no variation during all the 3 years spanned by the survey.

(b) The CaII emission line stars showed a much lower incidence rate of variables, and those found have smaller amplitudes and greater periods than the variables of the previous class.

(c) No definite variation was found in non-emission line stars.

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P. B. Byrne and M. Rodonò (eds.), Activity in Red-Dwarf Stars, 175–177.

The suspected and confirmed variable stars are summarized in Table II. Everything said above is consistent in the frame of the evolution of activity in red dwarf stars.

TABLE II

Gl	Name	Sp	Variability
103	CC Eri	K6Ve	1.561
182	V1005 Ori	dM0.5e	1.86
	DK Leo	dM0e	7.982
388	AD Lec	dM3.5e	YES?2.6?
410		dM2e(?)	YES?
494	DT Vir	dM1.5e	1.535
	FK Com	G2IIIe	2.407
517	EQ Vir	dk5e	3.90
	V914 Sco	dM3e+dM4e	2.69
	V4046 Sgr	dk5e	1.7035
	FK Ser	K5Ve+K5Ve	4.54
729	V1216 Sgr	dM4.5e	YES?
799	AT Mic	dM4.5e+dM4.5e	YES?
803	AU Mic	dM2.5e	4.8540
	AY Ind	M2Ve	YES?
867A	FK Aqr	dM2e	4.276?
425	HD 98712	K7V	YES 11.56
566	ξ Boo	G8V	10.137?
567	131511	K1V	YES?
879	TW PsA	K5V	10.295

(d) Au Mic, observed during five years, has shown a variable light - curve from year to year, but all the data may be represented by a single ephemeris of constant period. We do not need to suppose that there is a variable period or a phase shift of the minimum. If we interpret the data as produced by the same activity center, this may be a challenge to the differential rotation hypothesis. It should be noted that the photometric data on the CaII-emission line star TW PsA may be described with a single ephemeris for five years too.

DISCUSSION

van Leeuwen: We have been doing observations of AU Mic in October and November 1981. They show, on combination with published observations by Hoffmann and by Respaju(?), the effect you mention, that is that the minimum of the light curve stays at constant phase but not the maxima. These observations extend over 10 years.

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Johnson: It is very interesting if Gliese 644 or Wolf 630 or V1054 Oph is non-variable for 3 years since it is a well-known flare star. I realize that you were looking for BY Dra variability but do I understand correctly that you observed non flares in 3 years?

Torres: Our observations are for the non-flaring variations only. If a flare occurs during our observations that data is removed.

Johnson: So your statement excludes flares.

Torres: Yes.

van Leeuwen: We observed 2 flares during 3 weeks observing AU Mic.

Torres: Yes. We have observed many flares on AU Mic and other stars but this was not the purpose of the search.

Jordan: Is there any periodicity in the flaring as there is in the mean light?

Torres: No.

Mullan: I think that it is worth pointing out that there is an historical distinction between the dMe stars and M dwarfs which do not have the Balmer lines in emission. It may not have any physical significance other than that there may be more chromospheric heating in the emission-line stars. What Cram and l showed was that when one takes a star with an effective temperature of 4000K or 3500K one does not expect to see Balmer lines at all, either in emission or absorption. In order to get formation of Balmer lines even in absorption one needs to have a chromospherere whose energy is a significant fraction of σT^4 since the T^4 factor falls off so rapidly towards cooler stars. So I think it is misleading to have two separate groups of dM stars. Both those with Balmer lines in emission and those with them in absorption require chromospheric heating which is a significant fraction of σT^4.

Linsky: We have observed AU Mic with IUE for 3 days. One thing which is quite obvious from this data is that there is a lot of variability in the UV line strengths. Individual exposures are of duration of the order of 1 hr. Lines such as CIV change by as much as 50% in this time and by as much as a factor of 2 in the course of several hours. There are certainly real. There is no strong evidence of BY Draconis variability. Rather there is a great deal of shorter-term variability. Do you see, superimposed on the optical BY Draconis variability, short-term variability?

Torres: My data would not see this kind of variability since we observed usually only once per night.

van Leeuwen: In observing long-term variability in the Pleiades K stars we see no short-term variability with an upper limit of 2 thousandths of a magnitude.

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