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POSSIBLE METAL-POOR VARIABLE STARS

We have been observing high-velocity and metal-poor stars in the uvby β photometric system at the San Pedro Martir Observatory, Baja California, Mexico and at the European Southern Observatory, La Silla, Chile. To date more than 700 program stars have been observed. Five program stars and one intended standard star have shown some evidence of photometric variability. These are listed in Table I, where column 1 gives the HD or Giclas numbers of the stars. Columns 2, 4, 6, 8, and 10 give the average observed values for V, b-y, m_1 , c_1 and H β , respectively; beneath each V value is given in parentheses the number of uvby observations and beneath the H β value the number of H β observations. In columns 3, 5, 7, 9 and 11 are given the internal rms errors of one observation; beneath each of these errors are found in parentheses the measured internal rms errors for non-variable standard or program stars from the same observing period.

In Table II we give additional information for these stars. Columns 2 and 3 contain other identifying numbers, column 4 spectral types from several sources, and columns 5 and 6 preliminary values for the metal abundances and effective temperatures of the stars. The metal abundances, [Fe/H] 's, follow from the calibrations of Ardeberg et al. (1983), Olsen (1984) and from a new calibration that we are deriving; the effective temperatures from the calibrations of Olsen (1984) and Saxner and Hammarbäck (1985).

Our observations alone do not show variability for HD 33449. However, our c_1 value is 0.036 magnitude larger than that given by Olsen (1983). This difference is more than three times the combined mean errors. We have taken much care to transform well our uvby data for the F and G-type dwarf and subdwarf stars onto Olsen's system.

HD 34328 shows definite variability in the V magnitude. Consecutive good photometric nights in October 1984 gave values differing by 0.092 mag., 9.522 and 9.430.

In Table I the uvby and H β observations of HD 47147 were not made during the same observing period; the uvby observations during May 1985 at the Danish 50 cm telescope and the H β observations during October 1984 at the Danish 1.5 m telescope. HD 47147 shows variability in V and in c_1 ; the two observations of Table I are V = 9.174 and 9.109 and c_1 = .739 and .807, respectively. A single previous observation in uvby at the 1.5 m telescope during October 1984 gave V = 9.128, b-y = .291, m_1 = .045 and c_1 = .775. HD 47147 may be either a metal-poor, slightly variable F-type giant star, or an RR Lyrae variable. In the latter case all three uvby observations were made at nearly the same phase. (For example, near minimum light the RR Lyrae variables of Siegel (1982) give colors similar to those of HD 47147).

TABLE I

Photometry of the Stars

HD	V	m.e.	b-y	m.e.	m_1	m.e.	c_1	m.e.	HB	m.e.
33449	8.488	.004	.423	.006	.201	.010	.273	.007	2.564	.005
	(4)	(.006)		(.003)		(.007)		(.008)	(3)	(.006)
34328	9.476	.060	.371	.012	.060	.006	.205	.003	2.567	.001
	(2)	(.006)		(.006)		(.009)		(.008)	(2)	(.006)
47147	9.142	.039	.286	.001	.051	.004	.771	.042	2.610	.016
	(2)	(.008)		(.005)		(.008)		(.007)	(2)	(.006)
197192	9.390	.047	.574	.012	.356	.006	.217	.007	--	--
	(4)	(.008)		(.005)		(.008)		(.007)	(0)	--
218396	5.960	.023	.188	.006	.137	.005	.689	.017	2.742	.004
	(21)	(.008)		(.005)		(.007)		(.007)	(32)	(.005)
G190-15	11.013	.026	.489	.026	.052	.020	.074	.009	2.536	.034
	(5)	(.008)		(.005)		(.007)		(.007)	(5)	(.008)

TABLE II

Additional Information

HD	DM	Other	Sp	[Fe/H]	T_{eff} ($^{\circ}$ K)
33449	-7 $^{\circ}$ 989	LTT 2189	GO	- 0.35	5600
34328	-59 $^{\circ}$ 1024	LTT 2211	F6VI,G5VI	- 2.00	5600
47147	-45 $^{\circ}$ 2613		sdF WLE, A2/5 W	- 2.50:	6300:
197192	-66 $^{\circ}$ 2415	LTT 8207	K3V-VI, K0V	- 0.90	4700
218396	+20 $^{\circ}$ 5278	HR 8799	A5V,A5IV	- 0.55:	7100:
G190-15	+38 $^{\circ}$ 4955	LTT 16828	sdG8,sdG3, sdF6	- 2.20	4800

The star HD 197192 is definitely variable in V with values ranging from 9.318 to 9.436. Smaller variations in b-y may be correlated, with brighter magnitudes corresponding to bluer colors.

HD 218396 was selected to be used as a photometric standard star, but showed both negative and positive transformation residuals, some as large as 0.05 in V and as large as 0.03 in c_1 . Also, the variations in V and c_1 are correlated, brighter magnitudes corresponding to larger values for c_1 . HD 218396 is interesting as a candidate for being a slightly metal-poor, low amplitude δ Sct star, with approximate amplitudes of 0.08 in V and 0.05 in c_1 .

The variations of G190-15 are not understood and may possibly be due to atmospheric or instrumental effects. Four uvby δ observations in July 1985 showed good agreement. One observation the night of October 23/24, 1985 indicates variability with significant changes in y and in H β . Also, using 20 second integrations rapid variations of about 8% in y and 2% in b were measured over a period of two minutes during this October observation; in contrast the u and v measures remained nearly constant. Since we normally monitor only the u counts, these variations were not noticed until later. Most perplexing, four "sky" measures, two approximately 1' north of the star and two approximately 1' south-south-east, showed rapid variations in y and to a lesser degree in b but not in u and v. These observations were made with a simultaneous six-channel uvby δ photometer using a 20" diaphragm. The sky was clear of clouds, and the moon, four days before full, was approximately 50° from G190-15. This star shows no nebulosity on the Palomar prints, and no other star before or since has shown a similar behavior.

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