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## HD 13654: a new spectroscopic and eclipsing double-line binary of large $RV_{lsr}$

HD 13654 ( $\alpha_{2000} = 2^h15^m11^s.8$ ,  $\delta_{2000} = +59^\circ20'50''$ ) belongs to the field of the open cluster Stock 2, but it is not a cluster member according to its spectroscopic parallax (230 pc) and radial velocity ( $\langle RV \rangle = 44 \text{ km sec}^{-1}$ ) (Munari 1992a). HD 13654 has captured little attention in the past. Some photometry and spectral classification on objective prism plates can be found in a number of papers dealing with Stock 2 (Stock 1956, Brodskaya & Shajn 1958, Krzeminski & Serkowski 1967, Martini 1971, McCuskey 1974), which give for HD 13654  $\langle V \rangle = 9.86$  and an early A spectral type.

HD 13654 has been extensively observed with the Boller & Chivens + CCD spectrograph at the 1.8 m telescope of the Asiago Astrophysical Observatory during a long term spectroscopic investigation of the Stock 2 cluster (Munari 1992a). 10 spectra have been recorded at resolution of 1 and 2 Å/pixel (40 and 80 Å/mm) over the period February 1990 - December 1991. A journal of the observations is given in Table 1. Following the procedure described in detail by Munari (1992b), each spectrum was classified by comparison with a library of reference spectra of MKK standards observed with the same instrument and dispersion, and their RVs were determined by cross-correlation techniques. As template stars we used the Stock 2 cluster non-binary members HD 13518, HD 13688, HD 13909, HD 14025 and HD 14161, with their RVs taken from Pesch & McCuskey (1974). The measured RVs are reported in Table 1. It can be seen that HD 13654 presents a large RV variation, indicative of binarity and large orbital inclination. No obvious orbital period has been found from a Fourier analysis the data, which are probably too few to this aim.

Nine of the ten HD 13654 spectra we recorded turned out to be very similar, giving a spectral classification of A2.6( $\pm 0.1$ ) V (see Figure 2a). The spectrum secured on 28.09.1990 showed instead a G9 star continuum (see Figure 2b). The sudden change was immediately recognized during preliminary on-line analysis of

Table 1: Journal of observations

Date	grating ln mm <sup>-1</sup>	scale (Å/pixel)	range (λ Å)	RV (km/sec)	JD (+2440000)
18.02.90	1200	1	3850-4400	+33	7941.311
28.09.90	600	2	3790-4910		8163.390
14.10.90	600	2	3790-4910	+51	8179.370
08.01.91	600	2	3790-4910	+1	8265.243
25.01.91	600	2	3790-4910	+141	8282.259
26.01.91	600	2	3790-4910	+75	8283.241
20.10.91	1200	1	3850-4400	+21	8551.455
17.12.91	1200	1	3850-4400	+25	8608.386
18.12.91	1200	1	3850-4400	+10	8609.379
19.12.91	1200	1	3850-4400	+34	8610.246

Table 2: UBV and RGU magnitudes of comparison stars

Star	UBV			RGU		
	V	U	B	G	R	U
A	8.74	9.53	9.18	9.40	8.83	9.83
B	8.93	11.46	10.31	9.96	8.49	11.46
C	9.29	11.24	10.30	9.98	9.01	11.31
D*	9.94	12.37	11.31	10.85	9.43	12.31
E	10.66	11.70	11.24	11.20	10.38	11.80
F†	11.94	12.72	12.76	12.48	11.32	12.63
G	12.81	14.45	13.82			
H*	14.18	16.74	15.66			
I*	14.70	16.03	15.62			

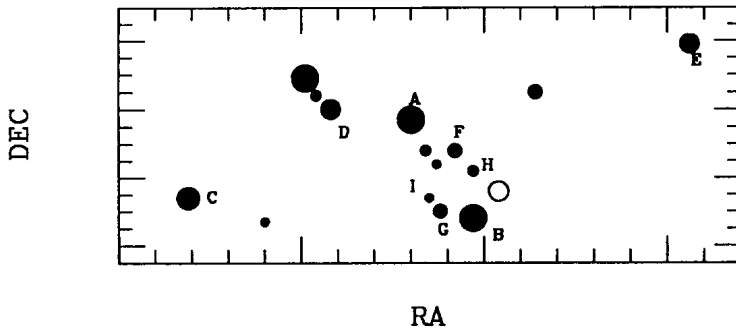


Figure 1. Identification chart for HD 13654 and comparison stars in Table 2.

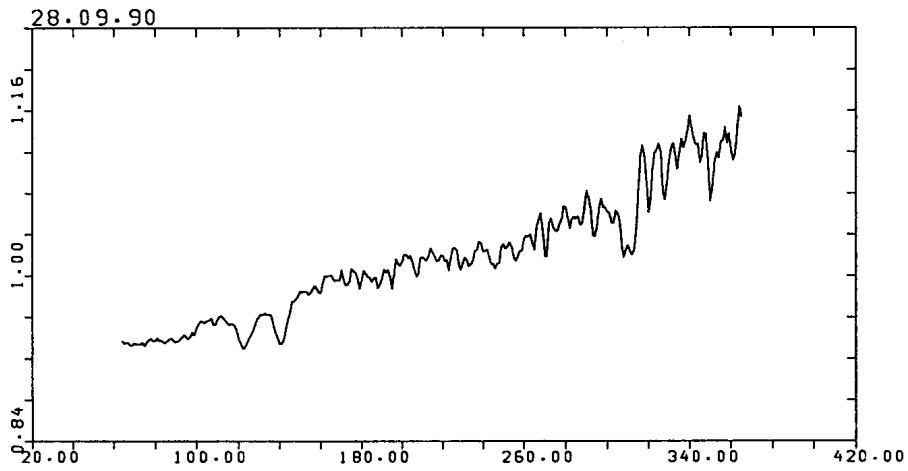
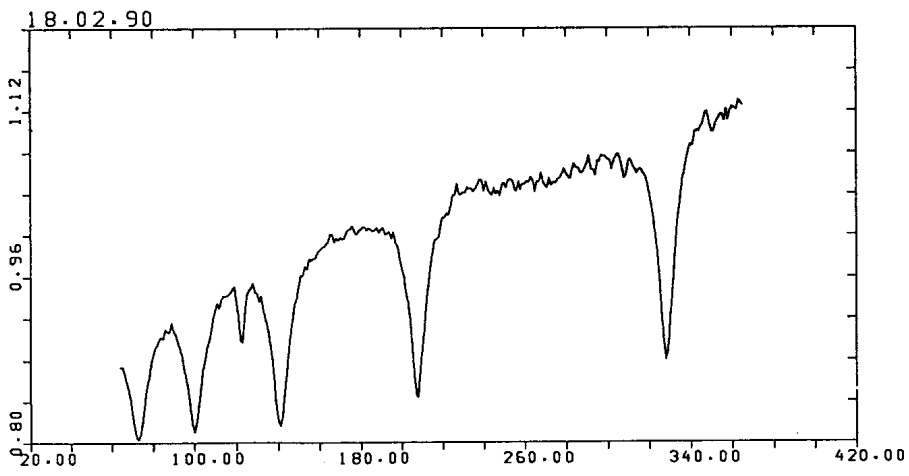


Figure 2. Spectra of HD 13654: *top* = outside eclipse; *bottom* = in eclipse

the data at the telescope and the star identification was carefully controlled, so the change in spectral type has been *real*.

The large RV variation and the spectrum change recorded on 28.09.1990 suggest that HD 13654 is an *eclipsing* spectroscopic binary. A test spectrum secured out of eclipse in the 7000-9000 Å region with the equipment above described, showed absorption lines assignable to the G9 companion. Being an eclipsing system, the determination of the orbits of the two components would immediately give their masses. What makes HD 13654 still more interesting is its relatively large RV in the Local Standard of Rest:  $RV_{lsr} = +48 \text{ km sec}^{-1}$ , much more than expected from A type stars belonging to the young thin-Disk of the Galaxy (Freeman 1987).

Clearly, HD 13654 is worth of a detailed investigation. It is relatively bright and lies at only 2° from the  $\eta$  and  $\chi$  double cluster in Perseus. This makes it a worth object to search in plate archive and to be observed by amateur astronomers. For this reason a finding chart (Figure 1) and a photometric comparison sequence (Table 2) are given here. The UBV photometry is the mean of the values reported by Krzeminski & Serkowski (1967) and Martini (1971) and it should be accurate to 0.017 mag (0.024 for stars marked by \* which were not observed by Martini 1971). The RGU photometry is from Stock (1956). Star F has anomalous colors but no record of variability.

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