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uvbyβ PHOTOMETRY OF THE NEWLY DISCOVERED PULSATING STAR HR 8851

After HR 8851 was found to be a pulsating star, possibly a δ Scuti star (Hao and Huang, 1993), we made observation in Strömgren uvbyβ system with the 60 cm reflector located at Xinglong Station, Beijing Astronomical Observatory on January 21, 1993. The aim of the observation is to get more information about the physical character of this star.

The observation was performed on a very good photometric night. We chose HD 221421 (COM1) and HD 221167 (COM2) as the comparison stars whose standard uvbyβ values are listed in Table 1.

We use the relations by Crawford (1975)

$$E(c_1)=0.20E(b-y)$$
$$E(m_1)=-0.32E(b-y)$$
$$E(b-y)=0.74E(B-V)$$

to correct for the interstellar extinction. We know that HR 8851 is listed as an F0IV type star with B−V=0.24 in Preliminary Version of the Bright Star Catalogue, 5th Revised Edition (Hoffleit and Warren, 1991), but for an F0IV type star, $(B-V)_o$=0.29 (Straizys, 1977), then E(B−V)=−0.05<0. So we think that the MK classification for HR 8851 adopted by BSC is uncertain. Here we use A7V type (see RGOB, 1968, **135**, 385, as searched from Simbad) for HR 8851 to estimate $E(B-V)=B-V-(B-V)_o$=0.24−0.20=0.04. After making the correction, we can get the results listed in the last row of Table 2.

In order to determine the absolute magnitude, we use the empirical relation (Breger, 1990)

$$M_v=-9(c_1)_o+15\beta-32.22$$

Table 1. Standard values for the two comparison stars (Olsen, 1983)

	SAO number	Sp	V	b−y	m_1	c_1	β
HD 221421	10770	F8	8.215	0.349	0.158	0.403	2.628
HD 221167	10752	G0	7.737	0.332	0.125	0.364	2.615

Table 2. uvbyβ results observed for HR 8851

	u	v	b	y	b−y	m_1	c_1	β
with COM1	7.366	6.058	5.723	5.557	0.166	0.169	0.973	2.727
with COM2	7.353	6.067	5.731	5.555	0.176	0.160	0.950	2.740
average					0.171	0.165	0.962	2.734
					$(b-y)_o$	$(m_1)_o$	$(c_1)_o$	
					0.141	0.175	0.956	

which results in M_v=0.19±0.3. We also use another relation (Breger, 1979)

$$M_v = -3.052 log P + 8.456(b-y)_o - 3.121,$$

where P=0.272 days is the period of light variation (see Hao and Huang, 1993), to get M_v=−0.20±0.3. These two independent determinations of M_v agree very well with each other within the uncertainty. So we can take the mean M_v=0.0 as our estimate for the absolute magnitude. This value is too bright to fit either F0IV or A7V type star and is due to the extremly large $(c_1)_o$ which is an indicator of the luminosity. We examined our observation carefully, but no problems were found.

According to the uvbyβ indices calibration made by Philip and Relya (1979), we obtain T_{eff}=(7700±200)K, and $log g$=3.65±0.1.

For A7 to F2 type stars, BC=0.0, M_{bol}=M_v. So, we use the radiation law

$$log(R/R_\odot) = -0.2 M_{bol} - 2 log T_{eff} + 8.472$$

to derive R=(5.0±1.0)$R_\odot$. Then from

$$log g = log g_\odot + log(M/M_\odot) - 2 log(R/R_\odot),$$

we have M=(4.0±1.7)$M_\odot$.

From the uvbyβ photometry and the physical parameter determinations we can find that

(a) UBV measurement and MK classification taken by BSC do not agree well with each other, and

(b) HR 8851 has an extremely large c_1 in comparison with those stars which have the same other indices as HR 8851. This leads to a too bright absolute magnitude to fit any of the calibrations for the models of A−F stars.

Further observations on this star are necessary. High resolution spectroscopy covering a wide range of wavelength is especially desirable for clarifying the possible effects of the binarity which may be the cause for the problems mentioned above.

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