

**PHOTOMETRIC EXAMINATION OF CP2-PECULIARITY FOR  
HD 200405, HR 44, HR 7752 and HR 9092**

In the course of a programme aimed at checking spectroscopic peculiarity assignments of chemically peculiar stars on the upper main sequence belonging to group CP2 (in older terms: the  $\alpha^2$  CVn variables) we have chosen the above stars for 3 runs at the L. Figl Observatory (Univ. of Vienna) on the summit of Schöpfl using its 60cm photometric telescope equipped with a classical one-channel photoelectric photometer (photomultiplier: EMI 9844A, Peltier-cooled). Observer was AS.

The filter system employed is that of  $\Delta a$  (Maitzen, 1976) which has been shown to identify CP2 stars as effectively as classification spectroscopy (Maitzen and Vogt, 1983). Details on the filters  $g1$  and  $g2$  were given in Maitzen and Floquet (1981), the third filter is a conventional Strömgren system filter  $y$ .

Measurements for this programme were obtained on August 5/6, August 9/10 and October 15/16, 1994. 10 stars were chosen to define the normality line of the index  $a(= g2 - (g1 + y)/2)$  versus the colour index  $b - y$ , the deviation of which has been defined as  $\Delta a$ -value. A measurement series for a programme star consisted of 8-12 repeats of the sequence  $g1, g2, y$  each covering 15 seconds of integration. The resulting mean error for the HR-stars was 2-3 millimags in  $a$ , and 3-4 millimags in  $g1 - y$ . Only for the relatively faint HD 200405 the error was 3-4 millimags in  $a$  and 4-5 millimags in  $g1 - y$ .

We have taken the  $b - y$ -values from Hauck and Mermilliod (1990), but no such value seems to have been published for the peculiarity candidate HD 200405. Since a very good correlation between  $b - y$  and the colour difference  $g1 - y$  had been found on previous occasions, we made use of it also in the present case. Fig. 1 shows this correlation with a slope of 0.51.

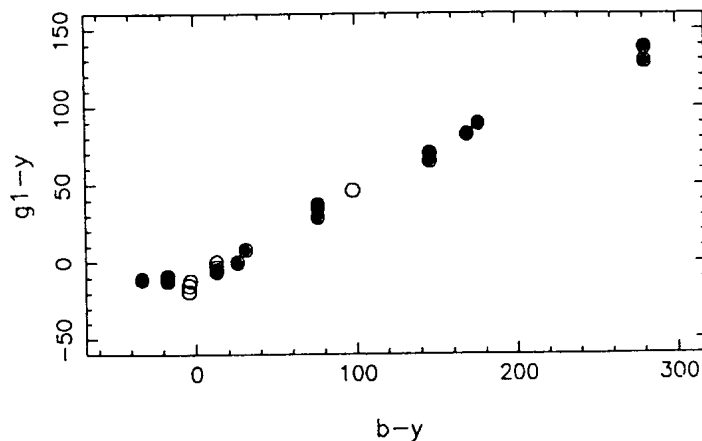


Figure 1. Correlation between  $g1 - y$  and  $b - y$  (both in mmags). Candidates for peculiarity are represented by open circles.

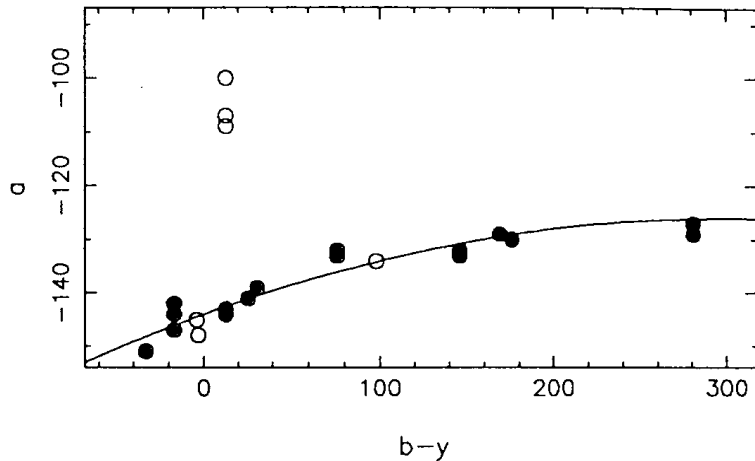


Figure 2. Peculiarity index  $a$  vs.  $b - y$  (both in mmags). Open circles are for measurements of CP2 candidates. Full line is the locus of normal stars.

From this correlation a value  $b - y = 0.013$  can be inferred for HD 200405. Even considering an error of 0.020 mag of this value, this will only very marginally influence the resulting  $\Delta a$ -value. The relationship  $a$  vs.  $b - y$  is displayed in Fig. 2. A regression curve yields

$$a = -144 + 0.12(b - y) - 0.0002(b - y)^2$$

with a scatter of only 2.28 millimags for the normal stars. Table 1 gives the results of our  $\Delta a$ -system measurements individually for the 3 nights, expressed in millimags.

#### RESULTS AND DISCUSSION:

##### 1. HD 200405 = Renson (1991) Catalogue (=RE) 55830.

North (1994) has shown that this binary has the shortest orbital period (1.63 days) known among those which host a CP2 star. Although he reports a  $\Delta(V1 - G) = 0.021$  indicating a CP2 star photometrically, North (private communication) asked for an independent confirmation of this result. Without any doubt we can give this confirmation based on our photometry:

our  $\Delta a$ -values (36, 43, 34 millimags, obtained on JD 2449/570.513, 574.553, 641.374, resp.) classify the pertaining component as medium strong peculiar star with a slight indication that it may be variable. Variability should not be very pronounced according to the orbital analysis of North (1994) since the star seems to be seen nearly pole-on. Future observations may help to get more insight into this very special example of a binary containing a CP2-star whose characteristics are obviously preserved despite the important tidal forces exerted by the nearby companion (North, 1994).

##### 2. HR 44 = RE 150

Cowley et al. (1969) have classified this star A1V Si:. This prompted Floquet (1975) to reobserve this object and she derived A0III for this star. Our  $\Delta a$ -result (obtained on JD 2449641.434) is in agreement with a non-peculiar star.

##### 3. HR 7752 = RE 53850

Osawa (1959) classified this star B9.5Vp with the remark that the K-line is as strong as in A1 and that He I 4026 is visible. Floquet (1970), however, classifies this object as normal A0V star which is in agreement with our completely normal  $\Delta a$ -values (obtained on JD 2449/570.398 and 574.395).

Table 1.  $\Delta a$ -photometry

Object	$b - y$	$a$			$\Delta a$			$g1 - y$		
HD 200405	13	-107	-100	-110	36	43	34	-3	-5	0
HR 44	-3			-148			-4			-12
HR 7752	-4	-145	-145		-1	-1		-19	-15	
HR 9092	98			-134			0			46
HR 68	26			-141			0			0
HR 70	-33			-151			-3			-11
HR 114	169			-129			0			82
HR 7253	176		-130			-1			89	
HR 7453	146	-133	-132		-2	-1		70	65	
HR 7756	281	-127	-129		-1	-3		129	138	
HR 7769	13	-144	-143		-2	-1		-6	-5	
HR 7792	-17	-142	-147	-144	4	-1	2	-9	-12	-12
HR 7826	31		-139			2			8	
HR 8463	76	-133	-132	-133	3	4	3	37	29	35

#### 4. HR 9092 = HD 224995

Contrary to the preceding three stars this object is not contained in the Renson catalogue of Ap and Am stars. It has been included in our programme because  $\Delta a$ -photometry of Vogt et al. (1995) exhibited a marginally peculiar value (0.015 mags).

Except for the observation of Hauck (1986) that HR 9092 is one of 22 stars classified as dwarfs in the Bright Star Catalogue, but which have the same Geneva colours as giants, this star does not show a peculiar behaviour, and lacks CP2 characteristics. Our photometric value has been obtained on JD 2449641.418.

As a summary we arrive at the conclusion that only HD 200405 is photometrically a CP2-star. Because of its special nature as member of a close binary system it deserves further observations. The other three stars are normal in our photometry.

This research has made use of the Simbad database, operated at CDS, Strasbourg, France.

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