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VARIABILITY OF THE EXTREME SILICON STAR ALPHA Dor=HD 29305 +)

In a forthcoming paper Renson and Manfroid (1981) show this star to be variable with an extremely large amplitude in Strömngren-u of 0.1 mag. Due to the fact that Alpha Dor is a binary, Renson and Manfroid conclude from a Δm of 0.3 - 0.4 that the intrinsic variability of the Ap-component should be increased by a factor of 1.7.

The period, unfortunately, turned out to be close to 3 days that their light curves (obtained in the uvby system) exhibit 3 pronounced gaps, while the relatively large number of observations ($n=39$) gather at 3 equidistant phases, one around the maximum and the others at nearly the same minimum level. In the light curves of Renson and Manfroid one rather easily recognizes that the differential indices $\Delta(b-y)$, Δm_1 and Δc_1 show a markedly smaller scatter than the colour differences Δu , Δv , Δb and Δy . One plausible explanation would be a slightly variable comparison star with negligible variability in the colour differences. Manfroid (1981) offered another explanation, which is related to the type of photometer used by Renson and Manfroid:

This photometer (attached to the 50-cm Danish telescope on La Silla) records the registrations in uvby simultaneously, hence any variations of the sky transmission appear in all filters with the same amount. In the case of HD 29305 very short integration times were selected (owing to the brightness of the star) so that there was not sufficient time for the sky fluctuations to average out in the individual filter measurements. Such fluctuations, however, cancel out when forming colour differences of simultaneous filter measurements.

Hence, it is more useful in this case to look at the differential curves of $b-y$, m_1 and c_1 to draw some conclusions about the possible shape of the variation curve within the phase gaps.

It is especially the c_1 -curve which suggests that between the minima phases there might be a secondary maximum of this variation.

As silicon stars exhibit (or seem to exhibit) less frequently double wave variations than the Ap stars of later type, it would be an interesting undertaking to obtain information also on the phase regions not covered by Renson and Manfroid.

In order to contribute to this project I have carried out measurements of this star on two photometric runs on La Silla. The first one was performed already in fall 1971 at the Bochum 60 cm telescope, the second one in Nov/Dec 1979 at the ESO 50 cm telescope. In both cases the uvbyg₁g₂ system, as described by Maitzen (1976) was used.

It is not very easy to find a good comparison star for Alpha Dor. In the first run I took HD 31203/4 (iota Pic) a visual binary as comparison star, which showed to be rather unhandy due to its separation of 12". Thus, for the second time I used HD 27647 and HD 30478 (Kappa Dor).

From the 1971 observations it was clear that the period of Alpha Dor should be related to 3 days. The same conclusion can be drawn from the observations in 1979, although by chance only 1 minimum phase could be observed. Thus, there is the problem of a period so close to a small integer number of days that it takes a long observing time during one season to cover the whole variation cycle. Another approach which should possibly be preferred is to combine observations performed from two or more observatories with sufficient separation in longitude. As there are only bright stars involved the required telescope size is rather small, hence the availability should be rather easily ensured.

The present measurements, given in Table I do not yet define an unambiguous final period, when added to the Renson and Manfroid set, since the gap between all three observing periods is too large.

Finally, from a comparison of the differences Alpha Dor minus HD 30478 and HD 30478 minus HD 27647, especially on 1979-11-24 it is clear that HD 30478 must vary within the time scale of hours. The amplitude of the variations should be within 3 or 4 percent. All this points to a Delta Sct variable.

Table I

Differential measurements.

a) Alpha Dor minus Iota Pic (=HD 31203/4)

JD - 2440000	u	v	b	g_1	g_2	y	Night Y M D
1278.80	-2.782	-2.519	-2.215	-2.116	-2.018	-1.949	711122
1279.77	846	512	223	107	038	960	23
1281.77	776	493	201	102	013	932	25
1282.75	855	519	232	123	047	964	26
1283.71	775	495	204	097	016	935	27
1285.71	-2.856	-2.512	-2.234	-	-	-1.964	711129

b) Alpha Dor minus HD 27647

4202.61	-4.628	-4.087	-3.945	-3.949	-3.918	-3.882	791124
4202.81	617	081					24
4203.60	538	058	913	916	885	841	25
4203.61	541	056	916	924	892	842	25
4203.81	543	058	917	924	894	852	25
4205.77	623	085	947	957	923	882	27
4208.62	627	085	947	955	924	887	30
4214.65	-4.613	-4.077	-3.942	-3.949	-3.920	-3.881	791206

c) HD 27647 minus HD 30478 (Comparison stars)

4202.61	1.708	1.788	1.843	1.868	1.882	1.907	791124
4202.81	1.678	1.742					24
4203.60	1.676	1.757	1.825	1.852	1.866	1.890	25
4203.81	1.685	1.755	1.824	1.850	1.869	1.890	25
4205.77	1.664	1.733	1.802	1.830	1.846	1.876	27
4208.62	1.676	1.750	1.817	1.844	1.861	1.888	30
4214.65	1.692	1.770	1.836	1.866	1.879	1.906	791206

In Table II I present the results of the absolute photometry for the 3 stars observed during the 1979 mission. The comparison star HD 27647 has had no published Strömberg parameters so far.

Table II

Absolute photometry in 1979 (n = 6)

HD	V	b-y	m ₁	c ₁	δ _V	δ _{b-y}	δ _{m₁}	δ _{c₁}
27647	7.172	0.039	0.191	0.988	6	2	5	5
29305	3.297	-0.030	0.120	0.610	20	3	4	34
30478	5.283	0.113	0.181	0.989	10	3	5	7

The sigmas are given in units of 0.001 mag.

It is interesting to note that the variable comparison star Kappa Dor (HD 30478) shows a relatively large mean error in the catalogue of Grønbech and Olsen (1976) in agreement with our finding.

According to the Δa-values found for Alpha Dor it should be a very mild Ap star. However, we have to take into account that the strength of the 5200 Å depression is diluted by the presence of the second star which contributes a depressionless 5200-Å region to the measurements.

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