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ULTRAVIOLET ANS PHOTOMETRY FOR THE FIVE SUSPECTED LONG PERIOD Ap STARS HD 89 822, HD 137 389, HD 187 474, HD 204 411 AND HD 221 760

The main problem of the very long period magnetic CP stars is whether the nature of those stars is the same as for the "normal " short period ones. To answer this question it is necessary to determine the periods and then to compare their characteristics of variability, which certainly should be different, if different mechanisms are working. The Ap stars show pronounced typical characteristics in their UV variability, e.g. large amplitudes and antiphase relations to the visible spectral regions.

For five of the suspected long period Ap stars given by Hensberge et al. (1984), more than two single UV observations from ANS (Wesselius et al., 1982) are available (Table I).

Table I

ANS UV observations

J.D. 2400000+	15W		18		22		24		33	
HD 89822	Mg									
42350.328	4.231+	4	4.207+	3	4.326 ±	2	4.696+	3	4.836+	4
42527.971	4.222−	3	4.200−	3	4.317	1	4.684−	3	4.831−	2
42528.176	4.226	2	4.199	3	4.315	1	4.691	2	4.827	3
HD 137389	Si									
42400.006	5.302	11	5.299	7	5.523	5	5.831	15	5.964	8
.623	5.306	5	5.314	4	5.520	2	5.811	7	5.951	5
.623	5.314	6	5.311	5	5.521	3	5.814	5	5.959	6
42580.355	5.316	7	5.332	4	5.516	2	5.803	4	5.947	5
42581.507	5.328	5	5.324	4	5.519	2	5.803	4	5.955	4
.977	5.327	6	5.319	6	5.520	3	5.798	3	5.959	6
42583.872	5.315	5	5.326	3	5.515	2	5.805	4	5.956	5
HD 187474	Si Cr Eu									
42336.792	5.341	6	5.103	4	4.873	2	5.275	4	5.100	2
337.004	5.331	5	5.118	5	4.877	3	5.271	5	5.102	3
515.907	5.179	6	4.972	5	4.819	2	5.207	5	5.123	3
.907	5.186	4	4.967	4	4.815	2	5.218	3	5.121	3
880.397	5.158	2	4.966	3	4.841	1	5.216	2	5.135	2
.861	5.153	9	4.968	5	4.838	2	5.211	8	5.129	3
HD 204411	Cr Si									
42575.899	7.892	18	6.165	8	5.887	5	6.181	5	5.783	6
.899	-	-	6.144	5	5.885	3	6.193	5	5.773	4
42576.914	7.863	29	6.157	7	5.879	3	6.190	6	5.771	5

Table I (cont.)

J.D. 2400000+	15W		18		22		24		33	
HD 204411	Cr Si									
42576.914	7.866	± 19	6.157	± 8	5.884	± 4	6.186	± 6	5.782	± 5
42578.134	7.891	16	6.169	7	5.877	3	6.194	7	5.771	4
.134	-	-	6.160	6	6.879	2	6.198	6	5.770	4
HD 221760	Sr Cr Eu									
42377.901	6.222	9	5.259	6	5.048	2	5.407	4	5.045	3
.901	6.196	9	5.257	6	5.048	2	5.413	4	5.039	3
42378.105	6.226	10	5.258	5	5.055	2	5.407	4	5.044	3
.105	6.229	10	5.266	5	5.053	2	5.410	4	5.049	4
42558.656	6.180	10	5.232	4	5.048	3	5.401	4	5.037	4
42559.466	6.278	10	5.232	5	5.049	3	5.408	4	5.050	4
.466	6.292	9	5.245	4	5.050	2	5.411	4	5.050	4
.470	6.274	10	5.235	5	5.052	2	5.414	5	5.048	4
42743.556	6.202	8	5.263	4	5.044	4	5.410	6	5.047	4
.556	6.187	10	5.257	4	5.041	3	5.406	4	5.050	3
42744.626	6.236	10	5.267	5	5.050	2	5.411	3	5.044	2
.630	6.218	12	5.268	5	5.051	3	5.409	4	5.048	3

For three of the stars (HD 89 822, HD 137 389, HD 204 411) no significant variations have been found. That means that HD 89 822 and HD 137 389, if variable, have periods, much longer than 180 days. For HD 204 411 found to be constant in the visible by different authors, one can exclude UV variability with a period less than 10 days. For HD 221 760 the observed magnitude differences, at least in the wide 1550 A band are significantly greater than the errors. The short time scale of variations suggests a period length in the order of days.

The star HD 187 474 clearly shows variations which agree with the time scale given by Hensberge et al. (1984). Assuming similar shapes of the light curves in u and in the near-by 3300 A band and shifting the magnitude scale to fit the two sets of observations, we can correct the period given by the above mentioned authors. This leads also to a little better agreement between the uvby observations. The obtained elements are:

$$\text{JD (phase zero)} = 2444457.77 + 2300 \cdot E \pm 50$$

Figure 1 shows the observations plotted in the phase diagram. The visible magnitudes were taken from Figure 1 of Hensberge et al. (1984), the phases were computed from the mean time of the corresponding observing runs, given there (+absolute measurement). The dashed lines indicate our interpretation of the observations. The distribution of the observations at different wavelengths in the phase diagram suggests a double wave in the light curves. The variations in the UV have large amplitudes and are in antiphase to the

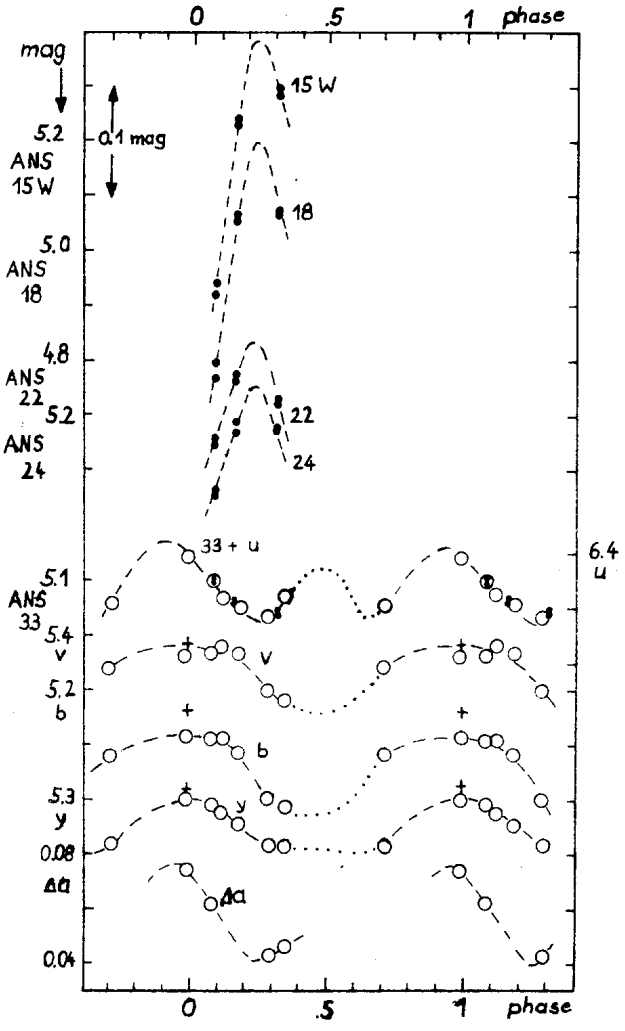

Figure 1

variations in the visible spectral region including the 3300 A band. The characteristics of the photometric variability of this very long period (6.2 years) star are very similar to normal short periodic Ap stars, suggesting intrinsic slow rotation and rotational variability for HD 187 474. The intermediate long period Ap stars HD 221 568 (P = 159 d) and HD 188041 (P = 224 d) clearly show rotational variability. Now HD 187 474 extends

this property to much longer periods. Therefore it does not seem to be necessary to assume generally any other mechanism for explaining the very long period Ap stars. On the other hand, the expected short rotational period, estimated by Kurtz (1983) from his oblique pulsator model for Gamma Equ in connection with the long time scale variations of the magnetic field (s. Krause, Scholz, 1981) might indicate that for different long period magnetic CP stars different mechanisms can be responsible for their variability. We thank Dr. Wesselius, who made it possible to use the individual observations from ANS.

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