A statistical investigation of pulsating stars.

Tenth paper : *Variables in or near the constellation Corona Australis*

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Özet: Corona Australis takım yıldızının civarında ve içinde bulunan bir takım değişen yıldızlar tetkik edilmiştir. $\pi(1)$ ve A(f) için elde edilen değerler tabloda verilmiştir. Şekilde A(2) değerleri mütekabil log P değerlerine nazaran izdüşürülmüştür. A(2) — log P korelasyon düzleminde değişkenlerin dağılımı Sagittarius bulutu için elde edilen dağılımla hemen hemen aynidir. Bu vaziyet tetkik edilen bölgenin bu bulutun kenarında bulunmasından dolayı şayanı hayret değildir.

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Abstract: A number of variables in or near the constellation Corona Australis is analysed. The resulting values for $\pi(1)$ and A(f) are given in the table. In the figure the values A(2) are plotted against the corresponding values log P. The distribution of the variables in the A(2) — log P correlation plane is nearly the same as that obtained for the Sagittarius cloud. This is not surprising as the region considered here is on the edge of this cloud.

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In the present paper we have analysed a number of variables in or near the constellation Corona Australis. The light curves of these variables have been determined by *H. van Gent*[1]. Of the light curves given by *van Gent* 56 were analysed in the present paper by the autocorrelation and subsequent power series analysis. This method has been fully explained in the first paper of this series and therefore no further explanation is given here. The symbols used here also are identical to those in the previous papers of this series and consequently $\pi(1)$ indicates the intensity of the principal on a scale on which a pure sinus curve has the intensity 1. A(2), A(3) and A(4) indicate the relative intensities of the first, second and third overtone respectively.

For the 56 light curves mentioned above, the results of our analysis are collected in table 1. The numbers in the first column of our table are the numbers by which the variables are indicated in the lists of *van Gent*. The light curves which have been analysed were selected in such a way that all periods are represented. Because both the very short and the very long periods are rare, all available light curves both for these very short and for the very long periods have been analysed.

Of the intermediate periods only about 1/3 of the available light curves has been analysed. In first instance the choice of the light curves was made in an arbitrary way, so that our results would represent a general mean. In addition to this a number of light curves were analysed which:

1. According to *van Gent* must be considered as being irregular;

2. The shape seemend to deviate from the light curves of the variables with corresponding periods;

3. The scatter of the normal points around the mean light curve, especially near maximum, seemend larger than usual.

In our table we have indicated the first of these additional groups of stars by "irr". It is possible that from further observations it will appear that a few of the others also will prove to be of the R. W. Draconis type.

In some cases the evidence as to this seemed to be rather positive. In our table these variables have been designated by "irr ?".

The area in Corona Australis, inspected by *van Gent*, contains the globular cluster N. G. C. 6723. Due to the scale of his plates he could determine the shape of the light curve only for a few of its variables e. g. those in the outer regions of the cluster.

In our table the variables which *van Gent* assigned to the cluster have been indicated by "cl". The further arrangement of the table is self evident. The variables are given in order of increasing period. The various columns give the logarithm of the period and the computed values $\pi(1)$; A(2); A(3) and A(4).

In fig. 1 the values A(2) of the table are plotted against the corresponding values log P.

The variables which in the table are indicated by either "irr"

TABLE 1.

The variables in or near the constellation Corona Australis, analysed in the present paper.

No	log P	π (1)	A (2)	A (3)	A (4)	No.	log P	π (1)	A (2)	A (3)	A (4)	Rem.
272	.032—1	.929	.227	.032	.089	45	.688—1	.665	.418	266	.122	
78	.074—1	.995	.170	.095	.084	86	.697—1	.684	.430	.347	272	
120	.465—1	.933	.100	.167	.105	204	.703—1	.846	.390	.145	.045	irr.
189	.520—1	1.000	.118	.110	.105	8	.715—1	.661	.528	.387	.244	
182	.524—1	.980	.032	.032	.000	35	.719—1	.716	.524	.270	.257	
126	.553—1	.940	.200	.118	.000	123	.721—1	.839	.378	.170	.063	d.
172	.602—1	.790	.454	.000	.084	12	.724—1	.721	.464	.274	.203	cl.
14	.637—1	.821	.385	.192	.145	90	.727—1	.693	.381	.270	.102	
119	.637—1	.670	.572	.345	.190	213	.731—1	.802	.416	.187	.077	cl.
1	.638—1	.739	.439	.352	.165	104	.747—1	.691	.524	.237	.117	
30	.640—1	.751	.476	.319	.176	193	.750—1	.777	.486	.277	.053	
196	.646—1	.830	.389	185	.110	222	.763—1	.762	.326	.295	.155	
199	.646—1	.709	.483	.247	.232	208	.772—1	.688	.602	.265	.110	
174	.653—1	.841	.359	.207	.077	68	.774—1	.733	.488	.271	.164	
57	.653—1	.733	.519	.228	.141	47	.785—1	.844	.345	.190	.095	irr ?
11	.654—1	.723	.402	.413	.163	2	.792—1	.773	.456	.237	.077	
49	.659—1	.863	.439	.362	.221	187	.792—1	850	.310	.221	.118	
58	.661—1	.896	.276	.148	.055	107	.793—1	.883	.346	.000	.000	
130	.663—1	.726	.525	.259	.130	14	.801—1	.673	.440	.236	.119	
164	.663—1	.720	.460	.210	.158	188	.813—1	.698	.555	.259	.164	
10	.666—1	.971	.084	.114	.141	13	.825—1	.679	.559	.363	.131	
237	.672—1	.708	.430	.270	.346	122	.828—1	.727	.544	.276	—	
5	679—1	.792	.435	.292	.141	70	.831—1	.759	.493	.239	.077	
168	.683—1	.691	.542	.361	.138	303	.842—1	856	354	.130	.095	
84	.685—1	.723	.415	.361	.187	66	.872—1	.793	.451	.217	.055	
						202	.882—1	.772	.378	.305	.158	
						97	.884—1	.896	.247	.145	.045	
						131	.004	.671	.528	.366	.182	
						136	.052	.705	.423	.359	.261	
						81	.520	.857	.302	.262	.105	
						3	1.216	.937	.217	.105	.032	

or "irr ?" have been indicated by open circles. The variables in N. G. C. 6723 are indicated by crosses. All other variables are indicated by black discs. In the figure we have also indicated the various provisional levels as found by E. A. Kreiken a. o.[2] for ω Centauri and for the Cepheids [3]. The elongated vertical rectangle corresponds to the range of the values A(2) for A. R. Her [4].

When considering this figure it should be remembered that the region in Corona Australis investigated by *van Gent* is on the edge of the great star cloud in Sagittarius. As a matter of fact several of his variables are in the constellation Sagittarius.

Our figure therefore represents the distribution of the values A(2) for the variables in a part of the Sagittarius cloud. It is therefore not surprising that the distribution found here closely corresponds to the one which E. A. Kreiken, N. Andaç and J. Ulusoy [5] obtained for a more central part of the Sagittarius cloud. Here also we find that only a few variables are on one of the *c* levels. The two variables of exceptionally short period (Nos. 272 and 78) may be on the extension of the sublevel c^2. The great majority of the variables are on the levels *a*. Here also we find that the variables in the cloud are scattered mainly along the sublevel *a* 1, while only relatively few are near the sublevel *a* 2.

With ω Cen. the variables were equally distributed over the two sublevels. In this part of the Sagittarius cloud also the *a* level is extended to much shorter periods than in the clusters. The shorter limit closely corresponds to the one found for the central part of the cloud [5]. The two points corresponding to the variables N 131 log P = 0.004 and N 136 log P = 0.052 are rather curious.

Around these periods variables are scarce. The few which have been analysed up till now all were on the extension of the sublevel *a* 1 or at least near the extension of this sublevel.

Of the points corresponding to the two variables mentioned above, one falls on the extension of the sublevel *a* 2 while the other is even above this sublevel. These are the first points which were found in this part of the diagram.

In our figure there is no clear distrinction between the area occupied by the irregular variables and that occupied by the other variables on the *a* level. Several of the latter variables are in

the area which was previously found to be occupied by the variables of the R. W. Draconis type. The light curves published by *van Gent* are provisional ones, and it may be that on further observation either small corrections will have to be applied to the curves or that some of the variables may actually turn out to be irregular.

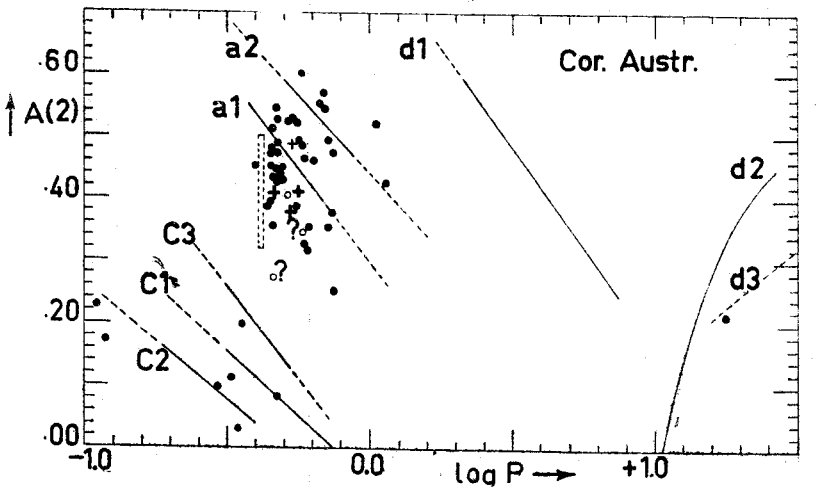

Fig. 1.

However, it would be premature already now to indicate them as being irregular.

The lists of *van Gent* contain only a very few variables with periods > 1 day. Although all of them have been analysed and are plotted in the figure, nothing can be said about the distribution of these Cepheids. One point is situated rather far below the level *d* 1 and might be on the extension of *a* 2, the other is on the level *d* 3.

It seems advisable in a later stage to combine the results obtained in this paper with those obtained for the central part of the Sagittarius cloud.

Literature :

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