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POSSIBLE HETEROGENEITY OF THE δ Sct COMPLEX

The relation between the normal A, the metallic A_m and the variable stars of δ Sct type is theoretically examined by Vauclair (1976). In this work it is supposed that the normal A and the δ Sct stars come from the stable A_m phase. The time scale of the A_m phenomenon is of the order of 1.5×10^6 years and it is possible to reach it on different stages of evolution, since it may be repeated many times at the same star (Vauclair, 1976).

All this calls forth the question about the homogeneity of the δ Sct complex, in spite that the boundaries, in which their physical characteristics change, are narrow. Nevertheless, still on their setting apart as a separate group of variables by Eggen (1956), attempts are made to differenciate groups in the complex of δ Sct variables (Leung, 1970 - two groups with different masses, in different stages of evolution; Frolov, 1972 - two groups with different periods; Breger and Bregman, 1975 - two groups with different temperatures, different pulsation constants and different period-luminosity dependences; Dworak and Zieba, 1975 - two groups with different luminosities).

On the basis of the systematized photometric data made in the Strömgren system published up to the middle of 1978 for about 120 variable stars of δ Sct type we decided to examine once more the question of the existence of sub-groups among them, which would allow the classification of some problems related to the evolution of these variables.

The comparison of the effective temperatures T_{eff} and the absolute stellar magnitudes M_v for 65 stars of δ Sct type, for which there are calculated pulsation masses (Baglin et al., 1973; Breger, Bregman, 1975; McMillian et al., 1976; Kurtz, 1977), is shown in Fig.1. The analysis of the Figure using the

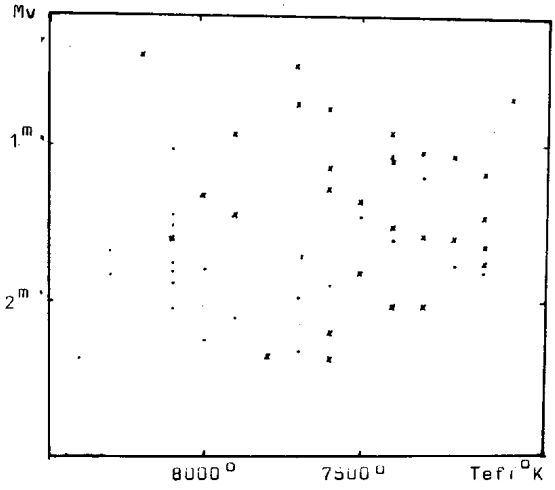

Fig. 1

data of the pulsation masses of the stars shows that the masses increase in the direction of lower temperatures and higher luminosities. Therefore the stars of the "cooler" group have masses on the average by 0.5 $M_\odot$ higher than the masses of the stars of the "hot" group (Breger and Bregman, 1975). Several stars which make an exception (τ Peg, δ Sct, HR 7501, 28 And, HR 8006, 26 Ari, HD 73798), have anomalies in their chemical composition, which are expressed in the increased abundance of metals from the group of iron. Besides, the errors on defining the pulsation masses reach up to 30 percent (Tsvetkov, 1977).

The comparison of the amplitudes of the light change for the two groups after Breger and Bregman (1975) shows on the average a three-times higher average amplitude for the stars with $T_{eff} \leqq 7\ 800^\circ$ in comparison to the stars with $T_{eff} \geqq 7\ 800^\circ$ (Fig.2).

The position of the δ Sct stars on the diagram log g - T_{eff} (Fig.3) depends on their chemical composition (Lub, 1977). The stars with solar abundances of elements fall near the main sequence, built for the stars of the Hyades cluster (Strömgren, 1963). The stars with metallic deficit, such as the RR Lyr type stars,are grouped far from the main sequence, in the region of the giants with low log g. In this diagram the variable stars of δ Sct type

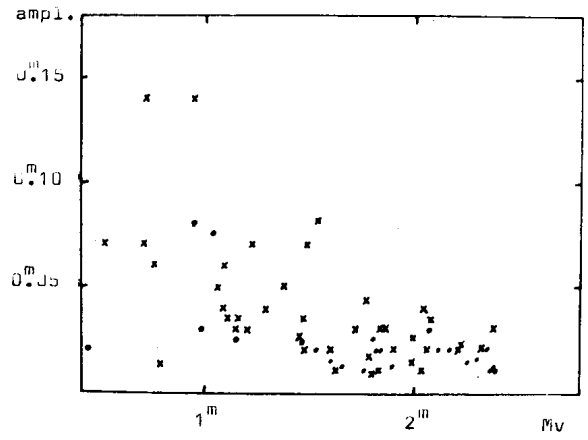

Fig.2

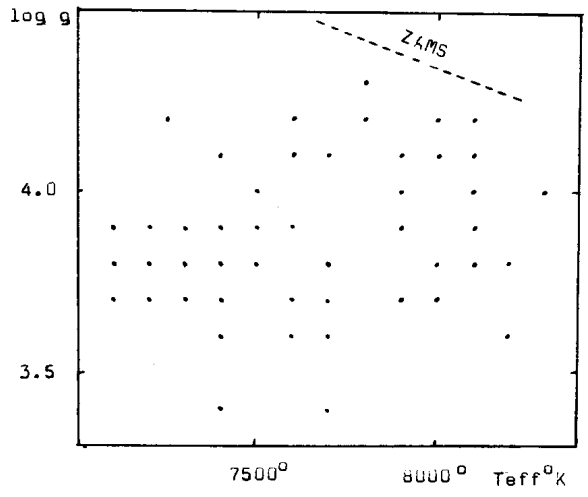

Fig. 3

are divided anew in two groups with a limit of about 7 800°,falling around the main sequence.

In conclusion we may summarize confirming Leung's inferences with richer material:

1. The group of the "cool" δ Sct stars with $T_{eff} \leq 7\ 800^{o}$ consists of stars with masses of about 2.1 $M_{\odot}$, which pulsate mainly in the basic or first harmonic frequency. They have, on the average, longer periods and larger amplitudes of light change. They are in their stage of evolution on the way to the giant branch crossing the instability strip for the first time.

2. The group of the "hot" δ Sct stars consists of stars with masses of about 1.6 $M_{\odot}$, which pulsate mainly in the second overtone or the first one. They are on the main sequence or descend from it.

3. The existence of two groups of δ Sct stars is a proof that the phenomenon "variability" of δ Sct type may come into being at different stages of stellar evolution.

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