SHELL STARS IN THE GENEVA PHOTOMETRIC SYSTEM

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L. Divan (1979) showed that the Balmer jump is greater in a Be-shell star than in a star of same spectral type and we will consider if this property is also present in A and F-shell stars by studying their data in the Geneva photometric system. Two photometric parameters in this system are correlated with the Balmer jump: d=(U-B1) -1.430 (B1-B2) and Δ=(U-B2) -0.832 (B2-G). In addition to the Balmer jump, Δ is also sensitive to blanketing. Both parameters are reddening free. A study of the Be stars of luminosity class V or IV classified by Slettebak (1982) shows that, in a d vs Δ diagram, they are in the area of main sequence stars or a little above, while the majority of Be-shell stars are above the Be star sequence. Pleione is well known for presenting a Be phase followed by a shell phase. The mean values of d and Δ for 1962, 1965, 1973, 1977, 1979, 1982 and 1984 are represented by triangles in Fig. 1. We see that after 1973 Pleione is clearly a shell star. Thus we observe that we can predict the beginning of a shell phase.

A list of the Be, A and F-shell stars has been set up from the studies of Abt & Moyd (1973), Andersen & Nordström (1977), Andrillat et al. (1983), Plavec et al. (1982) and Slettebak (1982), 45 of these stars being measured in the Geneva system. They are all plotted in a d vs Δ diagram (Fig. 1) and we see that the majority of the Be-shell stars are well above the area of main-sequence stars. In the case of A and F-shell stars, we consider the difference between their d value and the mean value of d, for their spectral type, indicated by Meylan et al. (1980). 26 stars are A or F-shell stars having data in the Geneva system. 16 have a Balmer jump greater than normal (Δd=d-<d> being greater than 0.100). Four have a big Balmer jump, or $0.050 \lesssim \Delta < 0.100$. Four others have a normal Balmer jump, while two have a smaller Balmer jump than that of a normal star (Δd< 0). These two stars are HD 39060 (β Pic) and HD 163296. Both are considered by Jaschek et al. (1986) as Infrared Anomalous Emitters. But two other IAE (HD 41511 and HD 144668) have a value Δd>0 !

It was considered whether a high Vsini value or binarity could be related to a big Balmer jump, but it must be concluded that no correlation exists.

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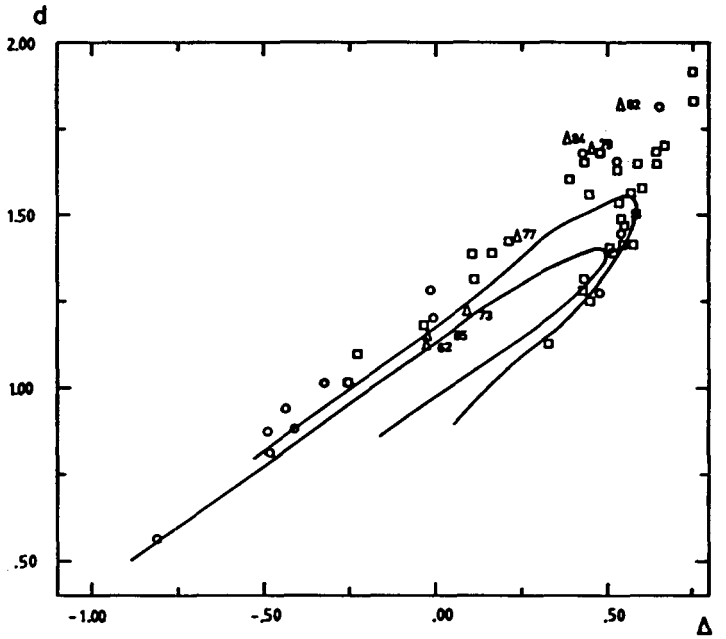
Fig. 1. d vs Δ diagram for Be, A and F-shell stars. The strip between the two solid lines is the location of the main-sequence stars. The B0 stars are located on the left of the upper branch while the A2 stars are in the "elbow". Circles are binary stars, triangles are mean value of Pleione for 1962, 1965, 1973, 1977, 1979, 1982 and 1984.



Analysis of the location of the B, A and F-shell stars in the d vs Δ diagram of the Geneva photometry leads us to conclude that the great majority of these stars exhibit an anomalous Balmer jump, as already mentioned by Divan (1979) for the Be-shell stars. The fact that the A and F-shell stars exhibit the same property allows us to conclude that these stars represent the cool end of the Be-star sequence, as already mentioned by spectroscopists.

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DISCUSSION FOLLOWING HAUCK

Zorec:

I would like to comment that the Balmer jump you are detecting with your photometric system correspond to the total Balmer jump which Be stars commonly show. These Balmer jumps have two components. One of them comes from the photosphere of the underlying star and the other one comes from the circumstellar envelope and is strongly variable. The photospheric component does not vary during line or photometric variations of Be stars.

Kogure:

Do you have data on rotational velocities for your stars? And do these stars show *high* rotational velocities among A and F stars?

Hauck:

These stars have relatively high rotational velocity but no correlation between vsini and their location in the d vs D diagram exists.

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