

CORRELATION BETWEEN SPECTRUM CHARACTERISTICS AND
PHOTOMETRIC BEHAVIOUR OF Be STARS

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Based upon a sample of 140 B0-A0 emission-line stars contained in "A Photographic Atlas of Be stars" statistical relationships between variable stars and Be stars are examined. It is found that 44 % of all the stars of the sample show some kind of photometric variations. The stars with narrow metallic absorption lines display relatively more intense photometric activity. Proceeding from this conclusion, the photometric variability of two stars HD 50138 and HD 193182 can be predicted.

It is known that photometric changes and rapid variations of the structure of the emission lines indicate instabilities in the envelopes of Be stars. Nevertheless, not all of them display the same activity.

The purpose of the present note is to determine what kind of spectrum characteristics are more closely associated with the photometric variability of these stars. To answer this question we have examined the photometric behaviour of the sample of 140 stars contained in "A Photographic Atlas of Be stars" (A.M. Hubert-Delplace, H. Hubert, 1979) using all information on variability published up to 1981.

Based upon a discussion of spectrum characteristics of the stars of this sample M. Jasek et al (1980) proposed for the first time to subdivide the Be star group into five physically significant subgroups. The distribution of the stars over the subgroups is given in Table 1. Under the group number are summarized the main spectral features. The number of variable stars among the stars in each subgroup and the fraction of variable stars expressed in percentages are also given in the second and third lines of table 1. The total fraction of variable stars is 44 %. This quantity is close to the 53 % obtained by L. Ferrer and C. Jasek (1971) from a comparison of individual brightness estimates presented for 130 bright Be stars in the catalogue of Blanco et al (1968).

Table 1

Subgroups	I	II	III	IV	V	Total
Stars	$\alpha, \beta, \dots + \text{Fe IIem}$	$\alpha, \beta + \text{Sh H}$	$\alpha, \beta + \text{Sh H} + \text{met}$	α, β, \dots	$\text{B} \rightarrow \text{Be}$	
Be	44	15	7	37	37	140
Be var.	24	6	6	8	18	62
Be var/Be	54 %	40 %	86 %	21 %	51 %	44 %
Be des.var	17	4	3	4	12	40
Be des.var/Bevar	67 %	66 %	50 %	50 %	66 %	64 %

According to Table 1, the maximum photometric activity is displayed by the stars of the subgroup III, (86 %) the least one by the stars of the subgroup IV (19 %). The sample of our information about variability is not homogeneous ; however, the following considerations allow us to conclude on the absence of bias, i.e. any preferential study of the stars of a certain group. In fact, an estimate of the fraction of designated variables, i.e. of the stars whose variability has been confirmed by special observations, in each subgroup is practically the same (fifth line of table 1).

The stars of subgroup V changed from B to Be or vice versa during the period of study, and some of them even underwent two changes ($\text{Be} \rightarrow \text{B} \rightarrow \text{Be}$ or $\text{B} \rightarrow \text{Be} \rightarrow \text{B}$). During their Be phase they can belong to subgroups II, III or IV. In Table 2 the distribution over subgroups of these objects is presented, as well as a similar distribution of the variable stars of the same group.

Table 2

Subgroups	II	III	IV	Abs.	Total
Stars					
Be	23	2	5	7	37
Be var.	13	2	2	1	18
Be var/Be	56 %	100 %	40 %	14 %	51 %

It is obvious that the photometric activity of the stars having variable emission is higher than that of the permanent emission members of same subgroups. Also it is interesting that among the stars that had no emission during 20 years the relative occurrence of variable stars is 14 %, being close to that of the subgroup IV (stars with emission).

The examination of the two tables permits to estimate the probability of a manifestation of the light variability of Be stars which possess certain spectral features. For instance, from Table 1 one can see that the variability is most probable for the members of the subgroup III having narrow metallic absorption lines in their spectrum. Although the statistical significance of the quoted estimate of the variable stars fraction for this group is not very reliable owing to the small number of objects in the group, additional data for the stars from the subgroup I and IV indirectly confirm our conclusion. Namely, in Table 2, according to the spectrum features in the Be phase, two of the 37 stars are attributed to the subgroup III, and both of these stars are variable, although the fraction of these in the group as a whole is 51 %. Among 44 members of the subgroup I, four also have shown metallic shell lines, three of them are variable, the occurrence of variables in the group being 54 %. Proceeding from this, one can expect manifestations of light variability for the two stars with narrow metallic absorption lines found in the group of non-variables, HD 50138 (subgroup I) and HD 193182 (subgroup III). At present, for the star HD 50138 there are spectral observations pointing to an instability of its envelope.

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