STATISTICAL ANALYSIS OF THE DATA AVAILABLE FOR Be STARS

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1. INTRODUCTION

A comprehensive catalogue of more than 1100 Be stars with known MK classification has been prepared at the Strasbourg Stellar Data Center, and is described in an other session of this Symposium (Jaschek and Egret, 1982). The compilation of photometric and spectroscopic data available for these stars has made possible a general statistical approach of the Be star spectral group.

2. DISTRIBUTION IN MAGNITUDES AND SPECTRAL TYPES

The sample studied here is not exhaustive to any given limit in magnitude or distance, and is affected by several observational biases. In the following we will often use the subsample of stars in the region south of $\delta=-40°$ covered by the Michigan Spectral Survey for the HD stars (Houk and Cowley, 1975; Houk, 1978): for this subsample statistical comparisons with normal B stars should be more significant.

The distribution in visual magnitudes is illustrated by Figure 1. There are 160 stars brighter than V=6.5 and 750 stars brighter than 9.5. In the region south of $-40°$ the number of detected Be stars is the following: 45 Be stars brighter than 6.5 (=9% of the B III to V stars) and only 420 HD stars (=4%). These numbers do not take into account the variability of the Be feature.

The distribution within the spectral types B0-B9 and the luminosity classes III-V is presented in Figure 2. The main features are the maxima at spectral types B2 and B8 and the increasing proportion of giants over dwarfs towards the later types.

3. THE UBV PHOTOMETRY OF Be STARS

Careful studies of the photometric behavior of the brightest Be stars have already been published (Feinstein and Maracco, 1979). We have extended the study to some 600 stars with UBV measures from the compilation by Nicolet (1978) and compared the positions of these stars in a (U-B) vs (B-V) diagram with those of main sequence B stars as given by

M. Jaschek and H.-G. Groth (eds.), Be Stars, 27–31.

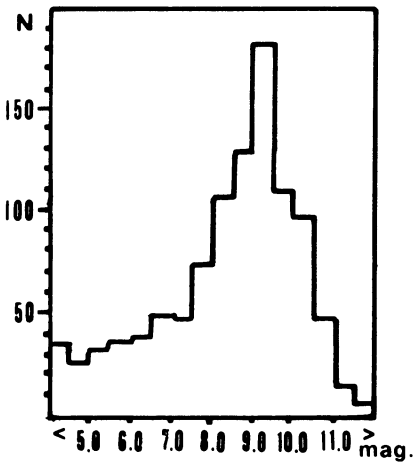


Fig. 1. Histogram of the visual magnitudes of 1000 Be stars.

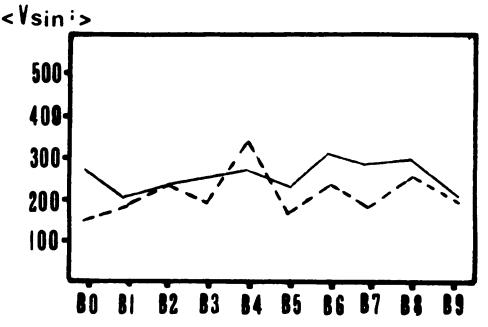
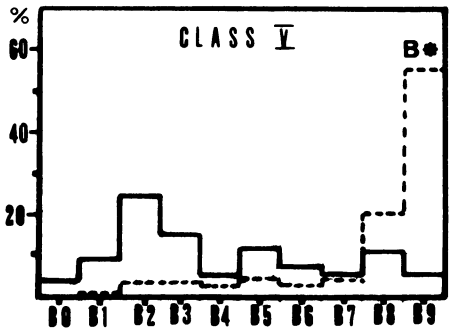


Fig. 3. Mean rotational velocity for each spectral group (luminosity classes III and V).



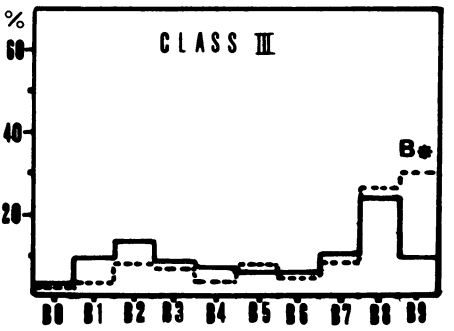


Fig. 2a and 2b. Distributions of the spectral types B0 to B9 in the region south of -40° (2a: class V; 2b: class III). The dashed line is the distribution of normal B stars.

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FitzGerald (1970). For a number of stars (and especially in the range B2-B4) the photometric classification is apparently earlier than the MK classification. This should be generally interpreted (provided that both oservations refer to the same state of Be features) by an ultraviolet colour excess of these stars. The (B-V) excess is often large and the distinction between circumstellar and interstellar reddening for field stars is quite delicate; however in the hypothesis of a normal interstellar reddening Av=3E(B-V), we can easily detect those stars for which the total absorption as a function of the magnitude exceeds the current values for B stars. An analysis of these data is in preparation (Egret, 1981).

4. THE ROTATIONAL VELOCITY OF Be STARS

The recent edition of the catalogue of stellar rotations (Uesugi and Fukuda (1981) contains values of V sin$i$ for about 300 Be stars. The distribution of <V sin$i$> vs spectral type is shown in Figure 3: the mean rotational velocity is not sensibly different for all the spectral types between B0 and B9, but the giants are apparently slightly slower rotators than the dwarfs.

5. THE SPATIAL DISTRIBUTION OF Be STARS

The major concentrations in the galactic plane are found in the direction of Perseus (ℓ=130°) and Carina (ℓ=290°, included in the Michigan Survey). This is illustrated by Figure 4.

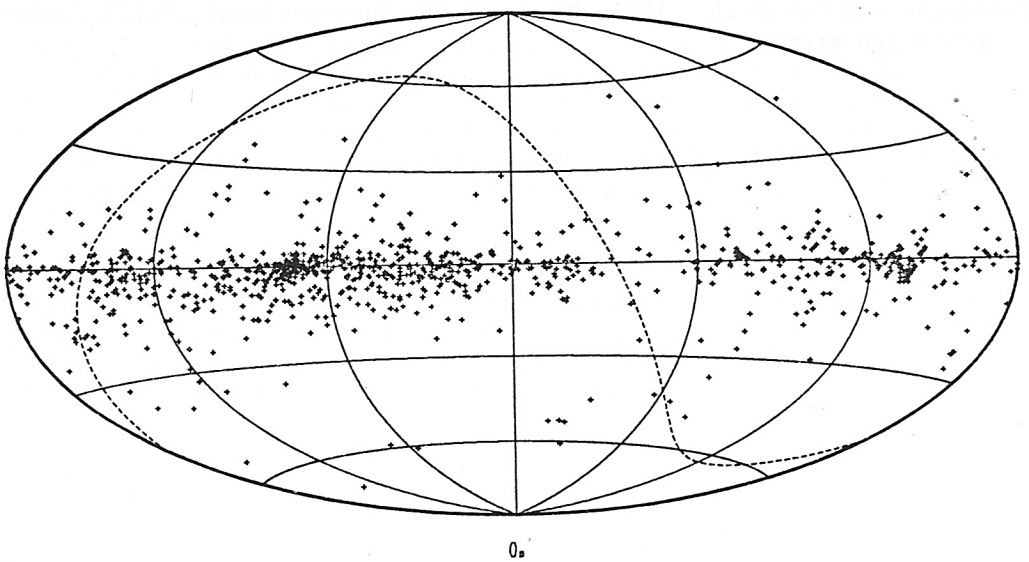

Figure 4. Distribution in galactic coordinates of Be stars. (The dashed line is the curve δ=0°).

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The galactic concentration of Be stars in the region south of $\delta = -40°$ appears similar to the one of normal B stars. For the whole catalogue the galactic concentration parameter is β=80pc (60pc for B stars) but there is a selection effect in favour of the stars outside the plane. 30 detected Be stars have a galactic latitude higher than 25°. A study of their kinematics is in preparation.

6. FINAL REMARK

Our statistical approach does not take into account the variability of the Be characteristics and does not pretend to supersede the detailed studies of some objects frequently observed. Anyway we hope that this will encourage future observing programs of more and more stars, the only way to improve our understanding of the common properties of Be stars.

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DISCUSSION

Snow: You said there are 30 Be stars in your catalogue that have galactic latitudes greater than 25°. Are these bright foreground stars, or are some of them sufficiently distant to really be out of the galactic plane?

Egret: Part of these stars are really distant stars (half are fainter than 6^m, and half a dozen fainter than 8^m). A detailed analysis of these stars is in preparation.

Metz: Are the rotational velocities presented in your catalogue derived both from shell emission lines and photospheric emission lines as well?

Egret: We have used the v sin i values by Bernacca and Perinotto (1973) and by Uesugi (1973) generally derived from photospheric absorption lines.

MacConnell: Did you include B stars in your analysis which Nancy Houk has indicated as having Hβ filled in? My observations on H_α objective-prism plates show that the majority of these stars have H_α in emission and are therefore Be stars.

Egret: Yes. In fact we used simultaneously MK classification catalogues (such as the one of N. Houk which does not cover the H_α regions) and catalogues or lists of H_α emission stars.

Doazan: You have considered only Be stars which have MK spectral types to define the population of Be stars relative to normal B's in the Jaschek's et.al. catalogue. These statistics biase your results severely and lowers considerably the percentage of Be/B stars. Can you say what results you would obtain by using Wackerling's catalogue for example, and all Be stars detected whatever the system of classification used?

Egret: I have not yet done such statistics concerning all the H_α emission line stars. The only thing we can say for the moment is that Wackerling's catalogue, for instance, obtains about 3 times more B stars (including supergiants) than our catalogue of "classical" Be stars, for comparable limits in magnitude.

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