Blaauw, A. Internal motions in associations.

Internal motions are studied in the nearest associations. The results communicated below are of a tentative character in so far as the accuracy of the radial velocities and, particularly, of the proper motions, may be improved in the next few years, and provisional parallaxes have been used. They are, however, of sufficient interest as a guide for the further studies of the state of motion of the early-type stars in and outside the nearest associations, and for theoretical investigations of the process of star formation.

Space velocities with respect to the centroid of the association have been derived from the proper motions and the radial velocities of O-B3 stars in five associations, II Per, I Lac, V Cyg, I Cep, and a loose group of B stars in Taurus. There appears to be a noticeable difference between the frequency distribution for single stars and that for the double and multiple stars. Single stars are here defined as those which neither occur in Aitken's *Double Star Catalogue* nor are spectroscopic binaries according to the available radial velocity measurements. Systems with separations too small to be discovered as visual binaries or too large to show orbital radial velocities, as well as "spectroscopic binaries" with unfavorable inclination of the orbital plane, are therefore included in our class of single stars. The table below shows that the mean velocities of the single stars on the average are about twice those for the rest.

Internal Space Velocity km/sec	Number of Systems	Percentage Single
10	22	23%
10 to 30	32	63%
30	6	100%

Extreme examples of single stars with very high velocities are also AE Aur and μ Col, which are associated with I Ori, and α Cam (gO5 Ia) which seems to belong to an association containing also the open cluster NGC 1502.

The same phenomenon is recognized in the frequency distribution of the 167 residual radial velocities of a somewhat larger sample of associations including I Ori in addition to those mentioned above, and supplemented with the distribution of the τ components in II Sco, which for this association are more accurate than the radial velocities. This frequency distribution can be represented by the formula $\sim e^{-|v|/5.0}$ where v is the velocity and the mean velocity is 5 km/sec. There is, however, an excess of very large velocities, >40 km/sec.

This velocity distribution is similar to that of the interstellar Ca^+ clouds as derived from Adam's measures, which can be represented by the same formula except for a similar excess of large velocities.¹

The percentage of single, double, and multiple stars appears to be the same for all associations in the sample studied, namely, 60, 22, and 18 per cent, respectively, and does not vary with the mean internal space velocity. We can summarize the results as follows:

- 1) In each association the mean velocity of the single stars is noticeably larger than that of the double and multiple stars, but
- 2) the percentage of single stars is the same for associations with large and with small internal velocities.

1. *B. A. N.* 11, 459, 1952.

*Sterrewacht,
Leiden, Holland.*

Boggess, Albert, III. Photometry of emission nebulae.

The University of Michigan isophotometer has been used to obtain definitive isophotes of a number of emission nebulosities in the Milky Way. The H. D. Curtis Schmidt telescope was used to obtain observations of these objects in the following emission lines: $H\alpha$, [OIII] $\lambda\lambda 4959, 5007$, [OII] $\lambda 3727$ and in the nebular continuum around $\lambda 5850$. Slit spectra were obtained to evaluate the contribution of [NII] $\lambda\lambda 6548, 6584$ to the $H\alpha$ image. Intensities in absolute units were obtained by alternating observations of the nebulosities with observations of M 32. Stebbins and Whitford have obtained the magnitude and relative spectral energy curve of M 32.¹ These data can be combined with the solar energy curve² to obtain surface brightnesses for M 32 and, in turn, for the nebulosities.

Three of these objects, M 17, M 8 and M 20, have recently been detected in the radio region at 3200 Mc.³ If it is assumed that the 3200 Mc radiation is thermal, electron temperatures can be determined by combining radio data with mean $H\alpha$ surface brightnesses obtained from the isophotes. The data for these three nebulae are summarized in the accompanying table.

The temperatures for M 17 and M 20 are excessive. Assuming the true temperature to be 10,000°K, the 3200 Mc radiation is greater than that required by thermal emission alone by a factor of 14 in the case of M 17, by a factor of 1.8 in the case of M 8, and by a factor of 5.7 in the case of M 20.