It may be added that, with very few exceptions, all the GC stars within a zone have either been measured on the plates or have been observed with the transit circle together with the reference stars for that zone. In addition, all the GC stars between $-30°$ and $-52°$ are at present being observed with the Gill reversible transit circle. Thus it seems probable that nearly all the GC stars south of $-30°$ will have been reobserved at the Cape by the end of 1955, the greater number of them in the ten years from 1945 onwards.

Prof. Zverev stressed the extreme importance of the astrometric work of the Cape Observatory, which is still the only one actively engaged in fundamental work in the southern hemisphere, and expressed the hope that this work could be taken up by other southern observatories.

Dr Jackson remarked that this concluded the first half of the programme and that the afternoon would be devoted to extra-galactic nebulae.

Afternoon Session. Dr Nemiro, *Chairman*

A few questions which arose from the morning session were first considered.

Prof. Kopff moved the following: It is recommended that Commissions 8 and 8*a* be asked to draw up a definitive programme for meridian circle observers in order to obtain a single catalogue of faint fundamental stars.

After discussion, Prof. Kopff's suggestion was adopted with the following addition moved by Profs. Oort and Zverev: Special programmes of stars important for stellar astronomy should be worked out along with other commissions (e.g. 24, 33 and 37).

7. PURPOSE AND REQUIREMENTS FOR PROPER MOTIONS OF FAINT STARS

By J. H. Oort

I. Purposes

These may be classed under four headings:

(*a*) Systematic motions at different points in space.
(*b*) Distribution of 'random' motions.
(*c*) Check on distances of faint stars as determined by spectrographic methods.
(*d*) Distances and motions of special types of stars.

Comments

(*a*) These determine the constants A and B of differential galactic rotation, and also deviations from the fundamental values of these constants, due to random motions, and related with the density distribution of stars.

(*b*) In a well-mixed state there must be a definite relation between velocity and density distribution. In a state such as is actually observed, which is *not* well-mixed, the velocity distribution shows the direction in which the density distribution will change with time. Determination of the velocity distribution in as many and as distant regions as possible is of essential importance.

(*d*) Proper motions are still our principal basis for calibrating absolute magnitudes of supergiants, RR Lyrae variables, long-period variables and several other types of stars.

Particularly interesting problems are presented by the expanding groups of early-type stars. Such expansions are likely to occur quite generally. They can best be studied from proper motions.

II. Requirements

(*a*) For the constants A and B probable errors of about $0''.0002$ per annum (i.e. half the present probable errors) should be aimed at. An extremely strong tie between faint stars and the bright fundamental stars will be essential; much better than any obtained

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so far except in the McCormick programme. For regions above 15° or 20° galactic latitude the use of extra-galactic reference points, as in the Lick survey, may furnish sufficient accuracy in about 25 years. An attempt is being made at Leiden to obtain some provisional results from old and new plates of clusters of nebulae taken at the Mt Wilson Observatory. In order to improve likewise the motions of super-giant stars in the Milky Way, it would be very important if meridian observers could furnish as strong a connexion as possible between these super-giants and fundamental stars above 20° latitude, which can in turn be tied to the nebulae.

(*b*) For low-latitude stars of the 14th and 18th magnitude, the mean random motions in galactic latitude will average about $\pm 0''.004$ and $\pm 0''.002$ per year, respectively. To obtain significant results, the probable errors of the individual motions should be less than half these amounts. Only *relative* motions are required for this purpose.

(*c*) The mean parallaxes of 14th and 18th magnitude stars in low latitudes may be estimated as $0''.0012$ and $0''.0004$, respectively. The accuracy of the absolute motions needed to determine the corresponding reflected solar motion (about $0''.005$ and $0''.002$) should again correspond to errors smaller than about $0''.0002$ per year.

(*d*) Super-giants are so rare that it is necessary to go to distances of at least 1000 parsecs to find sufficient numbers for calibration.

A similar accuracy will be needed to derive the expanding motions in most B-star clouds.

8. PROBLEMS OF STELLAR ASTRONOMY CONNECTED WITH THE PROPER MOTIONS OF FAINT STARS

By A. Blaauw

Investigations of proper motions of faint stars generally are concerned with either of two problems: the distribution of the peculiar motions of the stars, or the mean parallax of certain groups of stars. In both kinds of investigations the knowledge of absolute proper motions is of fundamental importance. The present paper deals with some of the actual problems.

(1) *The deviation of the vertex of the peculiar motions*

Investigations of bright stars. Various investigations of the motions of the bright stars—i.e. those brighter than $m = 8$—have revealed the deviation of the direction of preferential motion from the direction to the galactic centre. The deviation changes with spectral type. Table 1 shows results according to recent investigations, by Delhaye(1) and by Tannahill(2), both based on the proper motions in the *General Catalogue* of 33,342 stars by B. Boss. Delhaye, studying the stars between apparent visual magnitudes 6·0 and 7·5 subdivided into the spectral groups B8–A5, F0–F9 and K0–K2, applied two methods of analysis. The first is the classical one due to K. Schwarzschild, it is based on the ellipsoidal hypothesis. The observational data used are the statistics of the position angles of the proper motions. The size of the proper motions plays no role in this method, but the proper motions have to be in an absolute, fundamental system. The second method, called the dispersion method, uses the dispersion with respect to their mean for the components of proper motion in galactic longitude and latitude. In determining these dispersions it is irrelevant whether the proper motions are given in an absolute or in a relative system. The distribution of the sizes of a component of the proper motions determines the dispersions used in this method.

Tannahill applied Eddington's method of analysis into two streams to the stars of all apparent magnitudes in the GC, subdivided into the spectral groups A5–F5, F8–G5, K0–M. In this method, as in Schwarzschild's method, only the position angles are counted. The results obtained by Delhaye with Schwarzschild's method and those by