AN APPROACH TO THE DYNAMICS OF STELLAR SYSTEMS

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The theory of stellar systems begins with the study of our own Galaxy and the approach must at first be mainly of a descriptive kind. The study of the distribution of stars in space and of the distribution of stellar velocities forms a part of astronomy which is named stellar astronomy, or in a more restricted sense, stellar statistics, and serves to describe the properties of our galactic system. The first great pioneer in this field on an empirical basis was William Herschel and, after him, pioneer work was carried out by F. G. W. Struve, Gyldén, Seeliger and others.

A modern era in the study of stellar motions may be said to begin with Kapteyn's discovery of the two star streams, and with the subsequent development of the mathematical statistical methods of describing stellar motions. Schwarzschild introduced the theory of the velocity ellipsoid, which was later developed in a more general way by Charlier. Attempts to develop a dynamical theory of stellar systems on the basis of the ellipsoidal velocity function were made by Eddington, Schwarzschild and Jeans.

A revolution in our ideas concerning the dimensions of our stellar system occurred by Shapley's investigations of the distribution of the globular clusters. These studies definitely expanded the domain of our galactic system wide over the limits of the system devised by Kapteyn, and showed that our Sun is situated very far from the center of the Galaxy. The direction of this center, in the rich region of the Milky Way in Sagittarius, was also clearly indicated.

A corresponding revolution in the domain of stellar motions occurred in the study of large stellar motions relative to the Sun. If we consider physical groups of increasing internal velocity dispersion, the mean motion relative to the Sun increases in a direction which lies in the galactic plane at right angles to the direction towards the center of the Galaxy. This is the phenomenon which has been called the asymmetrical drift of large stellar velocities. The writer showed that this phenomenon, which had been studied in detail by Strömberg, could be interpreted in terms of a general motion of rotation of the system. The stellar system may be divided up into "subsystems" of different angular motion of rotation and different internal velocity dispersion. The maximum angular speed occurs at a vanishing internal velocity dispersion, and is equal to the angular speed of the circular orbits in the galactic plane. This corresponds nearly to the state of motion of the clouds in the Milky Way. With decreasing motion of rotation the internal velocity dispersion increases and the distribution in space assumes a less flattened formation. The globular clusters represent a subsystem of very small angular speed of rotation and of a nearly spherical distribution in space.