

THE PROBLEM OF STELLAR EVOLUTION CONSIDERED STATISTICALLY

OTTO STRUVE
UNIVERSITY OF CALIFORNIA

The specific problem which I should like to bring to the attention of the statisticians is the following: table I contains a list of 133 pulsating variable stars of a kind described as "RR Lyrae Variables" or "galactic cluster type variables." These stars are characterized by periods of their variation in brightness ranging between about 88 minutes and 24 hours. Column 5 gives for each star the period, expressed in fractions of a day. Columns 2 and 3 give the celestial coordinates, namely, the galactic longitude l measured in degrees along the great circle of the Milky Way, and the galactic latitude b , measuring the angular distance of the star above or below the central plane of the Milky Way.¹ Column 4 gives the median apparent brightness of each star and column 6 the mean radial velocity (corrected for the periodic change produced by the pulsation) as measured by means of the Doppler effect. These data are largely the product of the work of A. H. Joy at the Mount Wilson Observatory. But some additional data were taken from measurements by A. Colacevich and others at the McDonald and Lick Observatories.

If we group the stars according to the period, in column 5, and take mean values of the radial velocity without regard to the sign, we obtain table II. There is a conspicuous progression, indicating an increase in the motions of the stars with period. Next, we plot the velocities against the galactic coordinates, separately for $P < 0.4$ day and $P \geq 0.4$ day. The result, in figures 1 and 2, confirms what was already known: the velocities indicate a systematic drift with respect to the sun. The direction of this motion is in accordance with the apex determined from about one half of the present material by J. H. Oort [1] in 1939:

$$l_0 = 53^\circ, b_0 = +12^\circ (\pm 8^\circ).$$

The drift motion of the sun against the stars is thus directed approximately at right angles to the direction toward the galactic center in Sagittarius (at $l = 325^\circ$). The stars share in the phenomenon of galactic rotation, but their motion, though directed toward the same point in Cygnus which characterizes the circular motion of the sun's local standard of rest, is smaller by about 100–150 km/sec. The circular velocity of the local standard of rest, as determined from globular clusters and extragalactic nebulae is about 250 km/sec. That of the RR Lyrae variables is, on the average, about 120 km/sec.

¹ These "galactic coordinates" were taken, without interpolation, from the Lund tables by Ohlsson. Their precision is ample for the present purpose.