STATISTICAL STUDIES RELATING TO THE DISTRIBUTION OF THE ELEMENTS OF SPECTROSCOPIC BINARIES

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1. Introduction

A study of the relation between the theoretical distribution of the orbital elements of binary stars, on the one hand, and of the distribution of their catalogue values, on the other hand, is of interest in the problem of stellar evolution. One example is presented by the hypothesis of Struve [1] that the evolutionary process of certain binaries involves the emission of streams of gas which encircle the two components of the binary system.

With the spectroscope, the radial velocity (the component of velocity in the line of sight) of a star can be measured. If the star is a member of a binary system then its radial velocity will vary periodically with time in a type of periodic curve which is perfectly determined by Kepler's laws. If, in addition to the two stars, there is present a stream of gas then the measurements of the radial velocity of the bright component will be affected by the absorption of the star's radiation by the gas streaming between and encircling the two components. As a result, the numerical graph of radial velocities will not conform to Kepler's laws and the catalogue elements, representing "best fitting" compromise values obtained by forcing a Keplerian orbit onto the non-Keplerian graph, will be affected by systematic errors. Thus, the Struve effect would contribute to the differences between the distribution of the true elements of binaries and that of their catalogue elements. Struve has found some binaries for which there is strong evidence of a ring of gas.

Theoretical considerations suggest that the true value of ω, the longitude of periastron, which describes the orientation of the major axis of the orbital ellipse, must be distributed uniformly between 0° and 360°. However, it was shown [2], [3] that, at least for some categories of stars, the distribution of the catalogue value of ω is not uniform. It is obvious that the true distribution of ω could be distorted by many causes. For example, stars with some values of ω are easier to identify as binaries than others. This effect will be referred to as selective identifiability. Furthermore, the ordinary procedure of computing orbital elements from observations affected by errors is likely to favor some values of ω at the expense of others. Now, proof that the combined effect of these factors is not sufficient to explain the

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