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AN EXAMINATION OF DOUBLE STARS FROM THE GLIESE-JAHREISS CATALOGUE

S. NINKOVIĆ and V. TRAJKOVSKA
Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia
E–mail sninkovic@aob.aob.bg.ac.yu
E–mail vtrajkovska@aob.aob.bg.ac.yu

Abstract. The authors undertake a study of the Gliese-Jahreiss catalogue looking for double stars with reliable orbital parameters (angular semimajor axis, period) and individual astrophysical data (magnitudes, spectral types). Considering that this is a catalogue containing nearby stars, these double stars are expected to have also accurate distances so that a verification of the astrophysical relationship mass-luminosity is possible.

1. INTRODUCTION

The relationship between the mass and luminosity for individual stars is very well known. Recently, here, in Yugoslavia, a new form of this relation has been proposed for the main-sequence stars (Angelov, 1993). The intention of the present authors is to verify this relation using a sample of nearby double stars from the catalogue of Gliese and Jahreiss. Since the nearby stars are concerned, it may be expected that all the necessary data (distances, orbital elements, astrophysical parameters) are both available and known with sufficient accuracy. It would enable us to examine the relation mentioned above.

2. PROCEDURE

The Gliese-Jahreiss catalogue comprising nearby stars is a natural extension of the earlier well-known catalogue (Gliese, 1969). Unlike the latter one it has not been published, but instead it is available on a diskette only. Thanks to the courtesy of our colleagues from St Petersburg (V. V. Orlov and others) we have got such a diskette.

What we present here is only a preliminary report. A full account will be published elsewhere.

It should be mentioned here that unlike Gliese's (1969) catalogue the new one does not contain the orbital data concerning the double stars. Therefore, in the present preliminary analysis we used the orbital data from the old catalogue. Considering that these data are sufficiently old now, there is no need to carry out a detailed analysis. On the other hand Angelov's (1993) result can be interpreted as a correction to the old linear mass-luminosity law becoming essential only in the region of faint stars ($M \geq 10$). Therefore, here we use a simple linear relation

$$M = -8.67 log \mathcal{M} + 4.85 \, , \quad (1)$$

where M is the absolute magnitude and $\mathcal{M}$ the mass. This relation is calibrated to yield $\mathcal{M} = 1$ for the Sun ($M = 4.85$) and $\mathcal{M} = 0.14$ for Barnard's star (Gliese 699, $M = 13.25$). The mass value assumed here for Barnard's star has been frequently given in the literature (e. g. Lippincott, 1978).

3. CONCLUSIONS

The cases examined by us show that the agreement between the total mass of a double star calculated on the basis of its orbital elements and astrophysically by using (1) for calculating the individual masses is generally satisfactory, but there are significant discordances. The authors are inclined to attribute these discordances to the uncertainties in the orbital elements, rather than to the corresponding ones in the astrophysical data, i. e. the astrophysical relationship between the mass and the luminosity. The example of Gliese 127 might be an illustrative one. Though its semimajor axis seems relatively well established (about 35 *au*), the uncertainties in the period are so large (155- 264 years) that the resulting total-mass value is within the limits 0.7 $\mathcal{M}_\odot$ – 2 $\mathcal{M}_\odot$. In this way a new possibility arises, namely to use the individual masses determined astrophysically for the purpose of improving the period value in those cases where the distance is well established.

References

Angelov, T.: 1993, *Bull. Astron. Belgrade*, **148**, 1.
Gliese, W.: 1969, *Ver. Astron. Rech.-Inst. Heidelberg*, No 22.
Lippincott, S. L.: 1978, *Space Sci. Rev.*, **22**, 153.