

# Gravitational scale factor and quantum gravitational effect in luminosity of components of detached double-lined eclipsing systems (DDLESEs)

**S. V. Sinitsyn**  
s.sinitsyn@mail.ru

**Introduction.** The DDLES is consists of two very close stars which are the first and second components. The distance between these components is on the order of 1 or 10 solar radii. Indexes 1 and 2 indicate the first and second components, respectively.

If a quantum gravitational effect is carried out along the coordinate axis of the ratio of the values of any parameter of the first and second components, then it is of the second type.

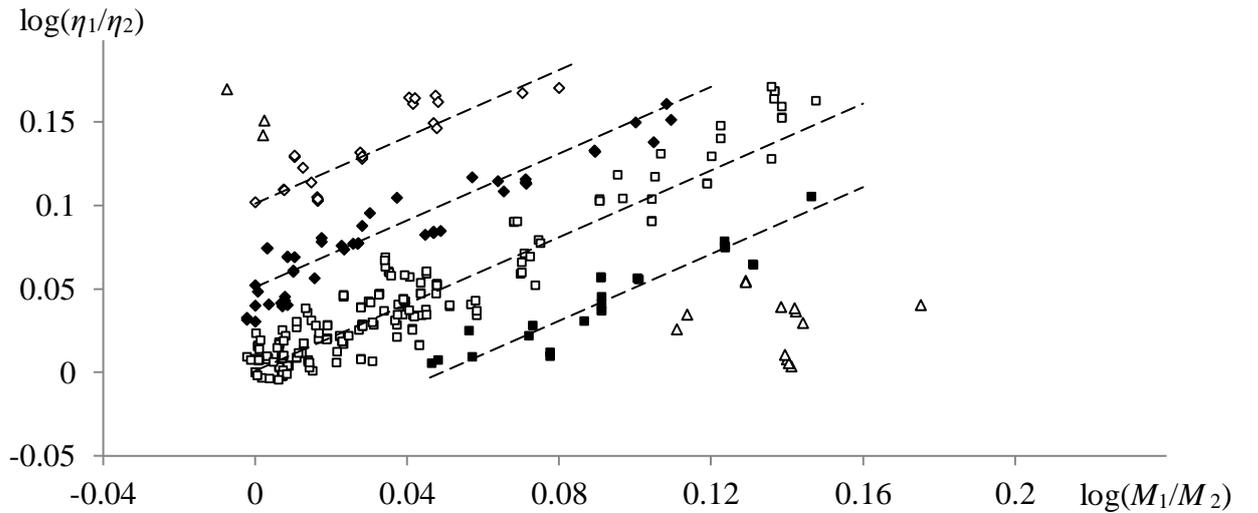
Using empirical data from catalogs [1 - 4].

**Part. 1. Gravitational scale factor.** It is found that for the components with masses from 0.445 to 14.10 solar masses

$$L = \eta M^4, \quad (1)$$

where  $L$ ,  $\eta$ ,  $M$  are the luminosity, the reduced luminosity and the mass of the component, respectively.

Figure 1 shows the distribution of the DDLESEs.



**Figure 1.** The distribution of 422 detached double-lined eclipsing systems.

The first (■), second (□), third (◆), fourth (◇), fifth (△) groups are divided.

For the first four groups

$$\log(\eta_1/\eta_2) = \log(M_1/M_2) + q, \quad q = 0.0500n + 0.0010, \quad n = -1, 0, 1, 2, \quad (2)$$

moreover  $M_1/M_2 \geq 1$ .

Hence, with a minimum deviation from (1) in the first four groups, for the first and second components  $L$  is determined as

$$L_1 = \eta^*_1 M_1^4 (M_1/M_2)^{1/2}$$

$$L_2 = \eta^*_2 M_2^4 / (M_1/M_2)^{1/2}$$

where  $M_1/M_2$  is the gravitational scale factor,  $\eta^*$  is the reduced luminosity of the component in the absence of the gravitational scale factor action.

Nucleosynthesis is carried out in the central part of a star. Therefore the obtained result can indicate that in the first component the central part is compressed additionally, while in the second component, on the contrary, it is expanded additionally. This leads, respectively, to the increase and decrease of the nucleosynthesis of the first and second components. In this case, additional compression and expansion are determined by the gravitational scale factor in the form of  $M_1/M_2$ .

**Part. 2. The quantum gravitational effect of the second type.**

According to (1 – 3)

$$q = \log(\eta^*_{(1)}/\eta^*_{(2)})$$

Then, the latter parameter is quantized in the form of (2).

As a result, the quantum gravitational effect of the second type is found along the coordinate axis  $\log(\eta^*_{(1)}/\eta^*_{(2)})$ .

**Conclusion:**

1. In the DDLES, there is some quantum physical system which creates the quantum gravitational effect of the second type in the ratio of the luminosities of the first and second components.
2. A general gravitational mass of the DDLES is proposed as the quantum physical system.

**References**

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