

Quantum gravitational effects in evolutionary expansion 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. Indexes 1 and 2 indicate the first and second components, respectively. M and R are the mass and radius of the component, respectively, H is the quantum gravitational constant which is 145.5 km/s. In addition $g = GM/R^2$ and is determined in cm/s^2 , as it is assumed in astrophysics.

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

The distributions of DDLESEs and its components are constructed using empirical data [1 - 4].

The quantum gravitational effects of the first type are found along the coordinate axes $(GM/R)/H^2$ and $\log(g)$. Figure 1 shows the distribution of components with masses from 1.55 to 2.77 solar masses.

Five peaks are visible, the positions of which are determined as

$$(GM/R)/H^2 = 1.177n + 5.601, n = 0 - 4$$

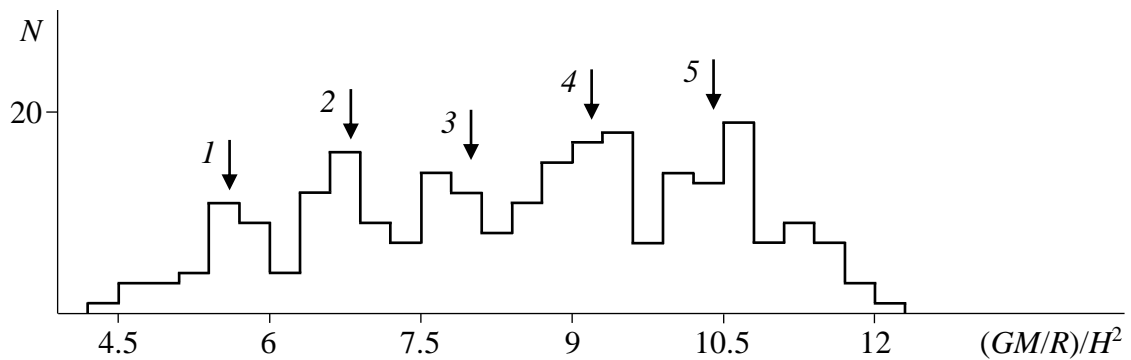


Figure 1. The distribution of 255 components of the detached double-lined eclipsing systems.

Figure 2 shows the distribution of the second components with masses from 2.77 to 8.60 solar masses.

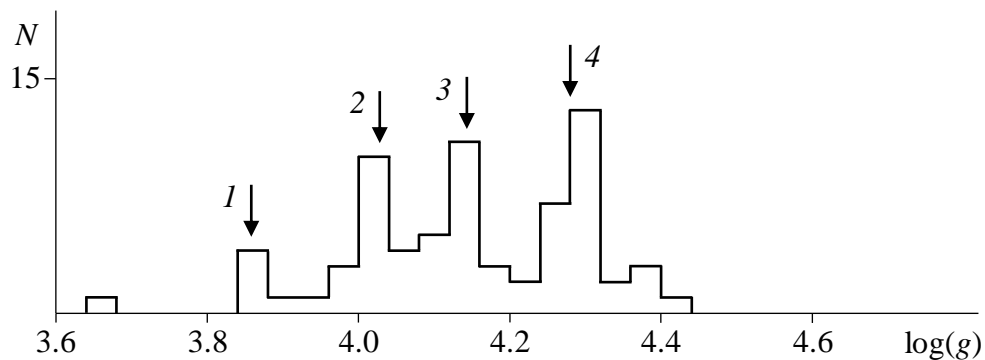


Figure 2. The distribution of 71 components of the detached double-lined eclipsing systems.

Four peaks are visible, the positions of which are determined as

$$\log(g) = 0.069n + 3.663, n = 3, 5, 7, 9$$

Conclusion:

The found effects are due to these facts:

1. In figures 1 and 2 the peaks are created by the populated areas of the temporal slowdown of the absolute evolutionary expansion of the component.
2. The absolute evolutionary expansion of the component is, in particular: its transitions along the coordinate axes $(GM/R)/H^2$ and $\log(g)$ between these areas and its temporal localization in the latter.
3. There is some quantum physical system which creates the quantum stepwise absolute evolutionary expansion of the component.
4. The gravitational mass of the component is proposed as the quantum physical system. This gravitational mass is also the measuring instrument of the size and gravitational parameters of the component.

The quantum gravitational effect of the second type is found along the coordinate axis $\log(g_1/g_2)$. Figure 3 shows the distribution of the DDLESEs along this axis.

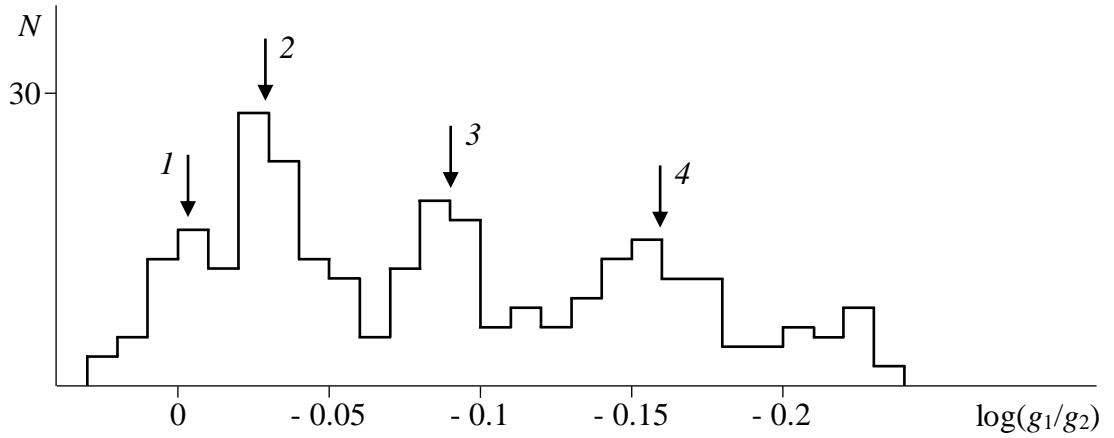


Figure 3. The distribution of 283 detached double-lined eclipsing systems.

Four peaks are visible, the positions of which are determined as

$$\log(g_1/g_2) = -0.0305n - 0.0004, n = 0, 1, 3, 5 \tag{1}$$

The quantum gravitational effects of the second type are also found along the coordinate axes $\log(R_1/R_2)$, $\log((GM/R)_1/(GM/R)_2)$.

The quantum gravitational effect of the third type is found along the coordinate axis $(GM/R)_1/(GM/R)_2$ in the relative evolutionary expansion of the first and second components with a mass of less than 1.55 solar masses.

Figure 4 shows the distribution of such DDLESEs about $(GM/R)_1/(GM/R)_2 = 1$.

At $n = 0$ and $(GM/R)_1/(GM/R)_2 = 1$ the symmetric separation of the populated area into three such areas (peaks *1A*, *1B*, *1C*) is visible. The quantization step is (0.017 ± 0.002) . The same effect is found along coordinate axis $((GM/R)_1/H^2 - (GM/R)_2/H^2)$ near 0 with the quantization step equal to (0.16 ± 0.02) .

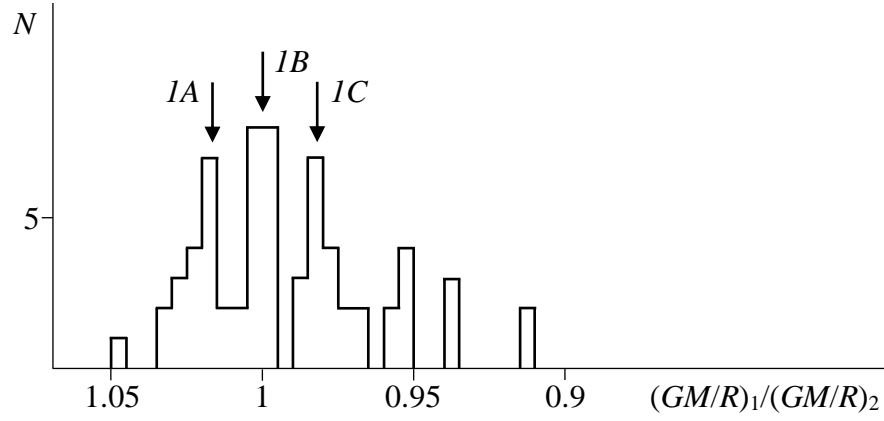


Figure 4. The distribution of 66 detached double-lined eclipsing systems.

Conclusion:

The found effects are due to these facts:

1. In figures 3 and 4 the peaks are created by the populated areas of the temporal coordinated relative evolutionary expansion of the first and second components.
2. The relative evolutionary expansion of the first and second components is, in particular: their transitions along three coordinate axes $\log(R_1/R_2)$, $\log((GM/R)_1/(GM/R)_2)$ and $\log(g_1/g_2)$ between these areas and their temporary localization in the latter.
3. There is some quantum physical system which creates the quantum stepwise relative evolutionary expansion of the first and second components.
4. A general gravitational mass of the DDLES is proposed as the quantum physical system. This gravitational mass is also the measuring instrument of the size and gravitational parameters of the first and second components.

References

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