Anomaly in the precession of the perihelion of Mercury

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In this brief description we wish to bring to the attention a discussion on classical calculus to define the anomaly in the precession of Mercury found in the literature due to the difference between observations and Newton's gravitational theory.

We believe that the formulation and calculations proposed here are consistent with Newton's gravitational theory and that the famous 43" (second century arc) missing, emerge without using Albert Einstein's General Relativity.

This does not mean that the RG is wrong but only that the RG is an extension or if we want, an alternative to Newton's gravitational theory.

Our work seems to have shed light on the matter by restoring Newton to the validity of his theory interpreted here.

Orbital values of Mercury in literature

$$Afhelion = 6{,}982\ x\ 10^{10}\ m$$

$$Perihelion = 4{,}6\ x\ 10^{10}\ m$$

$$Mercury\ mass = 3{,}3\ x\ 10^{23}\ kg$$

$$Average\ orbital\ speed = 4{,}737\ x\ 10^{4}\ \frac{m}{s}$$

$$Orbital\ revolution\ time = 87{,}969\ days$$

Using these values some inconsistencies in the results obtained through the use of classical equations for the calculations of forces are evident.

$$Fg > Fcp$$

$$G\ Ms > V_o^2\ R_o$$

Following an accurate qualitative and quantitative control survey, we rechecked all the equations and values attributed for the calculation of the Mercury orbital parameters as follows:

$$a^2 = b^2 + c^2$$

Where (a) is the value of the semi-major axis of the orbital ellipse.

We now derive the values for the semi-minor axis (b) through the use of the eccentricity value obtained from the orbital parameters Aphelium and Perihelion of the planet Mercury:

$$e = \frac{A - P}{A + P} = 0{,}20564$$

$$c = \sqrt{a^2 - b^2} = ea$$

$$b = \sqrt{a^2 - c^2}$$

Since (a), (b) and (R_o) are equivalent to:

$$a = \frac{c}{e} = \frac{a - P}{e}$$

$$b = \frac{e}{\frac{a - P}{R_o{}^2}}$$

$$R_o = \sqrt{\frac{A + P}{2} b} = \sqrt{ab} = 5{,}732 \; x \; 10^{10} \; m$$

We can now write the equivalent equation for eccentricity (e)

$$e = \frac{A - P}{A + P} = \frac{a - P}{R_o{}^2} \; b = 0{,}2056$$

The orbital speed to calculate the centripetal force is calculated on the basis of equivalence:

$$Fg = \frac{G \; Ms \; Mm}{R_o{}^2} = \frac{Mm \; V_o{}^2}{R_o} = 1{,}333 \; x \; 10^{22} \; N$$

$$V_o = \sqrt{\frac{GMs}{R_o}} = 4{,}812 \; x \; 10^4 \; \frac{m}{s}$$

The period of revolution respecting Kepler's law will therefore be:

$$t_o = \sqrt{\frac{a^3}{V_o{}^2 R_o}} = 87{,}964 \; days$$

Where (a) is the value of the semi-major axis of the ellipse.

The correction to the average orbital velocity value not only brings the gravitational force into balance with the centripetal one but also ensures the relationship in the ratio GM = V^2 R and the relations in the Kepler equation for the orbital period.

The detected anomaly of 43" resolved with the calculation of the RG also emerges in our new classical Newtonian formulation.

$$\Delta\theta = \frac{Fg\ 6\pi\ R_o}{Mm\ c^2}\ x\ \frac{1}{1-e^2} = 5{,}0707\ x\ 10^{-7}\ radianti = 43{,}42''\ century$$

This equation can be transformed into the following which will make use of the new mean orbital velocity.

$$\Delta\theta = \frac{6\pi\ {V_o}^2}{c^2}\ x\ \frac{1}{1-e^2} = \ 43{,}42''\ century$$

This new interpretation of ours is equivalent to the equation that we find in the literature:

$$\Delta\theta = \frac{6\pi\ G\ Ms}{c^2\ R_o}\ x\ \frac{1}{1-e^2} = 43{,}42''\ century$$

Through Albert Einstein's gravitational field equation we obtain for the Sun a curvature of the space-time (GÆ) of:

$$G\text{Æ} = \frac{8\pi G}{c^2}\frac{Ms}{\frac{4}{3}\pi\ Rs^3} = 2{,}625\ x\ 10^{-23}\ m^{-2}$$

This result is equivalent to:

$$G\text{Æ} = \frac{6Fg\ {R_o}^2}{Mm\ c^2\ Rs^3} = 2{,}625\ x\ 10^{-23}\ m^{-2}$$

According to our analysis described here, the two gravitational theories are equivalent to each other despite the great interpretative difference.

This for us means that Albert Einstein's theory of gravitational field is a vision that improves understanding of the nature of gravity without any need to penalize Newton's classic theory while being able to replace it.

However, we believe that further verification by the international scientific community is appropriate in order to share or reject this work of ours.

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