322(3): Summary of the Gravitomagnetic Description of Planar Orbits.

The angular velocity is:

$$\underline{\omega} = \frac{L}{mr^2} \underline{k} \quad -(1)$$

where L is the magnitude of the angular momentum. The gravitomagnetic field is:

$$\underline{\Omega} = -\left(\frac{MG}{mc^2}\right)\frac{1}{r^3} \underline{k} \quad -(2)$$

The ECE2 current of mass density is:

$$\underline{J}_m = -\frac{3M}{4\pi m} \frac{L}{r^4} \underline{e}_\theta \quad -(3)$$

Here:

$$\underline{e}_\theta = -\underline{i} \sin\theta + \underline{j} \cos\theta \quad -(4)$$

$$\underline{e}_r = \underline{i} \cos\theta + \underline{j} \sin\theta \quad -(5)$$

If the inverse square law of universal gravitation is accepted to be:

$$\underline{F} = -\frac{mMG}{r^2} \underline{e}_r \quad -(6)$$

then

$$L^2 = m^2 MG \alpha \quad -(7)$$

and the orbit is the conical section:

). Therefore all planar orbits can be explained with the ECE2 gravitomagnetic Ampère law:

$$\underline{\nabla} \times \underline{\Omega} = \frac{4\pi G}{c^2} \underline{J}_m \quad -(14)$$

A precessing planar orbit is described by:

$$r_1 = \frac{\alpha}{1 + \epsilon \cos(x\theta)} \quad -(15)$$

where x in the solar system is very close to unity. The angle of precession in radians is:

$$\Delta\theta = \theta(x - 1) \quad -(16)$$

and this is observable experimentally in astronomy. It is claimed that $\Delta\theta$ is known with precision in the solar system but this claim is very controversial among leading thinkers.

Accepting that $\Delta\theta$ is known experimentally, for the sake of argument only, then it is possible to calculate the effect of precession on $\underline{\omega}$, $\underline{\Omega}$ and $\underline{J}_m$ and to ascribe planar planetary precession to ECE2 gravitomagnetism.

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$$r = \frac{\alpha}{1 + \epsilon \cos\theta} \quad - (8)$$

where ϵ is the eccentricity. Both α and ϵ are tabulated in ephemera of astronomy.

For an ellipse:

$$\alpha = a(1 - \epsilon^2) \quad - (9)$$

where a is the semi major axis. For a hyperbola:

$$\alpha = a(\epsilon^2 - 1) \quad - (10)$$

where a is well defined by geometry. For a circle:

$$\alpha = r \quad - (11)$$

The orbital velocity is:

$$\underline{v} = \frac{dr}{dt}\underline{e}_r + \omega r \underline{e}_\theta \quad - (12)$$

$$= \frac{dr}{dt}\underline{e}_r + \underline{\omega} \times \underline{r}$$

From eq. (8):

$$\frac{dr}{dt} = \frac{\epsilon}{\alpha}\omega r^2 \sin\theta \quad - (13)$$

Therefore $\underline{\omega}$, $\underline{\Omega}$ and $\underline{J}_m$ can be calculated and plotted for any orbit in terms of M, a and ϵ, and m. These are known experimentally to high precision.

$$\Delta \underline{\omega} = \frac{L}{m(r_1^2 - r^2)} \underline{k}, \quad -(17)$$

$$\Delta \underline{\Omega} = -\left(\frac{MG}{mc^2}\right)\left(\frac{1}{r_1^3} - \frac{1}{r^3}\right) \underline{k} \quad -(18)$$

and

$$\Delta \underline{J}_m = -\frac{3ML}{4\pi m}\left(\frac{1}{r_1^4} - \frac{1}{r^4}\right) \underline{e}_\theta \quad -(19)$$

The precession is very tiny, so eq. (17) can be used to an excellent approximation. ECE 2 is a generally covariant unified field theory, so all these equations are equations of general relativity.

As is well known, Newtonian dynamics has no explanation for planar orbital precession, and Newtonian dynamics is a classical theory that has no explanation for orbits unless the centrifugal force is considered.