239(3): Calculation of the Minkowski Force for a Precessing Elliptical Orbit.

The precessing elliptical orbit is:

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

The non-relativistic force for this orbit is given by:

$$\underline{F} = -\frac{L_0^2}{mr^2}\left(\frac{d^2}{d\theta^2}\left(\frac{1}{r}\right) + \frac{1}{r}\right)\underline{e}_r \quad -(2)$$

From eq. (1):

$$\frac{d^2}{d\theta^2}\left(\frac{1}{r}\right) = -\frac{x^2\epsilon}{\alpha}\cos(x\theta) \quad -(3)$$

So:

$$F = -\frac{L_0^2}{mr^2\alpha}\left(1 + (1 - x^2)\epsilon\cos(x\theta)\right) \quad -(4)$$

From eqs. (1) and (4):

$$F = -\frac{L_0^2}{mr^2\alpha}\left(\frac{\alpha}{r}(1 - x^2) + x^2\right) \quad -(5)$$

In the solar system:

$$x \sim 1 \quad -(6)$$

to an excellent approximation.

The relativistic equivalent of eq. (2) is the Minkowski force:

2)

$$\underline{F} = -\gamma^2 \frac{L_0^2}{mr^2}\left(\gamma^2 \frac{d^2}{d\theta^2}\left(\frac{1}{r}\right) + \frac{1}{r}\right)\underline{e}_r \qquad -(7)$$

$$+ \frac{\gamma^4 L_0^2}{m^3 r^3 c^2} \frac{d}{d\theta}\left(\frac{1}{r}\right)\frac{d^2}{d\theta^2}\left(\frac{1}{r}\right)\underline{e}_\theta$$

where $$\gamma = \left(1 - \frac{v^2}{c^2}\right)^{-1/2} \qquad -(8)$$

For planetary orbits:

$$v << c. \qquad -(9)$$

So $$\underline{F} \sim -\gamma^2 \frac{L_0^2}{mr^2}\left(\gamma^2 \frac{d^2}{d\theta^2}\left(\frac{1}{r}\right) + \frac{1}{r}\right)\underline{e}_r \qquad -(10)$$

in which: $$\gamma^2 \sim 1 + \frac{v^2}{c^2} \qquad -(11)$$

for $$v << c. \qquad -(12)$$

Therefore:

$$F = -\frac{L_0^2 \gamma^2}{mr^2 \alpha}\left(1 + \epsilon \cos(x\theta) - \gamma^2 x^2 \cos(x\theta)\right) \qquad -(13)$$

i.e.

3)

$$F = -\frac{L_0^2 \gamma^2}{m r^2 \alpha}\left(1 + \left(1 - \gamma^2 x^2\right)\epsilon \cos(x\theta)\right) \quad -(14)$$

where

$$\cos(x\theta) = \frac{1}{\epsilon}\left(\frac{\alpha}{r} - 1\right). \quad -(15)$$

Therefore

$$F = -\frac{\gamma^2 L_0^2}{m r^2 \alpha}\left(\frac{\alpha}{r}\left(1 - \gamma^2 x^2\right) + \gamma^2 x^2\right)$$

$$-(16)$$

In the solar system, to an excellent approximation:

$$\boxed{F \sim -\frac{\gamma^4 L_0^2 x^2}{m r^2 \alpha}} \quad -(17)$$

in which

$$\gamma^4 = \left(1 - \frac{v^2}{c^2}\right)^{-2} \quad -(18)$$

$$\sim 1 + \frac{2v^2}{c^2}$$

so

$$F \sim -\frac{L_0^2 x^2}{m r^2 \alpha}\left(1 + \frac{2v^2}{c^2}\right) \quad -(19)$$

In this equation, using note 238(14):

4) $$v^2 = \left(\frac{L_0}{md}\right)^2 \left(\left(1+\epsilon\cos(x\theta)\right)^2 + x^2\epsilon^2\sin^2(x\theta) \right)$$

$$= \left(\frac{L_0}{mr}\right)^2 + \left(\frac{x\epsilon\sin(x\theta)L_0}{md}\right)^2 \quad -(20)$$

In this equation:

$$\sin^2(x\theta) = 1 - \cos^2(x\theta) \quad -(21)$$

$$= 1 - \frac{1}{\epsilon^2}\left(\frac{d}{r} - 1\right)^2$$

So $$v^2 = \left(\frac{L_0}{mr}\right)^2 + \left(\frac{x\epsilon L_0}{md}\right)^2 - \left(\frac{x\epsilon L_0}{md}\right)^2\left(\frac{d}{r} - 1\right)^2$$

$$= \left(\frac{L_0}{mr}\right)^2 + \left(\frac{x\epsilon L_0}{md}\right)^2\left(1 - \left(\frac{d}{r} - 1\right)^2\right) \quad -(22)$$

i.e. $$v^2 = \left(\frac{L_0}{mr}\right)^2\left(1 - x^2\epsilon^2\right) + 2\left(\frac{x\epsilon L_0}{md}\right)^2\frac{d}{r}$$

$$-(23)$$

So from eqs. (19) and (23):

$$F = -\frac{L_0^2 x^2}{mr^2 d}\left(1 + \frac{2}{c^2}\left(\frac{L_0}{mr}\right)^2\left(1 - x^2\epsilon^2\right) + \frac{4}{c^2}\left(\frac{x\epsilon L_0}{md}\right)^2\frac{d}{r}\right)$$

$$-(24)$$

i.e:

5) i.e.

$$F = -\frac{L_0^2 x^2}{m r^2 \alpha} - \frac{2x^2 L_0^4 (1 - x^2 \epsilon^2)}{m^3 \alpha c^2 r^4}$$

$$- \frac{4 L_0^4 x^4 \epsilon^2}{m^3 r^3 \alpha^2 c^2} \quad -(25)$$

In the solar system, the precession is a very tiny adjustment to the Newtonian theory, where:

$$\alpha = \frac{L_0^2}{m^2 M G} \quad -(26)$$

$$-(27)$$

So:

$$\boxed{F = -x^2 \frac{mMG}{r^2}\left(1 + 4x^4 \epsilon^2 \left(\frac{MG}{c^2 r}\right)\right) - 2x^2(1 - x^2 \epsilon^2)\left(\frac{L_0^2}{m r^3}\right)\left(\frac{MG}{c^2 r}\right)}$$

The Einsteinian general relativity gives:

$$F = -\frac{mMG}{r^2} - \frac{3 L_0^2 MG}{m c^2 r^4} \quad -(28)$$

but EGR uses the incorrect assumption of zero torsion, so eq. (28) is mathematically incorrect. Eq. (28) is derived from an incorrect Einstein field equation

6) by using a solution with a singularity, wrongly attributed to Schwarzschild. It is claimed that the use of eq. (28) in eq. (2) gives a precessing ellipse. The use of eq. (28) in eq. (2) is however an inconsistent procedure because eq. (28) is derived from Einstein's ideas about general relativity but eq. (2) is non-relativistic. The careful use of computer algebra in previous UFT papers has shown that the use of eq. (28) in eq. (2) produces a very complicated orbit that is not a precessing ellipse.

Eq. (27) on the other hand is an approximation to the correctly relativistic Minkowski force needed to describe the precessing elliptical orbit (1).