240(11): Precession of the Equinox of the Earth and its EGR Calculation.

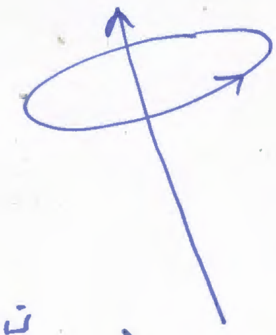

Fig (1)

The rate of the precession of the equinox of the earth is 50.291 arc seconds a year or 5029.1 " a century. This is 0.0139697° a year (Weisstein). So 2π radians or 360° are covered in:

$$T = \frac{360}{0.0139697} = 25{,}770 \text{ years.} \quad -(1)$$

This equinoctial precession is different from the nutational contribution to the precession, and is in fact the main observed perihelion precession of Mercury.

The equinoctial precession may be calculated by assuming that the sun is a symmetric top. The relevant sun earth potential is:

$$V(r) = -\frac{mMG}{r}\left(1 + \frac{\epsilon}{r^2}\right) \quad -(1a)$$

where

$$\epsilon = \frac{2}{5} R \Delta R \quad -(2)$$

where M is the mass of the sun, m is the mass of the earth, r is the earth sun distance, R the equatorial radius of the sun, and ΔR the difference between the sun's equatorial and polar radii.

From previous work eq. (1) it follows that the perihelion of the earth in orbit around the sun advanced every year by

$$\Delta\theta = \frac{6\pi\epsilon}{r^2} \quad -(3)$$

in radians. Here:

$$1 \text{ radian} = 2.06265 \times 10^{5} \text{ arc seconds.}$$

So

$$\frac{6\pi\epsilon}{r^2} = \frac{50.291}{2.06265} \times 10^{-5} \quad -(4)$$

$$= 2.438 \times 10^{-4} \text{ radians per year.}$$

The earth sun distance is:

$$r = 1.49 \times 10^{11} \text{ m} \quad -(5)$$

so

$$6\pi\epsilon = 5.413 \times 10^{17} \text{ m}^2 \quad -(6)$$

and

$$\epsilon = \frac{2R\Delta R}{5} = 2.872 \times 10^{16} \text{ m}^2 \quad -(7)$$

The equatorial radius of the sun is:

$$R = 5.96 \times 10^{8} \text{ m} \quad -(8)$$

so

$$\boxed{\Delta R = 1.25 \times 10^{8} \text{ m}} \quad -(9)$$

3) This would explain the equinoctial precession of the earth, i.e. the sun is not a perfect sphere and there is a difference of 1.25×10^{8} m between its equatorial and polar radii.

This simple calculation is used for the purpose of showing that the main contribution to the precession of the perihelion of the earth is the fact that the sun is a symmetric top.

The point being made is that this is a pure Newtonian calculation. It produces a plausible result. It is very difficult to measure the shape of the sun, and it may well be a symmetric top of this kind. Evidently the result of 5029.1" a century was used by le Verrier for Mercury as the main contribution.

The non-Newtonian EGR calculation of the earth's precession relies on:

$$V(r) = -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2 r^3} \quad -(10)$$

and for an approximately circular orbit gives the result:

$$\Delta\theta = \frac{6\pi MG}{c^2 r} \quad -(11)$$

$$= 3.85'' \text{ a century}$$

4)

So:

$$\left.\begin{aligned}\Delta\theta\,(\text{Newtonian}) &= 5029.1'' \text{ a century}\\ \Delta\theta\,(\text{non Newtonian}) &= 3.85'' \text{ a century.}\end{aligned}\right\} \quad -(12)$$

The two calculations rely on an entirely different philosophy and it is clearly inconsistent to use two different philosophies and add them up. Yet this is what happens in standard physics.

The consistent method is to use the same philosophy for both calculations. In the Newtonian philosophy:

$$\left.\begin{aligned}V\,(\text{ostlate}) &= -\frac{mMG}{r}\left(1+\frac{\epsilon}{r^2}\right)\\ \Delta\theta\,(\text{ostlate}) &= \frac{6\pi\epsilon}{r^2}\end{aligned}\right\} \quad \text{Newton} \quad -(13)$$

and

$$\left.\begin{aligned}V\,(\text{Newton}) &= -\frac{mMG}{r}\\ \Delta\theta &= 0\end{aligned}\right\} \quad \text{Newton} \quad -(14)$$

In the EGR philosophy:

$$\left.\begin{aligned}V\,(\text{oslate}) &= -\frac{mMG}{r}\left(1+\frac{\epsilon}{r^2}\right) - \frac{MGL_0^2}{mc^2r^3}\\ \Delta\theta\,(\text{oslate}) &= \frac{6\pi\epsilon}{r^2} + \frac{6\pi MG}{c^2r}\\ &= \frac{6\pi}{r^2}\left(\epsilon + \frac{Mr}{c^2}\right)\end{aligned}\right\} \quad \text{Einstein} \quad -(15)$$

5) and

$$V(\text{EGR}) = -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2 r^3}$$

$$\Delta\theta(\text{EGR}) = \frac{6\pi M}{c^2 r}$$

Einstein — (16)

The total precessions are:

$$\Delta\theta(\text{Newton} + \text{Einstein}) = 6\pi\left(\frac{\epsilon}{r^2} + \frac{MG}{c^2 r}\right) \quad -(17)$$

and

$$\Delta\theta(\text{Einstein} + \text{Einstein}) = 6\pi\left(\frac{\epsilon}{r^2} + \frac{2MG}{c^2 r}\right) \quad -(18)$$

i.e. $\Delta\theta(\text{Newton} + \text{Einstein}) = 5032.95''$ a century

$\Delta\theta(\text{Einstein} + \text{Einstein}) = 5036.80''$ a century.

$\Delta\theta(\text{Newton} + \text{Newton}) = 5029.1''$ a century.

In this calculation the EGR correction to the quadrupole term in eq. (1a) has been neglected for the sake of simplicity. Also the gravitational effect of other planets on earth has been neglected. In UFT 119 the gravitomagnetic field ECE approach of UFT 119 was used self consistently to explain the equinoctial precession.

) The historical approach may be summarized in the following sketch

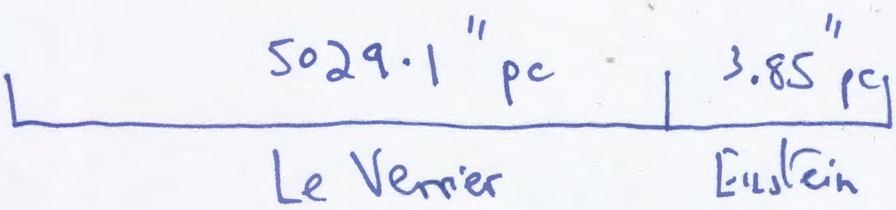

Fig (1)

The original work was done for Mercury, but to avoid complication it is clearer to apply it to Earth. It may be imagined that le Verrier calculated the 5029.1" per century using some method similar to eq. (1a). Naturally he would have used the Newtonian theory. The total precession was later observed to be greater than the le Verrier result. The difference was calculated using eq. (10) and simply added to the le Verrier calculation. Logically, the use of eq. (10) implies that in eq. (1a):

$$-\frac{mMG}{r} \rightarrow -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2 r^3} \quad -(19)$$

There are many arguments that show that eqn. (19) is not in fact the correct way of changing the Newtonian potential, because the EGR theory is geometrically flawed. It is best to proceed on the basis of an entirely new gravitomagnetic theory.

The standard modellers can attempt to counter this argument by assuming a potential of the type:

$$V(r) = -\frac{mMG}{r}\left(1+\frac{\epsilon}{r^2}\right) - \frac{MGL_0^2}{mc^2r^3}$$

$$= -\frac{mMG}{r} - \frac{1}{r^3}\left(mMG\epsilon + \frac{MGL_0^2}{mc^2}\right) \quad -(20)$$

which gives the observed precession plus what they would describe as the relativistic correction, but there is always the problem that eq. (20) is based on a mixed philosophy. In fact the consistent procedure would use:

$$V_1(r) = -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2r^3} - \frac{1}{r^3}mMG\epsilon$$

$$V_2(r) = -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2r^3} \quad -(21)$$

and $$V = V_1 + V_2 \quad -(22)$$

The entire EGR method is ~~dubious~~ incorrect and fails completely for galaxies, so in the next notes it will be replaced entirely by precession due to the spin connection.