241(1): Precession for a System of Planets

Consider the planets of the solar system and for each planet evaluate the EGR precession. For each planet the potential energy is:

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

giving the result

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

for an approximately circular orbit of each planet. The total precession is

$$\sum_i \Delta\theta = \sum_i \frac{6\pi M G}{c^2 r_i} \quad -(3)$$

It is clear that in this procedure the relativistic correction is applied n times, where n is the number of planets. The force law for eq. (1) is:

$$F(r) = -\frac{mMG}{r^2} - \frac{3MGL_0^2}{mc^2r^4} \quad -(4)$$

$$= -\frac{k}{r^2} - \frac{\epsilon}{r^4}$$

where

$$k = mMG, \quad \epsilon = \frac{3MGL_0^2}{mc^2}. \quad -(5)$$

For an approximately circular orbit the apsidal angle is:

$$\psi = \pi\left(3 + \frac{r}{F}\frac{dF}{dr}\right)^{-1/2} \quad -(6)$$

2) From eqs. (4) and (6):

$$\phi = \pi \left(1 - \frac{\epsilon}{kr^2}\right)^{-1/2} \left(1 + \frac{\epsilon}{kr^2}\right)^{1/2} \quad -(7)$$

If

$$\epsilon \ll kr^2 \quad -(8)$$

$$\phi \sim \pi \left(1 + \frac{1}{2}\frac{\epsilon}{kr^2}\right)\left(1 + \frac{1}{2}\frac{\epsilon}{kr^2}\right) \quad -(9)$$

$$= \pi \left(1 + \frac{\epsilon}{kr^2} + \frac{1}{4}\left(\frac{\epsilon}{kr^2}\right)^2\right)$$

To first order:

$$\phi \sim \pi \left(1 + \frac{\epsilon}{kr^2}\right) \quad -(10)$$

and

$$\theta \sim 2\pi \left(1 + \frac{\epsilon}{kr^2}\right) \quad -(11)$$

The precession of the perihelia is therefore:

$$\boxed{\Delta\theta = \frac{2\pi\epsilon}{kr^2}} \quad -(12)$$

From eqs. (5) and (12):

$$\Delta\theta = 6\pi \left(\frac{L_0}{mcr}\right)^2 \quad -(13)$$

For an approximately circular orbit the angular momentum is the following constant of motion:

$$L_0 = mvr \quad -(14)$$

so

$$\boxed{\Delta\theta = 6\pi\left(\frac{v}{c}\right)^2} \quad -(15)$$

where v is the orbital linear velocity.

In the Newtonian approximation and for an approximately circular orbit:

$$L_0^2 = \alpha m^2 MG \quad -(16)$$

where α is the half right latitude. In the case of an approximately circular orbit:

$$\alpha \sim r \quad -(17)$$

so:

$$\Delta\theta = \frac{6\pi MG}{c^2 r} = 3\pi\frac{r_0}{r} \quad -(18)$$

where the obsolete term "Schwarzschild radius" is defined by:

$$r_0 = \frac{2MG}{c^2} \quad -(19)$$

So:

$$\boxed{\Delta\theta = 6\pi\left(\frac{v}{c}\right)^2 = 3\pi\frac{r_0}{r}} \quad -(20)$$

for each planet. The total precession is:

4) $$\sum \Delta\theta = 3\pi r_0 \sum_{i=1}^{n} \frac{1}{r_i} \quad -(21)$$

The relativistic correction for each planet is inversely proportional to its distance from the sun if the orbit is nearly circular.

Clearly, the sum of $\sum^{n}$ corrections is used for n planets, and the potential (1) is used n times. The total apsidal angle is:

$$\sum \phi = \pi\left(1 + \frac{\epsilon_1}{kr_1^2} + 1 + \frac{\epsilon_2}{kr_2^2} + \dots\right) \quad -(22)$$

$$= n\pi + \sum_{i=1}^{n} \frac{\epsilon_i}{k_i r_i}$$

So:

$$\sum \theta = 2\pi n + 3\pi r_0 \sum_{i=1}^{n} \frac{1}{r_i} \quad -(23)$$

$$= 2\pi n + \sum \Delta\theta$$

and

$$\sum \Delta\theta = \sum \theta - 2\pi n \quad -(24)$$

In a similar manner consider the perturbation of the elliptical or Newtonian orbit of a mass m by a mass

5) m_1, where M is the mass of the sun:

$$V_1 = -\frac{mMG}{r} - \frac{mm_1G}{|\underline{r}_1 - \underline{r}|} \quad -(25)$$

where $\underline{r}_1$ is the distance of the mass m_1 from the sun. The mass m_1 causes the perihelion of the orbit of mass m to precess by:

$$\Delta\theta_1 = \frac{3\pi}{2}\frac{m_1}{M}\left(\frac{r}{r_1}\right)^3 \quad -(26)$$

to an excellent approximation for nearly circular orbits. The polar angle is:

$$\theta_1 = 2\pi\left(1 + \frac{3}{4}\frac{m_1}{M}\left(\frac{r}{r_1}\right)^3\right) \quad -(27)$$

Similarly earlier:

$$V_2 = -\frac{mMG}{r} - \frac{mm_2G}{|\underline{r}_2 - \underline{r}|}, \quad -(28)$$

so

$$\theta_2 = 2\pi\left(1 + \frac{3}{4}\frac{m_2}{M}\left(\frac{r}{r_2}\right)^3\right) \quad -(29)$$

$$\Delta\theta_2 = \frac{3\pi}{2}\frac{m_2}{M}\left(\frac{r}{r_2}\right)^3 \quad -(30)$$

and:

$$\Delta\theta_1 + \Delta\theta_2 + \dots + \Delta\theta_n = \frac{3\pi}{2}\left[\frac{m_1}{M}\left(\frac{r}{r_1}\right)^3 + \frac{m_2}{M}\left(\frac{r}{r_2}\right)^3 + \dots\right]$$

$$-(31)$$

) is the total precession due to the combined effect of $m_1, m_2, \ldots, m_n$.

Finally consider the combined effect of the EGR correction and the gravitational correction of a mass m_1 on a mass m:

$$V_1 = -\frac{mMG}{r} - \frac{MGL_0^2}{mc^2r^3} - \frac{mm_1G}{|\underline{r}_1 - \underline{r}|} \quad -(32)$$

so
$$\Delta\theta_1 = 3\pi\left(\frac{1}{2}\frac{m_1}{M}\left(\frac{r}{r_1}\right)^3 + \frac{r_0}{r}\right) \quad -(33)$$

Similarly:
$$\Delta\theta_2 = 3\pi\left(\frac{1}{2}\frac{m_2}{M}\left(\frac{r}{r_2}\right)^3 + \frac{r_0}{r}\right) \quad -(34)$$

so
$$\sum_i \Delta\theta = 3\pi\left[\frac{1}{2}\left(\frac{m_1}{M}\left(\frac{r}{r_1}\right)^3 + \frac{m_2}{M}\left(\frac{r}{r_2}\right)^3 + \ldots + \frac{m_n}{M}\left(\frac{r}{r_n}\right)^3\right) + n\frac{r_0}{r}\right] \quad -(35)$$

The total EGR correction is:

$$\boxed{\sum_i \Delta\theta = 3\pi n \frac{r_0}{r}} \quad -(36)$$

The standard physics claim the incorrect

1) result:

$$\sum_i \Delta\theta = ?\ 3\pi \frac{r_0}{r} \quad -(37)$$

when there are n planets perturbing the planet of mass m.

Therefore the claims of EGR are qualitatively incorrect and fundamentally illogical.
