410(5): The Universal Law of Precession applied to the Hulse Taylor Binary Pulsar.

The ULP asserts that any observable precession is given by:

$$\Delta \phi = \frac{2\pi}{c^2} \left(v_N^2 + 3\omega^2 r^2 \right) \quad -(1)$$

where v_N is the Newtonian velocity and v_θ the transverse velocity:

$$v_\theta = \omega r \quad -(2)$$

Here r is a point in the orbit and ω the angular velocity of the de Sitter rotation of the infinitesimal line element:

$$\Delta \phi' = \Delta \phi + \omega t \quad -(3)$$

The observable precession of the Hulse Taylor binary pulsar is

$$\Delta \phi = 4.226^\circ \text{ per earth year} \quad -(4)$$
$$= 1.526 \times 10^{-5} \text{ radians per } 2\pi$$

where 2π refers to the orbit of the binary pulsar.

Therefore:

$$v^2 = v_N^2 + 3v_\theta^2 = \frac{c^2}{2\pi} \times 6.526 \times 10^{-5} \, m^2 s^{-2}$$
$$= 9.335 \times 10^{12} \, m^2 s^{-2} \quad -(5)$$

and

$$v = 3.055 \times 10^6 \, m s^{-1} \quad -(6)$$

Using Marion and Thornton third edition the Newtonian velocity is:

$$v_N^2 = \frac{k}{\mu} \left(\frac{2}{r} - \frac{1}{a} \right) \quad -(7)$$

where

2) $$k = m_1 m_2 G, \quad \mu_1 = \frac{m_1 m_2}{m_1 + m_2} \quad -(8)$$

where m_1 and m_2 are the masses of the stars in the binary pulsar, r is a pt now in the orbit and a the semi major axis. At closest approach:

$$r = \frac{\alpha}{1+\epsilon}, \quad a = \frac{\alpha}{1-\epsilon^2} \quad -(9)$$

so $$v_N^2 = (m_1+m_2)\frac{G}{\alpha}\left(2(1+\epsilon)-(1-\epsilon^2)\right)$$
$$= (m_1+m_2)\frac{G}{\alpha}(1+\epsilon)^2 \quad -(10)$$

For the Hulse Taylor binary pulsar:

$$m_1 \sim m_2 = 2.804 \times 10^{30}\ kg \quad -(11)$$
$$\alpha = 5.371 \times 10^{8}\ m \quad -(12)$$
$$\epsilon = 0.8831 \quad -(13)$$
$$G = 6.67408 \times 10^{-11}\ m^3 kg^{-1} s^{-2} \quad -(14)$$

So $$v_N^2 = 1.561 \times 10^{12}\ m^2 s^{-2} \quad -(15)$$
$$v^2 = 9.335 \times 10^{12}\ m^2 s^{-2} \quad -(16)$$

and $$v_\theta^2 = \omega^2 r^2 = v^2 - v_N^2 \quad -(17)$$
$$= 7.774 \times 10^{12}\ m^2 s^{-2}$$

Therefore: $$v_\theta = \omega r = 2.778 \times 10^{6}\ ms^{-1} \quad -(18)$$

At closest approach:

$$r = \frac{\alpha}{1+\epsilon} = 2.850 \times 10^{8}\ ms^{-1} \quad -(19)$$

Therefore at closest approach:

$$\boxed{\begin{aligned}\omega &= \frac{v_\theta}{r} = \frac{2.778\times 10^{6}}{2.850\times 10^{8}} \qquad -(20)\\ &= 9.75\times 10^{-3} \text{ radians per second}\end{aligned}}$$

The experimentally observed precession of the Hulse Taylor binary pulsar is caused by the angular velocity $\omega = 9.75\times 10^{-3}$ radians per second of the de Sitter rotation (3). This is the rotation of the ECE2 covariant universal line element:

$$ds^2 = c^2 dt^2 - dr^2 - r^2 d\phi^2 \qquad -(21)$$

and is caused by spacetime torsion as argued in previous work. The precessions of the planets (UFT406) are explained in the same way.