1) Notes 106(2): Binary Pulsars in ECE Theory.

In the Hulse Taylor binary pulsar PSR B1913 + 16 two neutron stars are very close to each other and one is a pulsar. The orbit is very elliptical with an eccentricity of 0.62. From notes 106(1) the orbit is described by the potential

$$V(r) = \frac{mc^2}{2}\left(-\frac{r_s}{r} + \frac{a^2}{r^2} - \frac{r_s a^2}{r^3}\right) \quad -(1)$$

In the ECE theory:

$$r_s = -\frac{T}{R} \quad -(2)$$

and in the EH theory:

$$r_s = \frac{2MG}{c^2}. \quad -(3)$$

The binary pulsar system may be used to find experimentally whether the orbits obey eq. (3) or eq. (2). This is achieved in this note without any assumption other than that leading to the potential (1). In the standard model the assumption is made of the weak field limit, and also that the pulsar produces gravitational radiation. It is claimed in the standard model that the binary pulsar is indirect evidence for gravitational radiation, but the latter has never been observed experimentally.

All that is really known experimentally is that the binary pulsar system is not compatible with eq. (3).

2) It is known theoretically that the EH equation conflicts directly with the Bianchi identity, so is an incorrect description of a binary pulsar. Therefore the prediction of gravitational radiation from the EH equation cannot be correct - the fact that gravitational radiation has never been observed is therefore unsurprising.

A completely new approach to the problem of binary pulsars can be constructed straightforwardly by using eq. (2). This can be done phenomenologically, by using T/R as a parameter to fit orbital data, or by altering to calculate T/R. This can be done without using a weak field approximation, so that $V(r)$ is used as defined by eqs. (1) and (2). Circular orbits are possible when the effective force is zero:

$$F = -\frac{dV}{dr} = \frac{-mc^2}{2r^4}\left(r_s r^2 - 2a^2 r + 3 r_s a^2\right) = 0 \quad -(4)$$

This quadratic equation has solutions

$$r_{outer} = \frac{a^2}{r_s}\left(1 + \left(1 - \frac{3r_s^2}{a^2}\right)^{1/2}\right) \quad -(5)$$

and

$$r_{inner} = \frac{a^2}{r_s}\left(1 - \left(1 - \frac{3r_s^2}{a^2}\right)^{1/2}\right) \quad -(6)$$

The classical limit is $a \gg r_s$ and the

3) formulae become:

$$r_{outer} = \frac{2a^2}{r_s}, \quad r_{inner} = \frac{3}{2} r_s \qquad (7)$$

Substituting a and r_s into r_{outer} yields:

$$m\omega_\phi^2 r = \frac{GMm}{r^2} \qquad (8)$$

i.e the centripetal repulsion is balanced by ~~the~~ Newtonian attraction. The classical orbital speed is

$$\omega_\phi^2 = \frac{GM}{r_{outer}^3} = \frac{c^2 r_s^4}{16a^6} \qquad (9)$$

A small deviation from a circular orbit of radius r_{outer} will oscillate stably in EH theory with an angular frequency:

$$\omega_r^2 = \frac{1}{m}\left(\frac{d^2V}{dr^2}\right)_{r=r_{outer}} \qquad (10)$$

$$= \omega_\phi^2\left(1-\frac{3r_s^2}{a^2}\right)^{1/2}$$

i.e. $$\omega_r \simeq \omega_\phi\left(1-\frac{3r_s^2}{4a^2}+\dots\right) \qquad (11)$$

The precession of the orbit per revolution is given by multiplying by the period T of one revolution:

$$\delta\phi = T(\omega_\phi-\omega_r) \simeq 2\pi\left(\frac{3r_s^2}{4a^2}\right)$$

i.e. $$\delta\phi = \frac{3\pi m^2 c^2 r_s^2}{2L^2} \qquad (12)$$

4)

In the standard model

$$r_s = \frac{2MG}{c^2} \quad -(13)$$

but in ECE theory

$$r_s = \frac{T}{R} \quad -(14)$$

In the standard model the orbits are stable, but in ECE theory they may deviate from the prediction of EH theory. As argued these deviations are observed in binary pulsars, and in ECE ~~data~~ the experimental data from binary pulsars are used to determine T/R.

In the standard model

$$\delta\phi \sim \frac{6\pi G^2 M^2 m^2}{c^2 L^2} \quad -(15)$$

and this expression may be simplified using the elliptical orbit's semi axis A and eccentricity e defined by:

$$\frac{L^2}{G M m^2} = A(1-e^2) \quad -(16)$$

(standard model)

so:

$$\delta\phi = \frac{6\pi G M}{c^2 A(1-e^2)} \quad -(17)$$

and

$$\delta\phi = \frac{3\pi}{A(1-e^2)} \cdot \frac{T}{R} \quad -(18)$$

(ECE)