APPENDIX : SELF CONSISTENT CALCULATION.

In order to calculate non Einstein Hilbert orbits self - consistently the dependence of r_s on r and on the constants of motion is needed. In the standard model:

$$r_s = \frac{2GM}{c^2} \quad -(A1)$$

and is a constant for a given M. However in ECE theory:

$$|r_s| = \frac{T}{R} \quad -(A2)$$

and r_s is a variable. Consider the potential energy of the relativistic Kepler problem using the notation of the text:

$$V = mc^2\left(\frac{1}{2} - \frac{r_s}{r}\right) + \frac{mL^2}{2r^2} - mL^2\frac{r_s}{r^3}. \quad -(A3).$$

It is found that:

$$\frac{\partial V}{\partial r_s} = -\frac{mc^2}{r} - \frac{mL^2}{r^3}. \quad -(A4)$$

Therefore:

$$\left(\frac{\partial V}{\partial r_s}\right) r^3 + mc^2 r^2 + mL^2 = 0. \quad -(A5)$$

This is a cubic equation in r with three roots, an equation in which L is constant and where $\partial V / \partial r_s$ is a variable. The rate of change of V with r is:

$$\frac{\partial V}{\partial r} = \frac{m}{r^2}\left(c^2 r_s - \frac{L^2}{r} + 3L^2\frac{r_s}{r^2}\right) \quad -(A6)$$

Now use:

$$\frac{\partial V}{\partial r_s} = \frac{\partial V}{\partial r}\frac{\partial r}{\partial r_s} \qquad -(A7)$$

to find:

$$\frac{\partial r_s}{\partial r} = r\left(\frac{L^2}{r} - c^2 r_s - 3L^2\frac{r_s}{r^2}\right) \Big/ \left(r^2c^2 + L^2\right) \qquad -(A8)$$

and

$$\frac{\partial r}{\partial r_s} = \frac{1}{r}\left(r^2c^2 + L^2\right)\left(\frac{L^2}{r} - c^2 r_s - 3L^2\frac{r_s}{r^2}\right)^{-1}. \qquad -(A9)$$

Therefore by integration, the required dependence of r_s on r and L is found:

$$r_s = \int r\left(\frac{L^2}{r} - c^2 r_s - 3L^2\frac{r_s}{r^2}\right)\left(r^2c^2 + L^2\right)^{-1} dr. \qquad -(A10)$$

Conversely, the dependence of r on r_s is found by the following integration:

$$r = \int \left(rc^2 + \frac{L^2}{r}\right)\left(\frac{L^2}{r} - c^2 r_s - 3L^2\frac{r_s}{r^2}\right)^{-1} dr_s . \qquad -(A11)$$

For example, the integral could be worked out for a given:

$$|r_s| = (T/R)_0 \qquad -(A12)$$

so that:

$$r = \int_0^{(T/R)_0} \left(rc^2 + \frac{L^2}{r}\right)\left(\frac{L^2}{r} - c^2 r_s - 3L^2\frac{r_s}{r^2}\right)^{-1} dr_s \qquad -(A13)$$

As

$$r_s \to 0 \quad -(A14)$$

in Eq. (A9):

$$\frac{\partial r}{\partial r_s} \to \frac{r}{L^2}\left(r c^2 + \frac{L^2}{r}\right) \quad -(A15)$$

and so:

$$r \to \left(1 + \left(\frac{rc}{L}\right)^2\right) r_s. \quad -(A16)$$

This is a quadratic equation in r:

$$\left(\frac{c^2 r_s}{L^2}\right) r^2 - r + r_s = 0 \quad -(A17).$$

with solutions:

$$r = \frac{2L^2}{c^2 r_s}\left(1 \pm \left(1 - 4\left(\frac{c r_s}{L}\right)^2\right)^{1/2}\right). \quad -(A18)$$

Using the definition of L:

$$L = r^2 \frac{d\phi}{d\tau} \quad -(A19)$$

and in the limit:

$$r_s \to 0 \quad -(A20)$$

it is found that:

$$r \to \frac{4r^4}{c^2 r_s}\left(\frac{d\phi}{d\tau}\right)^2. \quad -(A21)$$

Since L is a constant of motion, then:

c.

$$r^3 \to \frac{1}{4} c^2 r_s \left(\frac{d\phi}{d\tau} \right)^{-2} \quad -(A13)$$

and form Eq. (A13) it is found that:

$$r \to 0 \text{ as } r_s \to 0. \quad -(A14)$$

This means that the orbit of a binary pulsar will decrease in radius as T / R decreases. This is observed experimentally as described in the text.

There are several limiting forms of Eq. (A3) that can be considered.

1) In the limit:

$$r_s \to 0 \quad -(A15)$$

the potential becomes:

$$V \to \frac{1}{2} mc^2 + \frac{mL^2}{2r^2} \quad -(A16)$$

and there is no attractive force. This is interpreted to mean that the two stars have collided so no further force of gravitational attraction is possible.

2) From Eq. (A3):

$$r_s = \left(\frac{1}{2} mc^2 - V + \frac{mL^2}{2r^2} \right) \left(\frac{mc^2}{r} + \frac{mL^2}{r^3} \right)^{-1} \quad -(A17)$$

and in the limit:

$$r \to 0 \quad -(A18)$$

it is found that:

d.

$$r_s \rightarrow \frac{r}{2}. \qquad -(A19)$$

3) In the limit of circular orbits (see text):

$$\frac{\partial V}{\partial r} \rightarrow 0 \qquad -(A20)$$

leading to the Newtonian limit for a circular orbit:

$$r \rightarrow \left(\frac{L}{c}\right)^2 r_s. \qquad -(A21)$$

This means again that r vanishes if r_s vanishes because L is a constant of motion.

4) From Eq. (A17) the limit (A15) also implies:

$$\frac{mc^2}{r} + \frac{mL^2}{r^3} \rightarrow \infty \qquad -(A22)$$

and since L is a constant of motion, Eq. (A22) means again that r vanishes if r_s vanishes.

5) From the definition of L, i.e.:

$$L = r^2 \frac{\partial \phi}{\partial \tau} \qquad -(A23)$$

as a constant of motion, it is found that when r vanishes, $\partial \phi / \partial \tau$ becomes infinite.

6) Finally in the limit of very small potential energy:

$$\frac{1}{2} c^2 r^3 - c^2 r^2 r_s + \frac{L^2}{2} r - L^2 r_s = 0 \qquad -(A24)$$

which is a cubic equation with three roots for r. These roots may be found by computer algebra. In the standard model the loss of potential energy in a binary pulsar is intepreted to mean that gravitational radiation is emitted. Although gravitational radiation has never been directly observed, it is falsely asserted in the standard model that this verifies the Einstein Hilbert equation. This cannot be meaningful in physics because the EH equation is self inconsistent at a basic level {1-10} as argued in the text. The ECE explanation of the orbit of a binary pulsar is based on the correct Cartan geometry and is preferred by Ockham's Razor. Using the ideas in this Appendix the orbit can be worked out by finding the dependence of r_s on r and L, graphed, and animated.