08(4): Relativistic Description of Gravitation Using the ECE2 Hamiltonian

The ECE2 covariant hamiltonian is:

$$H = \gamma mc^2 + U = (c^2p^2 + m^2c^4)^{1/2} + U \quad -(1)$$

here U is the potential energy. For gravitation:

$$U = -\frac{mMG}{r} \quad -(2)$$

In eq. (1):

$$p = \gamma m \underline{v} \quad -(3)$$

is the relativistic momentum, and γ is the Lorentz factor:

$$\gamma = \left(1 - \frac{v^2}{c^2}\right)^{-1/2} \quad -(4)$$

Here:

$$E = \gamma mc^2 \quad -(5)$$

is the relativistic total energy and

$$T = (\gamma - 1)mc^2 \quad -(6)$$

is the relativistic kinetic energy.

From eq. (1):

$$H_0 = H - mc^2 = \frac{p^2c^2}{H - U + mc^2} + U \quad -(7)$$

$$= \frac{p^2c^2}{E + mc^2} + U$$

$$= \frac{p^2}{(\gamma+1)m} + U$$

In the non relativistic limit:

$$\gamma \rightarrow 1 \quad -(8)$$

and

$$p \rightarrow m\underline{v} \quad -(9)$$

So
$$H_0 \rightarrow \frac{p^2}{2m} + U \quad -(10)$$
$$= \frac{1}{2}mv^2 + U$$
Eq. (7) can be expressed as:
$$H_0 = \left(\frac{\gamma^2}{1+\gamma}\right)mv^2 + U \quad -(11)$$
Here
$$\gamma^2 = \left(1-\frac{v^2}{c^2}\right)^{-1} \rightarrow 1+\frac{v^2}{c^2} \rightarrow 1 \quad -(12)$$
$$\gamma = \left(1-\frac{v^2}{c^2}\right)^{-1/2} \rightarrow 1+\frac{1}{2}\frac{v^2}{c^2} \quad -(13)$$
So
$$1+\gamma \rightarrow 2+\frac{1}{2}\frac{v^2}{c^2} \rightarrow 2 \quad -(14)$$
so eq (11) becomes eq. (10) in the non-relativistic limit, Q.E.D.

The Thomas half is part of the above ECE2 physics and enters into consideration by rotating the ECE2 invariant line element:
$$ds^2 = c^2 d\tau^2 = (c^2 - v^2)\,dt^2 \quad -(15)$$
$$= c^2 d\tau^2 = c^2 dt^2 - dr^2 - r^2 d\phi^2$$
[illegible]ing:
$$\phi' = \phi + \omega_0 t \quad -(16)$$
This produces the Thomas precession:
$$\Delta\phi_T = 2\pi(\gamma - 1) \quad -(17)$$
and the Thomas half:

$$\frac{\Delta\phi_T}{2\pi} \xrightarrow[v \ll c]{} \frac{1}{2}\frac{v^2}{c^2} \quad -(18)$$

Q.E.D.

The Thomas half is ubiquitous throughout ECE2 physics. This fact has been realized recently.

From eq. (15):

$$d\tau^2 = \left(1 - \frac{v^2}{c^2}\right) dt^2 \quad -(19)$$

so

$$\gamma = \frac{dt}{d\tau} \quad -(20)$$

and

$$\frac{dt}{d\tau} = 1 + \frac{\Delta\phi_T}{2\pi} \quad -(21)$$

Measurement of the Thomas precession is a test of time dilatation.

More generally wherever γ occurs in ECE2 physics it can be replaced by

$$\gamma = 1 + \frac{\Delta\phi_T}{2\pi} \quad -(22)$$

Eq. (11) can be expressed as:

$$H_0 = 2\left(\frac{\gamma^2}{1+\gamma}\right)\frac{1}{2}\frac{v^2}{c^2}mc^2 + U \quad -(23)$$

which becomes

$$H_0 = \frac{1}{2}\frac{v^2}{c^2}mc^2 + U \quad -(24)$$

in the non relativistic limit.

The hamiltonian (23) gives orbital precession and the hamiltonian (24) gives the Newtonian ellipse.

4) ECE2 is known to give an accurate and correct description of gravitational physics, so the above equations are a sufficient description of gravitation to state of art. Einsteinian general relativity (EGR) has been almost completely refuted by ECE2. If we attempt to use concepts from EGR, gravitation means that the Thomas precession must be replaced by the de Sitter precession. This implies that:

$$v^2 \rightarrow v_1^2 + \frac{2MG}{r} \quad -(25)$$

and the Thomas half becomes:

$$x = \frac{1}{2}\frac{v^2}{c^2} \rightarrow \frac{1}{2}\left(\frac{v^2}{c^2} + \frac{2MG}{rc^2}\right) \quad -(26)$$

The origin of $2MG/r$ is the de Sitter rotation, which is the same as Eq. (16) applied to the Schwarzschild metric. The latter is an incorrect idea, the solution of a field equation in a space without torsion - the Einstein field equation. EGR does not use the concept of potential, it introduces an effective potential from a metric. It should not be surprising therefore that if Eq. (25) is tried in an ECE2 equation such as

$$H_0 = \frac{1}{2}mv^2 - \frac{mMG}{r} \quad -(27)$$

an absurd result is obtained:

$$H_0 = \frac{1}{2}\frac{v^2}{c^2}mc^2 - \frac{mMG}{r} \quad -(28)$$

$$\rightarrow \frac{1}{2c^2}\left(v^2 + \frac{2MG}{r}\right)mc^2 - \frac{mMG}{r}$$

$$= ? \quad \frac{1}{2}mv^2$$

5) The effect of the incorrect de Sitter rule (25) is to produce (28), which is a hamiltonian without a potential energy term. This means that there is no gravitational attraction, reductio ad absurdum.

This type of demonstration can be extended to all the relativistic equations in this note. They will all produce absurdities if the de Sitter rule is used.

Similarly, all the metrics of EGR will produce absurd results if v^2 is replaced by a quantity of these metrics. An example is the Kerr metric.

Finally, the relativistic momentum p^2 becomes:

$$p^2 = \gamma^2 m^2 v^2 = \gamma^2 m^2 \left(v^2 + \frac{2MG}{r} \right) \quad -(29)$$

and the structure of equations such as (7) will be entirely changed.