223(1): Gravitational Time Dilatation in x Theory

Following the method of UFT 208 the unconstrained Minkowski method is:

$$ds^2 = c^2 d\tau^2 = g_{\mu\nu}\, dx^\mu dx^\nu \quad -(1)$$

$$= c^2 dt^2 - dr^2 - r^2 d\theta^2,$$

$$= g_{00}\, dx^0 dx^0 + g_{11}\, dx^1 dx^1 + g_{22}\, dx^2 dx^2.$$

Here:

$$dx^0 = c\,dt, \quad dx^1 = dr, \quad dx^2 = r\, d\theta, \quad -(2)$$

$$g_{00} = 1, \quad g_{11} = -1, \quad g_{22} = -1.$$

The orbit is defined by:

$$g = \frac{dr}{d\theta} \quad -(3)$$

and:

$$ds^2 = c^2 dt^2 - \left(\frac{dr}{d\theta}\right)^2 d\theta^2 - r^2 d\theta^2 \quad -(4)$$

So:

$$g = \frac{dr}{d\theta} = r\frac{dx^1}{dx^2}, \quad -(5)$$

$$(dx^1)^2 = \left(\frac{g}{r}\, dx^2\right)^2. \quad -(6)$$

Therefore:

$$ds^2 = g_{00}\, dx^0 dx^0 + g_{11}\left(\frac{g}{r}\, dx^2\right)^2 + g_{22}\left(dx^2\right)^2 \quad -(7)$$

Let..

2)

$$f = \left(\frac{r}{g}\right)^2 \quad -(8)$$

then

$$ds^2 = g_{00}\,dx^0 dx^0 + \frac{g_{11}}{f}\,dx^2 dx^2 + g_{22}\,dx^2 dx^2$$

$$= g_{00}\,dx^0 dx^0 + g_{22}'\,dx^2 dx^2. \quad -(9)$$

Thus:

$$ds^2 = c^2 d\tau^2 = c^2 dt^2 - \left(1 + \frac{1}{f}\right) r^2 d\theta^2 \quad -(10)$$

$$= c^2 dt^2 - v^2 dt^2$$

because:

$$\underline{dr} \cdot \underline{dr} = v^2 dt^2 = \left(1 + \frac{1}{f}\right) r^2 d\theta^2. \quad -(11)$$

Therefore:

$$d\tau^2 = \left(1 - \left(\frac{v}{c}\right)^2\right) dt^2 \quad -(12)$$

$$= \left(1 - \frac{r^2}{c^2}\left(1 + \frac{1}{f}\right)\left(\frac{d\theta}{dt}\right)^2\right) dt^2$$

$$= \left(1 - \frac{r^2}{c^2}\left(1 + \frac{g^2}{r^2}\right)\left(\frac{d\theta}{dt}\right)^2\right) dt^2$$

$$= \left(1 - \frac{1}{c^2}\left(r^2 + g^2\right)\left(\frac{d\theta}{dt}\right)^2\right) dt^2$$

3)

$$= \left(1 - \frac{1}{c^2}\left(r^2 + \left(\frac{dr}{d\theta}\right)^2\right)\left(\frac{d\theta}{dt}\right)^2\right) dt^2 \quad -(13)$$

Therefore

$$\frac{d\tau}{dt} = \left(1 - \frac{1}{c^2}\left(r^2 + \left(\frac{dr}{d\theta}\right)^2\right)\left(\frac{d\theta}{dt}\right)^2\right)^{1/2} \quad -(14)$$

For the processing conical section:

$$r = \frac{\alpha}{1 + \epsilon\cos(x\theta)}, \quad -(15)$$

then

$$\frac{dr}{d\theta} = \frac{x\epsilon}{\alpha} r^2 \sin(x\theta) \quad -(16)$$

where

$$\sin(x\theta) = \frac{1}{\epsilon r}\left(\epsilon^2 r^2 - (\alpha - r)^2\right)^{1/2} \quad -(17)$$

So:

$$\frac{dr}{d\theta} = \frac{x r}{\alpha}\left(\epsilon^2 r^2 - (\alpha - r)^2\right)^{1/2} \quad -(18)$$

From eqs. (14) and (18):

$$\frac{d\tau}{dt} = \left(1 - \frac{1}{c^2}\left(r^2 + \frac{x^2 r^2}{\alpha^2}\left(\epsilon^2 r^2 - (\alpha - r)^2\right)\right)\left(\frac{d\theta}{dt}\right)^2\right)^{1/2} \quad -(19)$$

Finally:

$$L = \mu r^2 \frac{d\theta}{dt}, \quad —(20)$$

so

$$\frac{d\theta}{dt} = \frac{L}{\mu r^2}. \quad —(21)$$

$—(22)$

Therefore:

$$\frac{d\tau}{dt} = \left(1 - \left(\frac{L}{c\mu r^2}\right)^2 \left(r^2 + \left(\frac{xr}{\alpha}\right)^2 \left(\epsilon^2 r^2 - (\alpha - r)^2\right)\right)\right)^{1/2}$$

i.e

$$\boxed{\frac{d\tau}{dt} = \left(1 - \left(\frac{L}{c\mu r}\right)^2 \left(1 + \left(\frac{x}{\alpha}\right)^2 \left(\epsilon^2 r^2 - (\alpha - r)^2\right)\right)\right)^{1/2}}$$

$—(23)$

The conventional theory is:

$$ds^2 = c^2 d\tau^2 = c^2\left(1 - \frac{r_0}{r}\right) dt^2 - \left(1 - \frac{r_0}{r}\right)^{-1} dr^2 - r^2 d\theta^2 \quad —(24)$$

where:

$$d\underline{r} \cdot d\underline{r} = \left(1 - \frac{r_0}{r}\right)^{-1} dr^2 + r^2 d\theta^2 \quad —(25)$$

$$= v^2 dt^2$$

5)

So:

$$ds^2 = c^2 d\tau^2 = \left(c^2\left(1-\frac{r_0}{r}\right)^{-1} - v^2\right) dt^2 \quad -(26)$$

and

$$\frac{d\tau}{dt} = \left(\left(1-\frac{r_0}{r}\right)^{-1} - \frac{v^2}{c^2}\right)^{1/2} \quad -(27)$$

Limit of Special Relativity

It is seen from eq (12) that in x theory:

$$\frac{d\tau}{dt} = \left(1-\left(\frac{v}{c}\right)^2\right)^{1/2} \quad -(28)$$

so x theory is compatible automatically with special relativity.

On the other hand eq. (27) is compatible with special relativity only if:

$$\frac{r_0}{r} \rightarrow 0 \quad -(29)$$

i.e.

$$r \rightarrow \infty. \quad -(30)$$

Here

$$r_0 = \frac{2mG}{c^2} \quad -(31)$$