1)

189(6): Complete Solutions for the m and n Functions

The complete and most general solutions are:

$$m(r,t) = \frac{1}{e^2} \exp\left(2\exp\left(-\frac{r}{6R(t)}\right)\right) \quad -(1)$$

and

$$n(r,t) = \frac{1}{e^2} \exp\left(2\exp\left(-\frac{t}{6\tau(r)}\right)\right). \quad -(2)$$

where R has the dimension of distance and τ the dimension of time. The infinitesimal line element is:

$$ds^2 = c^2 m(r,t)\,dt^2 - n(r,t)\,dr^2 - r^2 d\phi^2 \quad -(3)$$

in the plane:

$$dZ^2 = 0. \quad -(4)$$

In the limit:

$$r \rightarrow \infty \quad -(5)$$

then

$$m(r,t) \rightarrow 1. \quad -(6)$$

In the limit:

$$t \rightarrow \infty \quad -(7)$$

then

$$n(r,t) \rightarrow 1. \quad -(8)$$

In these limits the Minkowski metric is recovered with line element:

$$ds^2 = c^2 dt^2 - dr^2 - r^2 d\phi^2 \quad -(9)$$

The challenge is to use eqns (1) and (2) to describe

2) all known orbits without the use of dark matter, i.e. by using the philosophy of relativity and the correct geometry. In this method the parameter $R(t)$ is a characteristic distance and $\tau(1)$ a characteristic time. The functions m and n have been obtained using the fundamental commutator, the metric compatibility equation for the antisymmetric connection, and the Evans identity as an exact identity.

The equation of orbits is obtained from eq (3) as shown in previous work.

In the first instance R and τ can be assumed to be constants. The solar system is known empirically to be described by:

$$m = \frac{1}{n} = 1 - \frac{r_0}{r} \quad -(10)$$

i.e.

$$\frac{1}{e^2} \exp\left(2 \exp\left(-\frac{r}{6R(t)}\right)\right) = 1 - \frac{r_0}{r} \quad -(11)$$

which relates $R(t)$ and r_0. Similarly:

$$n^{-1} = m \quad -(12)$$

giving a relation between r, t, R and τ.

If

$$r \ll R \quad -(13)$$

then

$$\exp\left(-\frac{r}{6R(t)}\right) \sim 1 - \frac{r}{6R(t)} \quad -(14)$$

3)

So

$$m(r,t) \sim \frac{1}{e^2} \exp\left(2\left(1-\frac{r}{6R}\right)\right) \quad -(15)$$

$$= \exp\left(-\frac{r}{3R(t)}\right)$$

Therefore:

$$m(r,t) \sim 1 - \frac{r}{3R(t)} = 1 - \frac{r_0}{r} \quad -(16)$$

i.e.

$$\boxed{R(t) = \frac{1}{3}\frac{r^2}{r_0}} \quad -(17)$$

This condition gives the "Schwarzschild" metric. Therefore R is a function of time that increases with r. Note that:

$$\frac{\partial R}{\partial r} = 0, \quad \frac{\partial R}{\partial t} \neq 0. \quad -(18)$$

In other words r in eq. (17) is to be expressed as a function of t:

$$r = f(t) \quad -(19)$$

$$\boxed{R(t) = \frac{1}{3}\frac{f^2(t)}{r_0}} \quad -(20)$$

In obtaining the solution (1) it has been assumed that R is a constant - in the sense that the functional dependence of m on t is given by R(t).
