236(5): The Velocity in Hooke / Newton Dynamics

From pure kinematics, the velocity is:

$$\underline{v} = \frac{d\underline{r}}{dt} = \frac{dr}{dt}\underline{e}_r + r\frac{d\underline{e}_r}{dt} \quad -(1)$$

$$= \frac{dr}{dt}\underline{e}_r + \frac{d\theta}{dt} r \underline{e}_\theta$$

where the spin connection is:

$$\omega = \frac{d\theta}{dt} \quad -(2)$$

Therefore:

$$v^2 = \left(\frac{dr}{dt}\right)^2 + r^2\left(\frac{d\theta}{dt}\right)^2. \quad -(3)$$

Now use

$$\frac{dr}{dt} = \frac{dr}{d\theta}\frac{d\theta}{dt} \quad -(4)$$

to find that:

$$\boxed{v^2 = \omega^2\left(\left(\frac{dr}{d\theta}\right)^2 + r^2\right)} \quad -(5)$$

for any orbit in a plane.

The velocity of an object m in orbit around an object M is due entirely to the spin connection.

Eq. (1) can be written as:

$$\boxed{\underline{v} = \frac{dr}{dt}\underline{e}_r + \underline{\omega} \times \underline{r}} \quad -(6)$$

For the Newtonian ellipse:

$$\frac{dr}{d\theta} = \frac{\epsilon r^2}{\alpha} \sin\theta \quad -(7)$$

So

$$v^2 = \omega^2 r^2 \left(1 + \left(\frac{\epsilon r}{\alpha}\right)^2 \sin^2\theta\right) \quad -(8)$$

where

$$\sin^2\theta = 1 - \cos^2\theta = 1 - \frac{1}{\epsilon^2}\left(\frac{\alpha}{r} - 1\right)^2 \quad -(9)$$

So:

$$v^2 = \omega^2 r^2 \left(1 + \left(\frac{\epsilon r}{\alpha}\right)^2 \left(1 - \frac{1}{\epsilon^2}\left(\frac{\alpha}{r} - 1\right)^2\right)\right)$$

$$= \omega^2 r^2 \left(1 + \left(\frac{\epsilon r}{\alpha}\right)^2 - \frac{r^2}{\alpha^2}\left(\frac{\alpha^2}{r^2} - 2\frac{\alpha}{r} + 1\right)\right)$$

$$= \omega^2 r^2 \left(2\frac{\alpha}{r} - \left(\frac{r}{\alpha}\right)^2 \left(1 - \epsilon^2\right)\right) \quad -(10)$$

Now use:

$$L = m r^2 \omega \quad -(11)$$

where

$$\underline{L} = \underline{r} \times \underline{p} = m\, \underline{r} \times \underline{v} \quad -(12)$$

is the angular momentum:

$$\underline{L} = m r^2 \omega\, \underline{k} \quad -(13)$$

This is a constant of motion.

Define the semi major axis by:

$$a = \frac{\alpha}{1-\epsilon^2} \quad -(14)$$

then:

$$v^2 = \frac{1}{\alpha}\left(\frac{L}{m}\right)^2\left(\frac{2}{r} - \frac{1}{a}\right) \quad -(15)$$

In Newtonian dynamics:

$$\alpha = \frac{L^2}{m^2 MG} \quad -(16)$$

So

$$\boxed{v^2 = MG\left(\frac{2}{r} - \frac{1}{a}\right)} \quad -(17)$$

This is eq. (7.72), page 266 of J. B. Marion and S. T. Thornton, "Classical Dynamics", (Harcourt, NY, 1988, 3rd ed.)

$$-(18)$$

Note that:

$$\frac{1}{a} = \frac{1-\epsilon^2}{\alpha} = \left(\frac{1+\epsilon\cos\theta}{r}\right)\left(1-\epsilon^2\right)$$

So:

$$\boxed{v^2(\text{Newton}) = \frac{MG}{r}\left(2 - \left(1-\epsilon^2\right)\left(1+\epsilon\cos\theta\right)\right)} \quad -(19)$$

It follows that:

$$\boxed{V \xrightarrow[r \to \infty]{} 0} \quad -(20)$$

In a whirlpool galaxy:

$$\boxed{V \xrightarrow[r \to \infty]{} \text{constant}} \quad -(21)$$

This was discovered experimentally in the late fifties. Therefore the Newton theory fails completely in whirlpool galaxies.

The Einstein theory does no better. This is because the precessing ellipse is described by:

$$\frac{dr}{dt} = \frac{x \epsilon r^2}{\alpha} \sin(x\theta) \quad -(22)$$

i.e.

$$r = \frac{\alpha}{1 + \epsilon \cos(x\theta)} \quad -(23)$$

and the Einstein theory violates kinematics even in the solar system, because it produces the wrong kinematic force law for the function of the precessing ellipse, eq. (23).

If the function (22) is used in the pure kinematics, eq. (5), then:

$$v^2 = \omega^2\left(r^2 + \left(\frac{dr}{d\theta}\right)^2\right)$$

$$= \frac{L^2}{m^2 r^4}\left(r^2 + \left(\frac{dr}{d\theta}\right)^2\right) \quad -(24)$$

$$\boxed{v^2 = \left(\frac{L}{mr}\right)^2\left(1 + \frac{1}{r^2}\left(\frac{dr}{d\theta}\right)^2\right)} \quad -(25)$$

Using eq. (22) in eq. (25), the precessing elliptical orbit (23) produces the velocity:

$$v^2 = \left(\frac{L}{mr}\right)^2\left(1 + \left(\frac{x\epsilon r \sin(x\theta)}{\alpha}\right)^2\right)$$

$$= \left(\frac{L}{mr}\right)^2\left(1 + \left(\frac{x\epsilon\sin(x\theta)}{1+\epsilon\cos(x\theta)}\right)^2\right) \quad -(26)$$

so

$$\boxed{V \xrightarrow[r\to\infty]{} 0} \quad -(27)$$

for the precessing ellipse.

<u>Both</u> <u>Newton and</u> <u>Einstein fail qualitatively</u> <u>to describe</u> a <u>whirlpool galaxy</u>. <u>Einstein</u> <u>fails qualitatively</u> <u>even in</u> the <u>solar system</u>.

6) The ECE theory shows that the gravitational orbit is given by the spin connection ω as in eq.(5):

$$v^2 = \omega^2 r^2 \left(1 + \frac{1}{r^2} \left(\frac{dr}{d\theta} \right)^2 \right) \quad -(28)$$

$$= \left(\frac{L}{mr} \right)^2 \left(1 + \frac{1}{r^2} \left(\frac{dr}{d\theta} \right)^2 \right)$$

i.e.

$$v^2 = \frac{L^2}{m^2 r^2} + \frac{L^2}{m^2 r^4} \left(\frac{dr}{d\theta} \right)^2 \quad -(29)$$

in which the spin connection is defined by:

$$\omega = \frac{L}{mr^2} \quad -(30)$$

As

$$r \rightarrow \infty \quad -(31)$$

experimental observation in a whirlpool galaxy shows that v becomes constant. This means that:

$$v \rightarrow \frac{L}{mr^2} \left(\frac{dr}{d\theta} \right) = \omega \frac{dr}{d\theta} \quad -(32)$$

$$= \text{constant}$$

i.e.

$$\frac{dr}{d\theta} = \frac{v_\infty}{\omega} = \left(\frac{m v_\infty}{L} \right) r^2 \quad -(33)$$

7) Therefore:

$$\frac{d\theta}{dr} = \left(\frac{L}{mv_\infty}\right)\frac{1}{r^2} \quad -(34)$$

and

$$\theta = \frac{L}{mv_\infty}\int\frac{dr}{r^2} = -\frac{L}{mv_\infty}\frac{1}{r} \quad -(35)$$

The orbit of the whirlpool galaxy is the spiral:

$$\boxed{\theta = -\left(\frac{L}{mv_\infty}\right)\frac{1}{r}} \quad -(36)$$

and is governed in ECE theory by the spin connection defined by ω, where:

$$L = mr^2\omega = \text{constant} \quad -(37)$$

In UFT76 the galaxy M101 was fitted to a logarithmic spiral of type (36),

QED