215(1): Interpretation of Planetary Precession as a Coriolis Force

Consider the fundamental theorem:

$$\left(\frac{d\underline{Q}}{dt}\right)_{fixed} = \left(\frac{d\underline{Q}}{dt}\right)_{rotating} + \underline{\omega} \times \underline{Q} \quad -(1)$$

where $\underline{Q}$ is any vector. Here the subscripts refer to fixed and rotating frames. Let:

$$\underline{Q} = \underline{p} \quad -(2)$$

where

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

is the total linear momentum. Then:

$$\underline{F}_{fixed} = \underline{F}_{rotating} + m\,\underline{\omega} \times \underline{v} \quad -(4)$$

where

$$\underline{F}_{Coriolis} = m\,\underline{\omega} \times \underline{v} \quad -(5)$$

is the Coriolis force.

As in UFT 214:

$$\underset{\sim}{F}_{fixed} = -\frac{k}{r^2}\left(x^2 + (1-x^2)\frac{\alpha}{r}\right)\underline{e}_{r} \quad -(6)$$

$$\underset{\sim}{F}_{rotating} = -\frac{k}{r^2}\underline{e}_{rrot} \quad (7)$$

where

2)

$$\underline{e}_{rf} = \underline{i}\cos\theta + \underline{j}\sin\theta \quad - (8)$$

$$\underline{e}_{rrot} = \underline{i}\cos(x\theta) + \underline{j}\sin(x\theta) \quad - (9)$$

$$k = mMG \quad - (10)$$

$$\alpha = \frac{L^2}{mk} \quad - (11)$$

So:

$$\underline{F}_{Coriolis} = \underline{F}_{fixed} - \underline{F}_{rotating} \quad - (12)$$

$$= -\frac{k}{r^2}\left(x^2 + (1-x^2)\frac{\alpha}{r}\right)\left(\underline{i}\cos\theta + \underline{j}\sin\theta\right)$$

$$+ \frac{k}{r^2}\left(\underline{i}\cos(x\theta) + \underline{j}\sin(x\theta)\right)$$

$$= -\frac{k}{r^2}\left[\underline{i}\left(\left(x^2 + (1-x^2)\frac{\alpha}{r}\right)\cos\theta - \cos(x\theta)\right) + \underline{j}\left(\left(x^2 + (1-x^2)\frac{\alpha}{r}\right)\sin\theta - \sin(x\theta)\right)\right]$$

$$- (13)$$

When $x = 1 \quad - (14)$

then $\underline{F}_{Coriolis} = \underline{0} \quad - (15)$