192(1): Angular Velocity Test of GR.

The angular velocity of an orbiting object is:

$$\omega = \frac{d\theta}{dt} = \left(\frac{Lc^2}{E}\right)\frac{m(r)}{r^2} \quad \text{—(1)}$$

where the total energy E and the angular momentum L are constants of motion defined by:

$$E = m(r)\, mc^2 \frac{dt}{d\tau}, \quad \text{—(2)}$$

$$L = mr^2 \frac{d\theta}{d\tau}. \quad \text{—(3)}$$

Here m is the mass of the orbiting object and τ is the proper time.

The astronomical observation needed is to measure θ at a given time t and measure r directly.

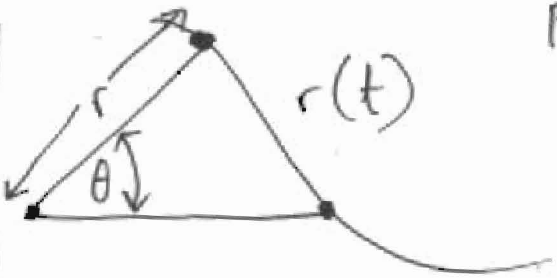


Fig. (1)

If this experiment is carried out for the moon the distance r can be measured with a laser beam.

From eq. (1):

$$\frac{dt}{d\theta} = \frac{E}{Lc^2}\frac{r^2}{m(r)}. \quad \text{—(4)}$$

So

$$dt = \frac{E}{Lc^2}\left(\frac{r^2}{m(r)}\right) d\theta \quad \text{—(5)}$$

2) In one orbit,

$$\theta = 2\pi = 360^\circ \quad -(6)$$

So:

$$\tau = \int_0^\tau dt = \frac{E}{L c^2} \int_0^{2\pi} \frac{r^2}{m(r)} \, d\theta \quad -(7)$$

In the standard model:

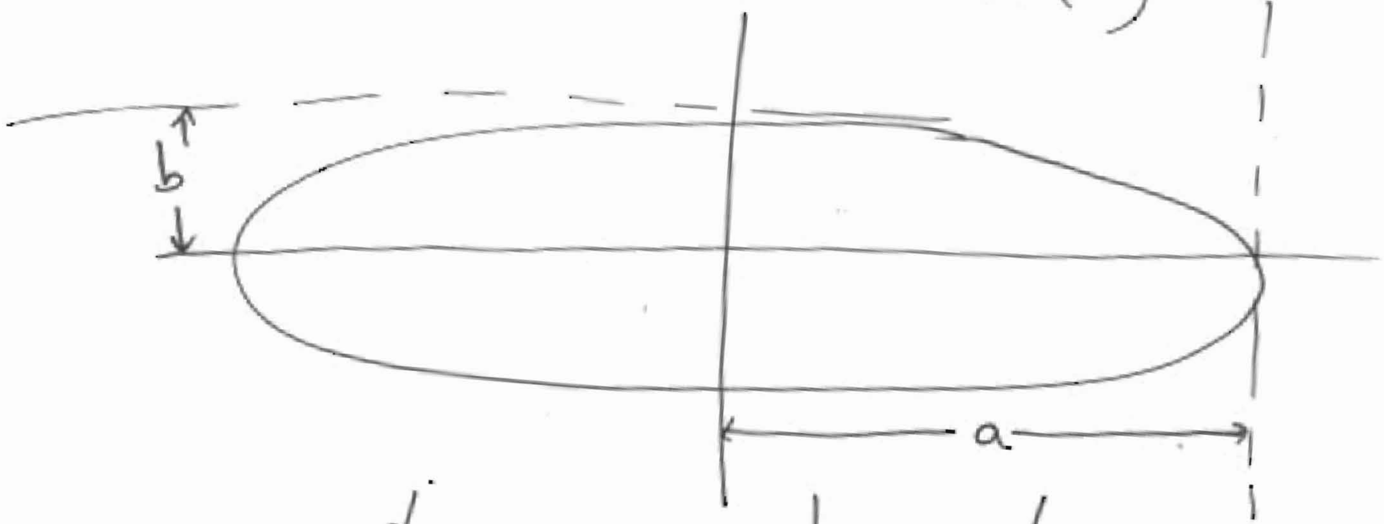
$$r = \frac{\alpha}{1 + \epsilon \cos(x\theta)} \quad -(8)$$

is a precessing ellipse claimed to originate in:

$$m(r) = 1 - \frac{r_0}{r} \quad -(9)$$

The angular velocity in the standard model is therefore claimed to be:

$$\omega = \frac{d\theta}{dt} = \frac{L c^2}{E} \left(\frac{1 + \epsilon \cos x\theta}{\alpha^2} \right)^2 \left(1 - \frac{r_0}{\alpha} \left(1 + \epsilon \cos x\theta \right) \right) \quad -(10)$$



$$a = \frac{\alpha}{1 - \epsilon^2}, \quad b = \frac{\alpha}{(1 - \epsilon^2)^{1/2}} \quad -(11)$$

3) Presumably, α and ϵ can be found experimentally from measurements of a and b. The quantity x can be measured from the precession of the perihelion, and the quantity:

$$y = \frac{Lc^2}{E} \quad -(12)$$

is a constant of motion. Here:

$$r_0 = \frac{2MG}{c^2} \quad -(13)$$

So measurements of $d\theta/dt$ all around the orbit should follow function (10).

In the Newtonian limit:

$$E \rightarrow mc^2 \quad -(14)$$

$$L \rightarrow mr^2\omega \quad -(15)$$

because:

$$\frac{dt}{d\tau} \rightarrow 1, \quad -(16)$$

and

$$m(r) \rightarrow 1. \quad -(17)$$

So

$$y \rightarrow \omega r^2, \quad -(18)$$

$$\alpha \rightarrow r. \quad -(19)$$

This limit can only be reached if:

$$r \rightarrow \infty \quad -(20)$$

and there is no orbit.