190(8): Relativistic Dynamics of the Whirlpool Galaxy.

The characteristics of the whirlpool galaxy are the velocity curve (Fig (1)) and large pitch logarithmic spirals (Fig (2)).

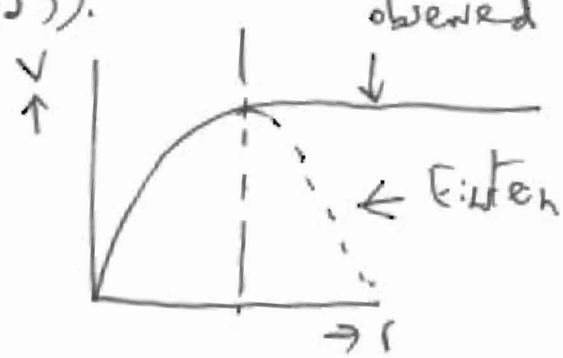

Fig (1)

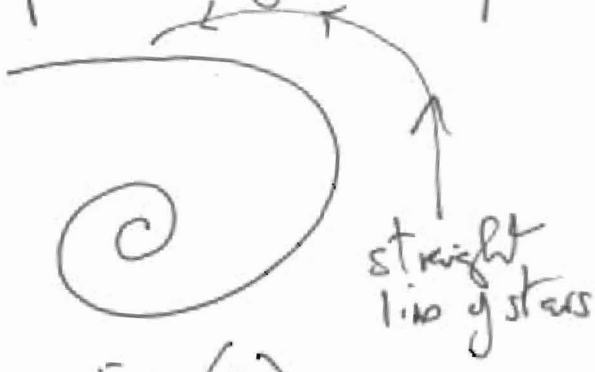

Fig (2)

The logarithmic spiral is defined by:

$$r = r_0 \exp(\alpha\theta) \quad -(1)$$

so

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

where α is the pitch. As α becomes very large the spiral becomes a straight line. This is observed in Hubble telescope photographs.

From previous work:

$$\frac{dr}{d\theta} = r^2\left(\frac{1}{b^2} - m(r)\left(\frac{1}{a^2} + \frac{1}{r^2}\right)\right)^{1/2} \quad -(3)$$

and

$$\frac{d\theta}{dt} = \frac{cb\,m(r)}{r^2} \quad -(4)$$

so the velocity of a star in the galaxy is:

2)

$$v = \frac{dr}{dt} = \frac{dr}{d\theta}\frac{d\theta}{dt} \quad -(5)$$

i.e.

$$\boxed{v = cbm(r)\left(\frac{1}{b^2} - m(r)\left(\frac{1}{a^2} + \frac{1}{r^2}\right)\right)^{1/2}} \quad -(6)$$

For a logarithmic spiral, eqs. (2) and (3) give:

$$\left(\frac{1}{b^2} - m(r)\left(\frac{1}{a^2} + \frac{1}{r^2}\right)\right)^{1/2} = \frac{\alpha}{r} \quad -(7)$$

so

$$v = cbm(r)\frac{\alpha}{r}$$

i.e.

$$\boxed{v = \frac{cb\alpha}{r}\left(\frac{r^2}{b^2} - \alpha^2\right)\left(\frac{a^2}{r^2 + a^2}\right)} \quad -(8)$$

Astronomical data show that as:

$$\boxed{r \rightarrow \infty, \quad v \rightarrow v_\infty = \text{constant}} \quad -(9)$$

From eq. (8):

$$v = cb\alpha\left(\frac{r}{b^2} - \frac{\alpha^2}{r}\right)\left(\frac{a^2}{r^2 + a^2}\right) \quad -(10)$$

i.e

$$v = \frac{ca^2}{b} \alpha \left(\frac{r}{r^2 + a^2} \right) - \frac{cb\alpha^3}{r} \left(\frac{a^2}{r^2 + a^2} \right) \quad -(11)$$

with

$$r = r_0 \exp(\alpha \theta) \quad -(12)$$

In the limit $r \to \infty$, $\theta \to \infty$. From eq. (11):

$$\lim_{r \to \infty} \frac{a^2}{r^2 + a^2} \to 0 \quad -(13)$$

so

$$v \longrightarrow v_\infty = \frac{ca^2}{b} \alpha \left(\frac{r}{r^2 + a^2} \right). \quad -(14)$$

$$\lim_{r \to \infty} \frac{r}{r^2 + a^2} = \lim_{r \to \infty} \frac{1}{r} \left(1 + \frac{a^2}{r^2} \right)^{-1}$$

$$\to \frac{1}{r} \quad -(15)$$

So

$$\boxed{v_\infty = \frac{ca^2}{b} \left(\frac{\alpha}{r} \right) = \text{constant}} \quad -(16)$$

as observed in Fig (1).

The whirlpool galaxy is described precisely by a spherically symmetric spacetime with constant angular momentum L due to spacetime torsion.

The Einstein claim fails completely as can be seen by using $n = 1 - \frac{r_0}{r}$ $\quad -(17)$ in eq. (6).