358(4): Gravitational Field from a Constant Spacetime Angular Momentum.

Consider the spacetime or aether angular momentum:

$$\underline{L}_F = m\,\underline{r}_F \times \underline{v}_F \quad -(1)$$

where m is the mass of a material object and $\underline{r}_F$ and $\underline{v}_F$ refer to fluid spacetime. Here $\underline{v}_F$ is the velocity field of the fluid spacetime and $\underline{r}_F$ a position vector of fluid spacetime. If a planar orbit is considered, $\underline{r}_F$ is the vector along the radius of the planar orbit.

Multiply both sides of eq. (1) by $\underline{r}_F \times$:

$$\underline{r}_F \times \underline{L}_F = \underline{m}\,\underline{r}_F \times (\underline{r}_F \times \underline{v}_F) \quad -(2)$$

$$= m\left(\underline{r}_F(\underline{r}_F \cdot \underline{v}_F) - \underline{v}_F(\underline{r}_F \cdot \underline{r}_F)\right)$$

The orbital velocity $\underline{v}_F$ is $\perp$ $\underline{r}_F$, so:

$$\underline{r}_F \cdot \underline{v}_F = 0 \quad -(3)$$

It follows that the velocity field of a spacetime with constant angular momentum $\underline{L}_F$ is:

$$\boxed{\underline{v}_F = \frac{1}{m r_F^2}\,\underline{L}_F \times \underline{r}_F} \quad -(4)$$

Now align $\underline{L}_F$ in the $\underline{k}$ axis:

$$\underline{L}_F = L_{FZ}\,\underline{k} \quad -(5)$$

so:

$$\underline{v}_F = \frac{1}{m r_F^2} \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ 0 & 0 & L_{FZ} \\ r_{FX} & r_{FY} & 0 \end{vmatrix}$$

$$= \frac{1}{m r_F^2} \left(-L_{FZ} r_{FY} \underline{i} + L_{FZ} r_{FX} \underline{j} \right)$$

$$= \frac{L_{FZ}}{m r_F^2} \left(-Y \underline{i} + X \underline{j} \right) \quad -(6)$$

$(\underline{\Omega})$

The material gravitomagnetic field generated by the spacetime velocity field $\underline{v}_F$ is the material vorticity:

$$\underline{\Omega}(\text{material}) = \underline{w}(\text{material})$$

$$= \underline{\nabla} \times \underline{v}_F$$

$$= \frac{L_{FZ}}{m r_F^2} \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ \partial/\partial X & \partial/\partial Y & 0 \\ -Y & X & 0 \end{vmatrix} \quad -(7)$$

$$= \frac{2 L_{FZ}}{m r_F^2} \underline{k} = \frac{2}{m r_F^2} \underline{L}_F$$

The material's gravitomagnetic field is directly proportional to the spacetime angular momentum.

The material's gravitational field is:

$$\underline{g}(\text{material}) = \left(\underline{v}_F \cdot \underline{\nabla} \right) \underline{v}_F \quad -(8)$$

) Here:

$$\underline{v}_F \cdot \underline{\nabla} = \frac{L_{FZ}}{m r_F^2}\left(-Y\underline{i} + X\underline{j}\right)\cdot\left(\frac{\partial}{\partial X}\underline{i} + \frac{\partial}{\partial Y}\underline{j} + \frac{\partial}{\partial Z}\underline{k}\right)$$

$$= \frac{L_{FZ}}{m r_F^2}\left(-Y\frac{\partial}{\partial X} + X\frac{\partial}{\partial Y}\right) \quad -(9)$$

So:

$$\underline{g}\,(\text{matter}) = \frac{L_{FZ}^2}{m^2 r_F^4}\left(-Y\frac{\partial}{\partial X} + X\frac{\partial}{\partial Y}\right)\left(-Y\underline{i} + X\underline{j}\right)$$

$$= \frac{L_{FZ}^2}{m^2 r_F^4}\left(\left(Y\frac{\partial Y}{\partial X} - X\right)\underline{i} + \left(X\frac{\partial X}{\partial Y} - Y\right)\underline{j}\right). \quad -(10)$$

Now assume that:

$$\frac{\partial Y}{\partial X} = \frac{\partial X}{\partial Y} = 0. \quad -(11)$$

It follows that:

$$\underline{g}\,(\text{matter}) = -\frac{L_{FZ}^2}{m^2 r_F^4}\,\underline{r} \quad -(12)$$

where

$$\underline{r}_F = X\underline{i} + Y\underline{j} \quad -(13)$$

Finally use:

$$\underline{r}_F = r_F\,\underline{e}_r \quad -(14)$$

where $\underline{e}_r$ is the radial unit vector.

It follows that:

$$\boxed{\underline{g}\,(\text{matter}) = -\frac{L_{FZ}^{2}}{m^{2} r_F^{3}}\, \underline{e}_r} \quad -(15)$$

This is an inverse cubed dependence which gives the orbit of a whirlpool galaxy.

The whirlpool galaxy is therefore due to a fluid spacetime with constant angular momentum