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GRAVITOMAGNETIC ACELERATION OF THE UNIVERSE

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According to Hubble's law V=H×R the dark energy produce an acceleration a=R×H^2. We use the approximation of the universe as a Minkowski flat spacetime and equations similar to those of Maxwell (GEM formalism) to calculate a lower bound to the gravitomagnetic acceleration that whole universe produce over one galaxy located at cosmological distance Z of the Milky Way. As result we find that gravitomagnetic acceleration a= 0.27×Z×H^2 which implies, it can explain at least 27 percent of the dark energy effect.

At the weak field limit of gravity it can be modeled with equations such as those of Maxwell (Gravitoelectromagnetism GEM) (Wald 1984) that is what we want to exploit in this work and to find a component of the gravitomagnetic field of the universe that can produce the observed acceleration.

It is expected that as the universe expands with radial velocity, we could partition the volume into tubes (per unit of solid angle) thus identifying parallel mass currents, which repel each other because of the gravitomagnetic component. having quasi-parallel velocities, accelerating radially.

As you can see in Figure 1, we can use azimuthal symmetry to a volume element placed on the Z axis to calculate the force of the universe on a test mass. We were able to find a component that does not cancel out the gravitomagnetic interaction and proceed to calculate the acceleration it produces, as shown in Figure 1.

With this approximation we obtain a lower bound to the value of the gravitomagnetic acceleration assuming that the density of the universe is constant and equal to the present density of the universe.

If the gravitomagnetic acceleration of the universe accounts for 23 percent of the observed acceleration of the universe, it means that we must rethink the cosmological models to consider their effects on the evolution of the universe.

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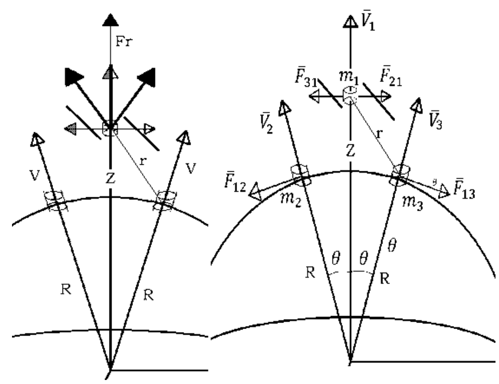

Fig. 1. A. Galaxies that we see moving away with radial and near-parallel velocities repel each other due to the gravitomagnetic interaction. B. Magnetic forces diagram.

$$|\bar{B}_{13}| = \frac{\mu_g I|\delta\bar{l} \times \hat{r}|}{4\pi r^2} = \frac{\mu_g}{4\pi r^2} m_1 V_1 \frac{(Rsen\theta)}{r}$$

$$\partial F_{13} sen\theta = (\partial m_3)|\bar{V}_3 \times \bar{B}_{13}| sen\theta$$

$$da_1 = \frac{dF_{13} sen\theta}{m_z} = V_Z V_m \frac{\mu_g}{4\pi r^3}(Rsen^2\,\theta)\cdot dm$$

$$|a_{\hat{k}}| = \frac{V_Z \mu_g}{4\pi}\int_v \frac{V_m Rsen^2\theta}{r^3}\rho\, dv$$

$$|a_{\hat{k}}| = \frac{\mu_g H^2 Z}{4\pi}\int_0^{\pi}\int_0^{\pi}\int_0^{R_{max}} \frac{sen^3\theta}{r^3}\rho R^4 d\varphi\, d\theta\, dR$$

$$|a_{\hat{k}}| = \frac{\mu_g H^2 Z}{4}\int_0^{Z}\left[\frac{8}{6}\frac{R^4}{Z^3} + \frac{R^2}{2Z} - \frac{R^3}{2Z^2}\right]\rho dR$$

$$+\frac{\mu_g H^2 Z}{4}\int_Z^{R_{max}}\left[\frac{8}{6}R\right]\rho dR$$

$$|a_{\hat{k}}| \approx \frac{\mu_g H^2 Z\rho}{4}\left[\frac{2}{3}R_{max}^2 - \frac{1.075}{3}Z^2\right] \approx (0.23)H^2 Z$$

REFERENCES

Wald, R.1984, General Relativity,The University of Chicago Press