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An Expected Revolution of the Galaxy Around the Expansion Center

L. Lorenzi *

Former Astronomer at the Astronomical Observatory of Torino, Italy

Abstract. After accepting, within the expansion center model (ECM), only the radial acceleration formula for an escaping splinter-galaxy, a fac-simile Hubble law for the Galaxy revolution is derived. Hence, by another simulation, an angular velocity formula and its finite difference at the observed distance r follow, expecting to be confirmed by observation. In conclusion two components of the matter density are presented, as responsible for a decelerated rotating Universe running away from the expansion center.

Key words. Cosmology

1. A fac-simile Hubble law for the Galaxy cosmic revolution

In the context of the expansion center model (ECM), the study of the G variation (Lorenzi, 2002), based on the Galaxy radial deceleration, in *c.g.s.* units,

$$\ddot{R} = -2H^2 R = -\frac{4}{3}\pi\rho G R + R\dot{\theta}^2 \quad (1)$$

after the introduction of the formulae $H = H_0 \cdot t_0/t$ and $\rho = \rho_0 \cdot t_0/t$, leads to

$$G(t) = \frac{3H_0^2}{2\pi\rho_0}\left(\frac{t_0}{t} + \frac{\dot{\theta}^2}{2H_0^2}\frac{t}{t_0}\right) \quad (2)$$

which, after deriving with respect to time, becomes

$$\dot{G}(t) = \frac{3H_0^2}{2\pi\rho_0}\left(-\frac{t_0}{t^2} + \frac{\dot{\theta}^2}{2H_0^2 t_0} + \frac{\dot{\theta}\ddot{\theta}}{H_0^2}\frac{t}{t_0}\right) \quad (3)$$

The ratio $\dot{G}/G$, applied to the Galaxy at our epoch $t = t_0$, gives the angular velocity equation

$$\dot{\theta}_0^2 = 2H_0^2\left(\frac{1+\varepsilon_0}{1-\varepsilon_0}\right) - \frac{2\dot{\theta}_0\ddot{\theta}_0\, t_0}{1-\varepsilon_0} \quad (4)$$

whose solution may be written as

$$\dot{\theta}_0 = y_0 H_0 \quad (5)$$

and

$$\ddot{\theta}_0 = \frac{\xi_0}{y_0}\frac{\dot{\theta}_0}{t_0} \quad (6)$$

with

$$\xi_0 = y_0^{-1}(1+\varepsilon_0) - 0.5 y_0 (1-\varepsilon_0) \quad (7)$$

Send offprint requests to: L. Lorenzi

* Poster at http://sait.oat.ts.astro.it/MSAIS/3/POST/Lorenzi_poster.pdf

Correspondence to: via Beccaria 21, 12084 Mondovì, Italy

$$\varepsilon_0 = \dot{G}_0 G_0^{-1} t_0 \tag{8}$$

The Galaxy angular de(ac)celeration (6) at our epoch t_0 (note both ξ_0 and y_0 are dimensionless) can be easily processed **in Hubble units** as follows:

$$\frac{d\dot{\theta}_{0_{(s^{-1})}}}{\dot{\theta}_{0_{(s^{-1})}}} = \frac{\xi_0}{y_0}\frac{dt}{t_0} \Rightarrow \frac{\delta\dot{\theta}_{0(H)}}{\dot{\theta}_{0(H)}} = -\frac{\xi_0}{y_0}\frac{3H_0}{c}\delta r \tag{9}$$

remembering

$$1 - \frac{3H_0 r}{c} \equiv \frac{t}{t_0} \Rightarrow \frac{dt}{t_0} = -\frac{3H_0}{c}\delta r \tag{10}$$

Then, from eq. (9) it is possible to get a fac-simile Hubble law for the angular de(ac)celeration of the Galaxy cosmic revolution around the expansion center.

In fact, after putting

$$W_0 = -3H_0\frac{\xi_0}{y_0} \tag{11}$$

we obtain

$$\left(\frac{\delta\dot{\theta}}{\delta r}\right)_0 = \frac{\dot{\theta}_0 W_0}{c} \tag{12}$$

where W and $\dot{\theta}$ take the place of H and R in the Galaxy Hubble law, respectively.

2. Galaxy angular velocity $\dot{\theta}_{MW}$ by another simulation

Working in the same way as the simulation carried out on the radial Galaxy Hubble law (Lorenzi,1995bc,1999a), always in Hubble units, after putting

$$\frac{\delta\dot{\theta}}{\delta r} = \frac{\dot{\theta}W}{c} \tag{13}$$

and

$$c\int_0^{\dot{\theta}_0} \delta\dot{\theta} =$$

$$= \dot{\theta}_0 \int_{-\frac{c}{W_0}}^{0} (W_0 + (\frac{\delta W}{\delta r})_0 \cdot r)(1 + \frac{W_0}{c}\cdot r)\cdot \delta r \tag{14}$$

with the assumption

$$\dot{\theta}_{MW} = \dot{\theta}_0 \rightarrow r = 0 \rightarrow t = t_0 \tag{15}$$

$$\dot{\theta}_{MW} = 0 \rightarrow r = -\frac{c}{W_0} \tag{16}$$

one obtains

$$\left(\frac{\delta W}{\delta r}\right)_{r=0} = \left(\frac{-3W^2}{c}\right)_{r=0} \tag{17}$$

from which it follows

$$W = W_0\left(1 + \frac{3W_0 r}{c}\right)^{-1} \tag{18}$$

that inserted in eq. (13), after the logarithmic reduction, gives finally

$$\dot{\theta} = \dot{\theta}_0 \left|1 + \frac{3W_0 r}{c}\right|^{\frac{1}{3}} \tag{19}$$

as the angular velocity formula of the Galaxy revolution.

3. An expected $\Delta\dot{\theta}_{MW}$ from observations

As it is plausible to imagine some angular de(ac)celeration ($\xi_0 \neq 0$) in the presence of some cosmic revolution ($y_0 \neq 0$), the expected variation of the Milky Way angular velocity, $\Delta\dot{\theta}_{MW} = \dot{\theta} - \dot{\theta}_0$, occured in the time measured by the observed light-space r, results to be

$$\Delta\dot{\theta}_{MW} = \dot{\theta}_0\left(\left|1 + \frac{3W_0 r}{c}\right|^{\frac{1}{3}} - 1\right) \tag{20}$$

that, at first order and at the observed distances r with $(1 + 3W_0 r/c) > 0$, gives the following simple formula (21), that must be confirmed by observation.

$$\Delta\dot{\theta}_{MW} \cong -\xi_0\frac{3H_0^2}{c}r = -\xi_0 K_0 r \tag{21}$$

4. A new density formula

After fixing the position (5), from eq. (1) the matter density at our epoch results to be

$$\rho_0 = \frac{3H_0^2(2+y_0^2)}{4\pi G_0} \qquad (22)$$

Being $\varepsilon_0 \simeq 0$ (Lorenzi, 2002), after accepting $\ddot{\theta} < 0$ (that is $\xi_0 < 0$), eq. (7) leads to

$$\varepsilon_0 \simeq 0 \quad \text{and} \quad \xi_0 < 0 \quad \Rightarrow \quad y_0 > \sqrt{2} \qquad (23)$$

Consequently eq. (22), if we put $y_0 \simeq 2$ as a first approximation, can be rewritten as the addition of two components, the following

$$\rho_0 = \rho_0' + \rho_0'' \simeq \frac{3H_0^2}{2\pi G_0} + \frac{3H_0^2}{\pi G_0} \qquad (24)$$

which, in terms of relative ratios, lead to

$$\frac{\rho_0'}{\rho_0} \simeq 0.3 \qquad \frac{\rho_0''}{\rho_0} \simeq 0.7 \qquad (25)$$

The numerical values in eq. (25) seem to agree with the results recently found for dark matter and dark energy (Bennett et al, 2003); however the ECM excludes dark energy. Consequently the results here proposed in (25) represent an alternative Universe dominated by dark matter, where a non canonical rotation (see parallel paper) finds its "reason d'etre" in the matter density component ρ_0''.

References

Lorenzi, L. 2003b, *The expansion center model as a challenge to cosmology, based on data, results, and 3 historical models*