SCHWARZSCHILD-DE SITTER AND MECHANICAL APPROACHES COMPARISON WITH RESPECT TO DARK MATTER HALOS

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ABSTRACT. We compare the Schwarzschild-de Sitter approach to deriving mass and potential distributions and corresponding parameters associated with dark matter halos for clusters of galaxies with the mechanical one, taking into account cosmological effects, in particular, dark energy influence.

Potential of pseudo-isothermal profile of the halo in two different metrics:

1. Schwarzschild –de Sitter

$$\Phi(R) = -\frac{8\pi G_N}{3}\rho_\Lambda\Big(\frac{R^2}{2} - R_\Lambda^2 + \frac{R_\Lambda^3}{R}\Big) +$$

$$+8\pi G_N \rho_c \frac{R_c^3}{R}\Big(\arctan\frac{R}{R_c} - \arctan\frac{R_\Lambda}{R_c}\Big) -$$

$$-8\pi G_N \rho_c R_c^2\Big(1 - \frac{R_\Lambda}{R}\Big) +$$

$$+4\pi G_N \rho_c R_c^2 \ln\frac{R^2 + R_c^2}{R_\Lambda^2 + R_c^2} - \frac{G_N m}{R_\Lambda}$$

2. Friedman

$$\Phi(R) = -\frac{\ddot{a}}{a}\Big(\frac{R^2}{2} - R_H^2 + \frac{R_H^3}{R}\Big) +$$

$$+8\pi G_N \rho_c \frac{R_c^3}{R}\Big(\arctan\frac{R}{R_c} - \arctan\frac{R_H}{R_c}\Big) -$$

$$-8\pi G_N \rho_c R_c^2\Big(1 - \frac{R_H}{R}\Big) +$$

$$+4\pi G_N \rho_c R_c^2 \ln\frac{R^2 + R_c^2}{R_H^2 + R_c^2} - \frac{G_N m}{R_H}$$

We found potentials, which give us an opportunity to consider motion of test massive bodies and light taking into account gravitational attraction to inhomogeneities and cosmological expansion of the Universe.

References

Eingorn M., Zhuk A.: 2012, *Hubble flows and gravitational potentials in observable Universe*. JCAP 09 (2012) 026, arXiv:1205.2384.