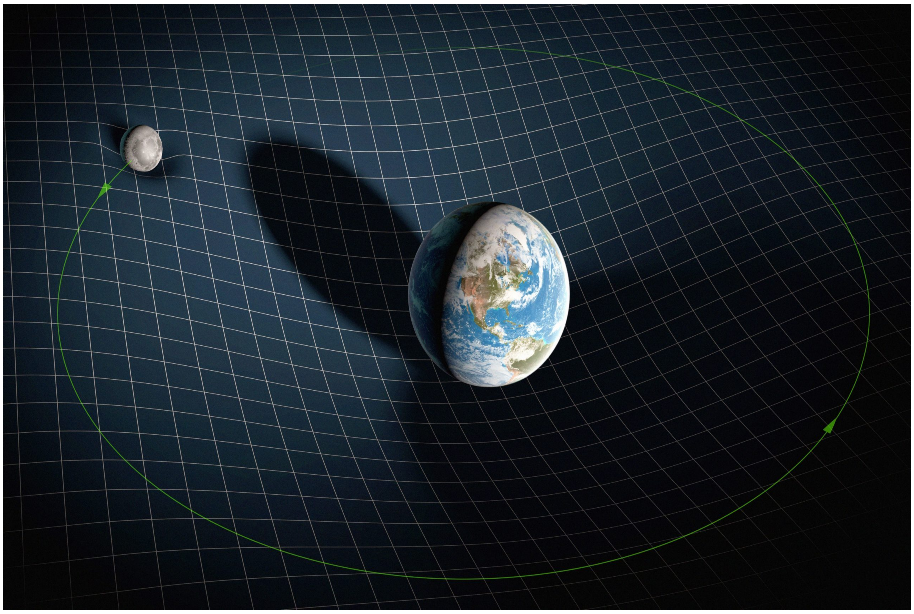
Faculty Of Sciences

Dynamical analysis of a dark-matter halo and galaxies in cosmological, hydrodynamical simulations.



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Contents

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Abstract

Keywords:

Chapter 1

Introduction

1.1 Cosmology

1.1.1 Cosmological parameters

$$1 + z = \frac{1}{a} \tag{1.1}$$

$$\Omega_m(z) = \frac{\Omega_{m,0}(1+z)^3}{\Omega_{m,0}(1+z)^3 + \Omega_{\Lambda,0}} \tag{1.2}$$

1.1.2 Unit system

$$kpc, M_\odot, Gyr \tag{1.3}$$

A general function can be expanded in spherical harmonics as

$$f(\mathbf{r}) = f(r,\theta,\phi) = \sum_{l=0}^{\infty}\sum_{m=-l}^{l} f_{lm}(r)Y_{lm}(\theta,\phi) \tag{1.4}$$

The coefficients are given by

$$f_{lm}(r) = \int Y^*_{lm}(\theta,\phi)f(r,\theta,\phi)d\Omega \tag{1.5}$$

where $d\Omega = \sin\theta d\theta d\phi$ is the solid angle element following the orthonormality relation of the spherical basis functions. For a fully spherically symmetric system, only the monopole term in the expansion survives, i.e. $l = 0, m = 0$.

For a discrete sampling of the underlying function, the above expression amounts to a summation over all particles in a shell of radius r_j.

$$f_{lm}(r_j) = \sum_i Y^*_{lm}(\theta_i,\phi_i)f(r_i,\theta_i,\phi_i) \tag{1.6}$$

For a discrete distribution of particles, with $\rho(\mathbf{r}_j) = \sum_i \delta(\mathbf{r}_j - \mathbf{r}_i)$, the coefficients can be expressed as

$$\rho_{lm}(r_j) = \int Y^*_{lm}(\theta,\phi)\rho(r_j,\theta,\phi)d\Omega \tag{1.7}$$

Chapter 2

Methodology

Chapter 3

Results and Discussion

Chapter 4

Conclusion

Appendix A

Appendix

A.0.1 Scripts

Bibliography