INVERSION METHOD APPLIED TO THE ROTATION CURVES OF GALAXIES

L. A. Márquez–Caicedo[1], F. D. Lora–Clavijo[1], and J. D. Sanabria–Gómez[1]

We used simulated annealing, Montecarlo and genetic algorithm methods for matching both numerical data of density and velocity profiles in some low surface brigthness galaxies with theoretical models of Boehmer–Harko, Navarro–Frenk–White and Pseudo Isothermal Profiles for galaxies with dark matter halos. We found that Navarro–Frenk–White model does not fit at all in contrast with the other two models which fit very well.

Inversion methods have been widely used in various branches of science including astrophysics (Charbonneau 1995, ApJS, 101, 309). In this work we have used three different parametric inversion methods (MonteCarlo, Genetic Algorithm and Simmulated Annealing) in order to determine the best fit of the observed data of the density and velocity profiles of a set of low surface brigthness galaxies (De Block et al. 2001, ApJ, 122, 2396) with three models of galaxies containing dark mattter. The parameters adjusted by the inversion methods were the central density and a characteristic distance in the Boehmer-Harko BH (Boehmer & Harko 2007, JCAP, 6, 25), Navarro–Frenk–White NFW (Navarro et al. 2007, ApJ, 490, 493) and Pseudo Isothermal Profile PI (Robles & Matos 2012, MNRAS, 422, 282).

The results obtained showed that the BH and PI Profile dark matter galaxies fit very well for both the density and the velocity profiles, in contrast the NFW model did not make good adjustments to the profiles in any analized galaxy.

[1] Escuela de Física, Universidad Industrial de Santander. Bucaramanga, Colombia (jsanabri@uis.edu.co).

BAO IN COSMOLOGICAL SIMULATIONS

Nataly Mateus Londoño[1] and Juan Carlos Muñoz-Cuartas[1]

According to ΛCDM paradigm, in the early universe the radiation and baryonic matter were coupled due to Thomson scattering. While, dark matter density fluctuations caused gravitational instabilities. These two competing forces caused baryonic acoustic oscillations (BAO) to appear. As the universe continued expanding and cooling, the formation of atoms led to the recombination epoch and decoupling. Afterwards, the oscillations were no longer subject to radiation pressure causing them to stop. Hence, an imprint in the distribution of matter must be present. The scale of this imprint is around $150Mpc$ and it is used as a standard ruler.

A way to study the clustering of matter distribution is through the power spectrum. It measures it through oscillation modes, i. e., a single mode includes all possible information about at a specific scale. Then, BAO can be found as an oscillation present at certain scales.

For a cosmological simulation, it is necessary to construct the density field for a point masses distribution. In the present work, the CIC window is used for such task. From this, it is possible to construct the power spectrum through a fast fourier transform. Several corrections as shot noise and aliasing have to be performed for the power spectrum calculation.

In this work, the power spectrum was calculated for the MDPL Multidark simulation, as well as, for different halo populations obtained from MDPL simulations, i.e., M >=1e11 $M_\odot$, 1e12 $M_\odot$ and 1e13 $M_\odot$. As a main result, we have shown the BAO signal estimated for the MDPL Multidark simulation. The power spectrum for different halo populations indicates that the tracer halo population affects the BAO signal. It is expected that the amplitude of the BAO increases with the scale of the population studied, although this has to be further quantified.

[1] Grupo de Física y Astrofísica Computacional, Instituto de Física, Universidad de Antioquia, Apartado Postal 1226, Medellín, Colombia (nataly.mateus@udea.edu.co).