UNIVERSIDAD DE ANTIOQUIA
FACULTAD DE CIENCIAS EXACTAS Y NATURALES
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THE PLACE OF THE MILKY WAY AND ANDROMEDA IN THE COSMIC WEB

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To all my family.

Abstract

Observaciones de la CMBR y algunos surveys muestran que en z=8 aproxidamente, los modos del campo de densidad de materia comienzan a entrar en régimen no lineal. Una de las características más interesantes de este régimen es el clustering debido al colapso gravitacional de las regiones sobredensas y la formación de estructuras jerarquicas a gran escala, en especial la estructura de red que se manifiesta tanto en simulaciones como en surveys (e.g. The Sloan Digital Sky Survey) y que presenta una alta anisotropia a escalas de Mpc pero tiende a ser isotrópica a escalas de Gpc. Ahora, esta alta anisotropía a escalas de Mpc permite definir un entorno para galaxias y clusters, donde según el esquema usado, se puede cuantificar de diferentes maneras; un esquema común constituye cuatro tipo de entornos: voids, filaments, sheets y knots, basados en la geometría local de la distribución de materia (e.g Hoffman Y. Metuki O. et. al., 2012, MNRAS, 425, 2069, Forero-Romero, J. E. Hoffman Y. et. al., 2009, MNRA, 396, 1815, Hahn O. Porciani C. et. al., 2007, MNRAS, 409, 355).

Reciente estudios han mostrado que la influencia del entorno en el cual están embedidos los halos de materia oscura tiene importantes implicaciones en las propiedades de formación de las galaxias. Siguiendo esta línea, se estudia la influencia del entorno en sistemas tipo grupo local (LG), definidos en este caso como sistemas de dos halos tipo Vía Láctea – Andrómeda (Andrómeda es la galaxia más cercana y junto con la Vía Láctea forman un sistema aproxidamente aislado.) que satisfacen propiedades de aislamiento, de distancia relativa, entre otras (ver Forero-Romero, J. E. Hoffman Y. et. al., 2009, MNRA, 396, 1815).

Los sistemas tipo LG son extraidos de catálogos de simulaciones cosmológicas de materia oscura; una de las simulaciones tiene condiciones iniciales completamente aleatorias y es suficientemente grande (250 Mpc/h) para ser usada en la construcción de distribuciones estadísticas necesarias, y tres simulaciones restringidas (Gottloeber et. al., 2010, arXiv:1005.2687) en las cuales las condiciones iniciales son escogidas específicamente para reproducir el universo local a z=0, que aunque con un volumen menor (64 Mpc/h), poseen sistemas tipo LG muy bien definidos. A partir de la muestra de LG de las simulaciones restringidas se propone un método para determinar una muestra análoga en simulaciones no restringidas partiendo de la forma local de la distribución de materia, después de esto se buscan correlaciones respecto al entorno en el que están embedidos los LG y posibles sesgos producidos en las historias de acreción.

Este estudio sugiere que el entorno más favorable para la formación de sistemas tipo LG son regiones dos dimensionales o sheets, para las cuales la distribución local de materia colapsa en una dirección y se expande en otras dos, mientras que no hay un sesgo aparente en las historias de acreción debido al método de construcción de la muestra LG en la simulación no restringida.

Acknowledgements

Estos son los agradecimientos.

Sinceramente,

Sebastian Bustamante

January 2013

Contents

List of Figures

List of Tables

Acronyms

LG Local Group

"Equipped with his five senses, man explores the universe around him and calls the adventure Science"

Edwin Hubble

CHAPTER

1

Introduction

"What is our place in the cosmos?" This is one of the more simple and transcendental question of the human beings, and powered by our innate curiosity has led to a current relatively understandable picture of our Universe. In fact, the astronomy and specifically the cosmology and large scale structure formation can be only considered as a scientific rigorous disciplines after the seventeenth century.

Almost in every scientific discipline a significant theoretical advance is accompanied of a technical improvement of its own instruments, it is for this reason that at the beginning of the seventeenth century Johannes Kepler could establish his three well-known empirical laws of the planetary movements based on the very precise data of astronomical bodies computed for Tycho Brahe. This event was very remarkable in the astronomy history due to was the first of many strikes against the well established anthropomorphic notion of the cosmos. Although the Kepler laws constituted the most crucial test to the Nicolaus Copernicus heliocentric model, it was only until 1685 when Isaac Newton formulated the law of universal gravitation (from which can be derived all the Kepler laws) when the astronomers could have a enough powerful tools to begin a depth and serious discussion about the real nature of our universe on scales bigger than the solar system, and thus inaugurating the *sciences of gravity* [2]

After the establishment of the universal gravitation, the next significative theoretical achievement in this area came in the centuries eighteenth and nineteenth with the development of classical mechanics, as the Hamiltonian and Lagrangian formalism, and powerful numerical tools. All this achievements impulse the study of key topics as the many body problem, allowing a depth understanding of the dynamic of complex gravitational system, as planetary system, star clusters, galaxies, etc.

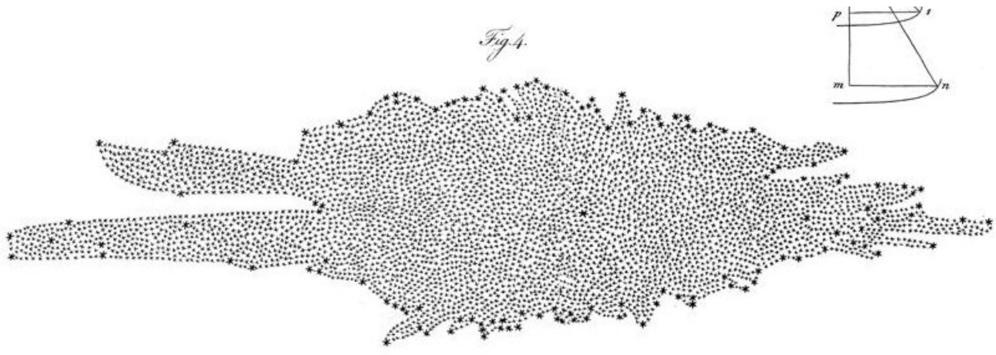

Figure 1.1: William Herschel's model of our galaxy based upon star counts and the equal luminosity assumption.[1]

1.1 The Current Cosmology Picture

1.1.1 First Stage of Our Universe

1.1.2 Nonlinear Epoch

1.1.3 Our Local Neighborhood, the Local Group

1.2 Numerical Simulations

1.2.1 N-body Simulations

1.2.2 The Cosmological Environment

1.2.3 Concordance with Real World

1.3 Cosmological Observations

1.3.1 COBE

1.3.2 WMAP

1.3.3 Planck

Personally, I think it does help, that it makes a beneficial difference, but the scientific literature on the subject is very messy.

Jeanne Petrek

CHAPTER

2

Theoretical Framework

2.1 Isotropic and Homogeneous Universe

2.1.1 General Relativity and Friedmann Equations

2.1.2 The Perfect Fluid Equations

2.1.3 Simple Solutions of the Universe

2.1.4 Cosmological Parameters

2.2 Nonlinear Evolution and Structure Formation

2.3 Quantification of Cosmological Environment

2.3.1 The T-web Method

2.3.2 The V-web Method

2.4 The Local Group

Historical methodology, as I see it, is a product of common sense applied to circumstances.

Samuel E. Morison

CHAPTER

3

N-Body Simulations and Environment Characterization

A brief introduction to N-body simulations bla

3.1 N-body Simulations Methods

3.1.1 Direct Sum

3.1.2 Tree Codes

3.1.3 Hidrodynamical and Dark Matter Simulations

3.2 Types of Simulations

3.2.1 Constrained Simulations (CLUES)

3.2.2 Unconstrained Simulations (Bolshoi)

3.3 Halos Detection and Sample Definitions

3.3.1 FOF Method

3.3.2 BDM Method

3.3.3 Sample of Pairs to Use

3.3.4 Pair Finder Method

3.4 Environment Characterization

3.4.1 The T-web Method

3.4.2 The V-web Method

Historical methodology, as I see it, is a product of common sense applied to circumstances.

Samuel E. Morison

CHAPTER

4

Results

A brief introduction to Results section

4.1 Statistical Properties of All Simulations

4.1.1 Environment Distributions

4.1.2 Halos Distributions

4.2 Properties of Sample Pairs

4.2.1 Statistical Properties of Pairs

4.2.2 Angular Momentum and Energy

4.2.3 Determination of their Host Environment

4.3 Correlations Between the Environment and Pairs Properties

4.4 Orientation of Pairs Angular Momentum

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[2] M. S. Longair. *Galaxy Formation*. Springer, New York, second edition, 2008. 1

Declaration

I herewith declare that I have produced this work without the prohibited assistance of third parties and without making use of aids other than those specified; notions taken over directly or indirectly from other sources have been identified as such. This work has not previously been presented in identical or similar form to any examination board.

The dissertation work was conducted from 20XX to 2013 under the supervision of Name Surname and Name Surname at the University of Deusto.

Bilbao,

This dissertation was finished writing in Medellín, Colombia on Wednesday 23 January, 2013

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