Grupo de
Física y Astrofísica
Computacional
Instituto de Física - Universidad de Antioquia

The Place of the Milky Way and Andromeda in the Cosmic Web

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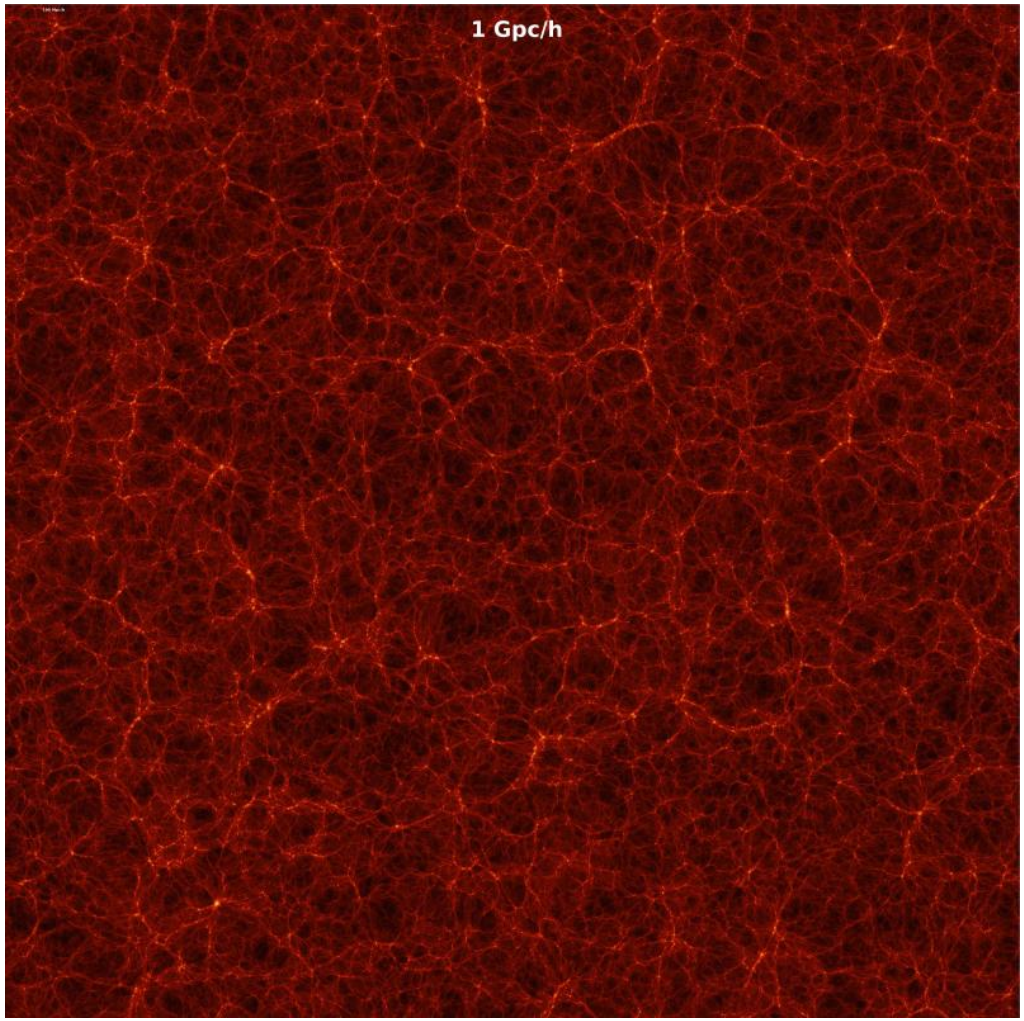
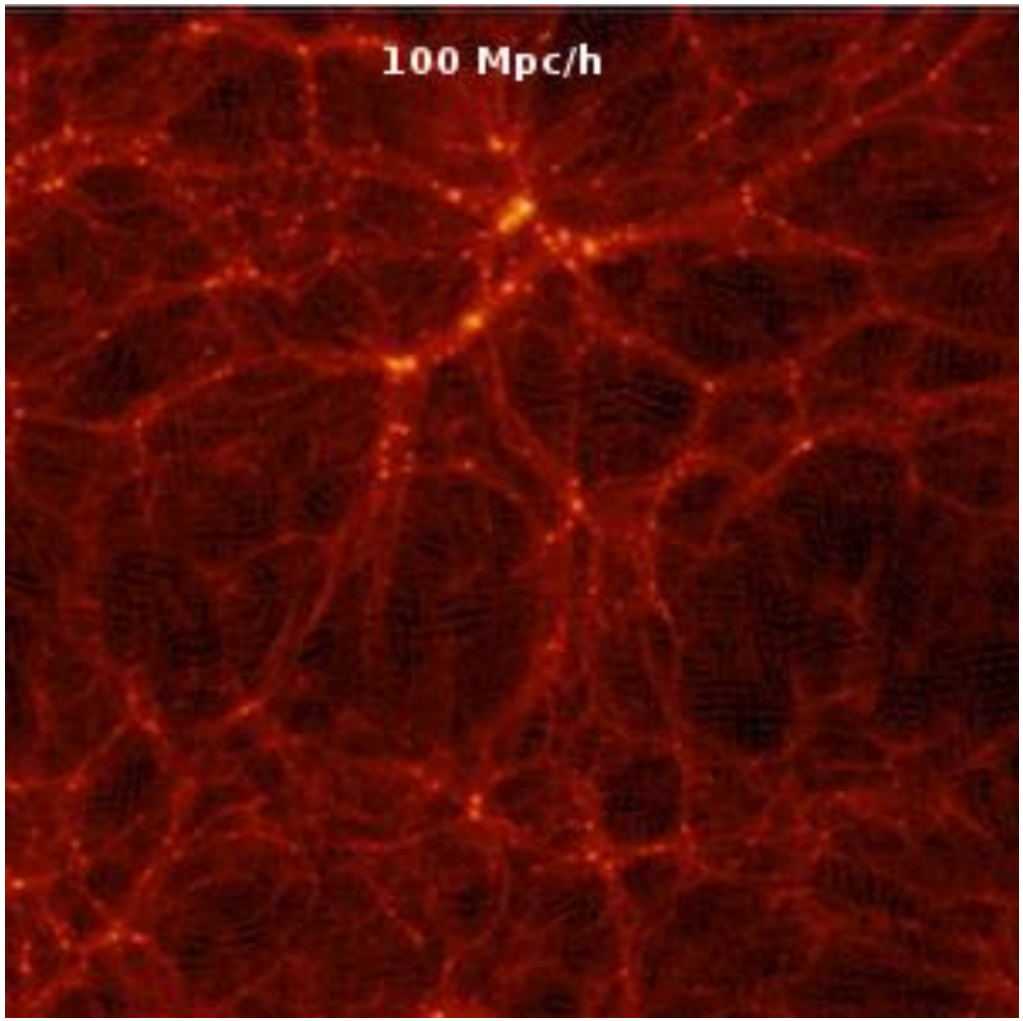
febrero de 20

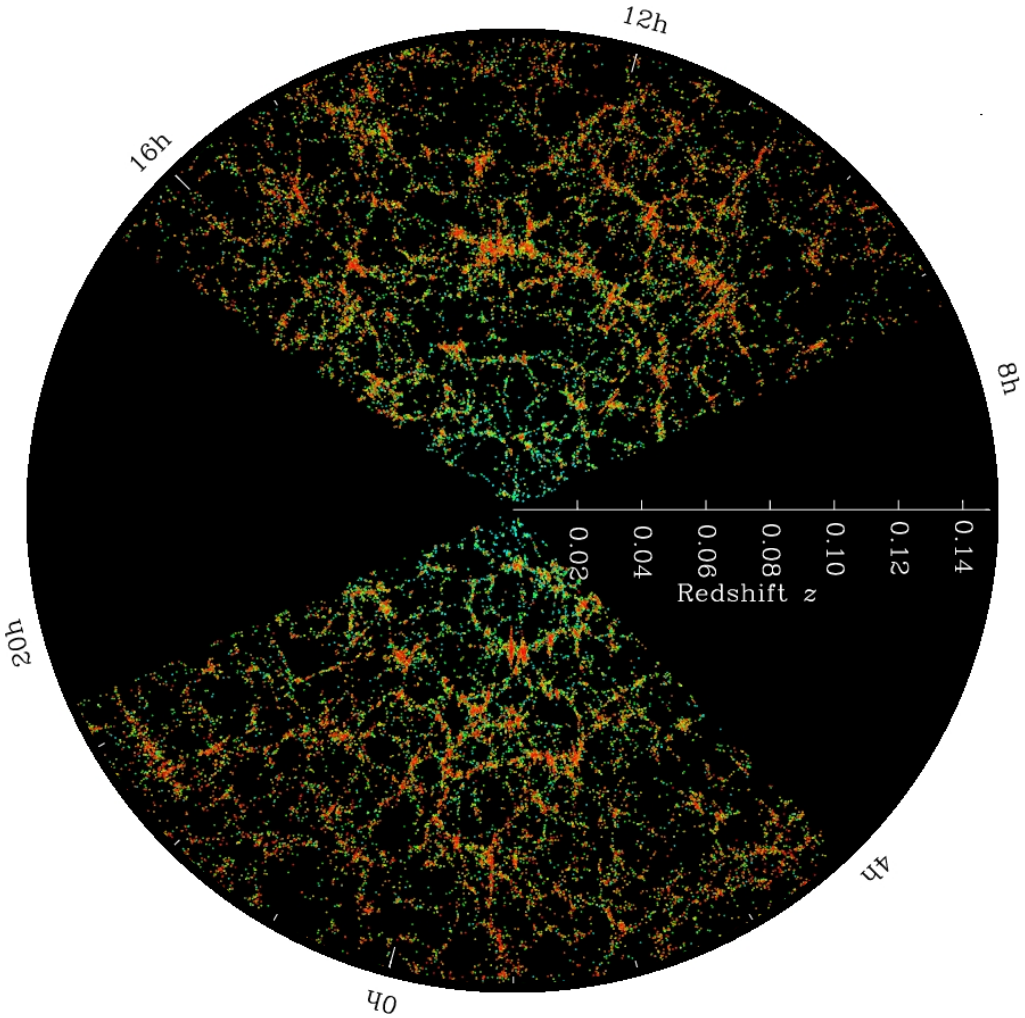
Cosmic Web



Cosmic Web



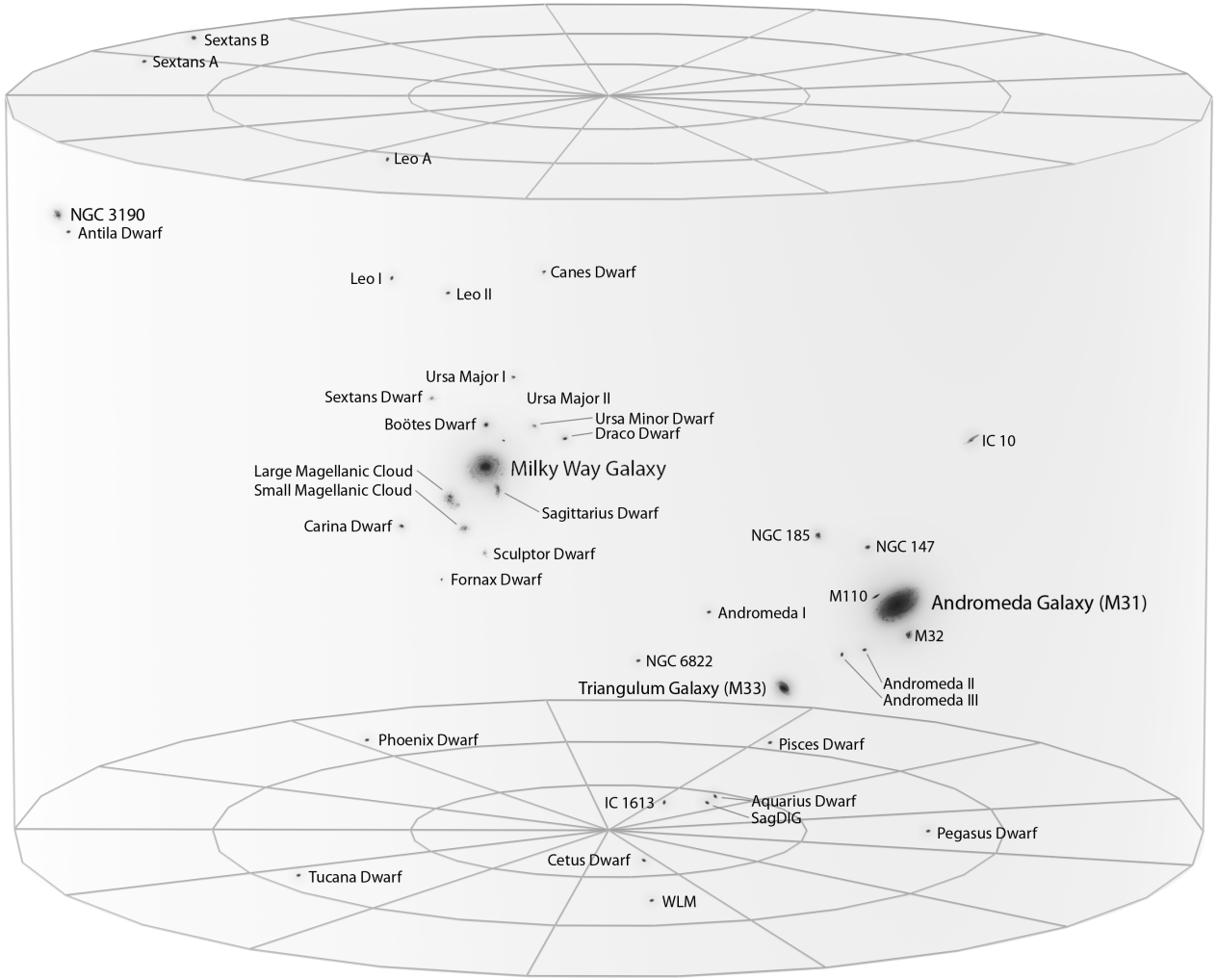
Observed Cosmic Web (SDSS)



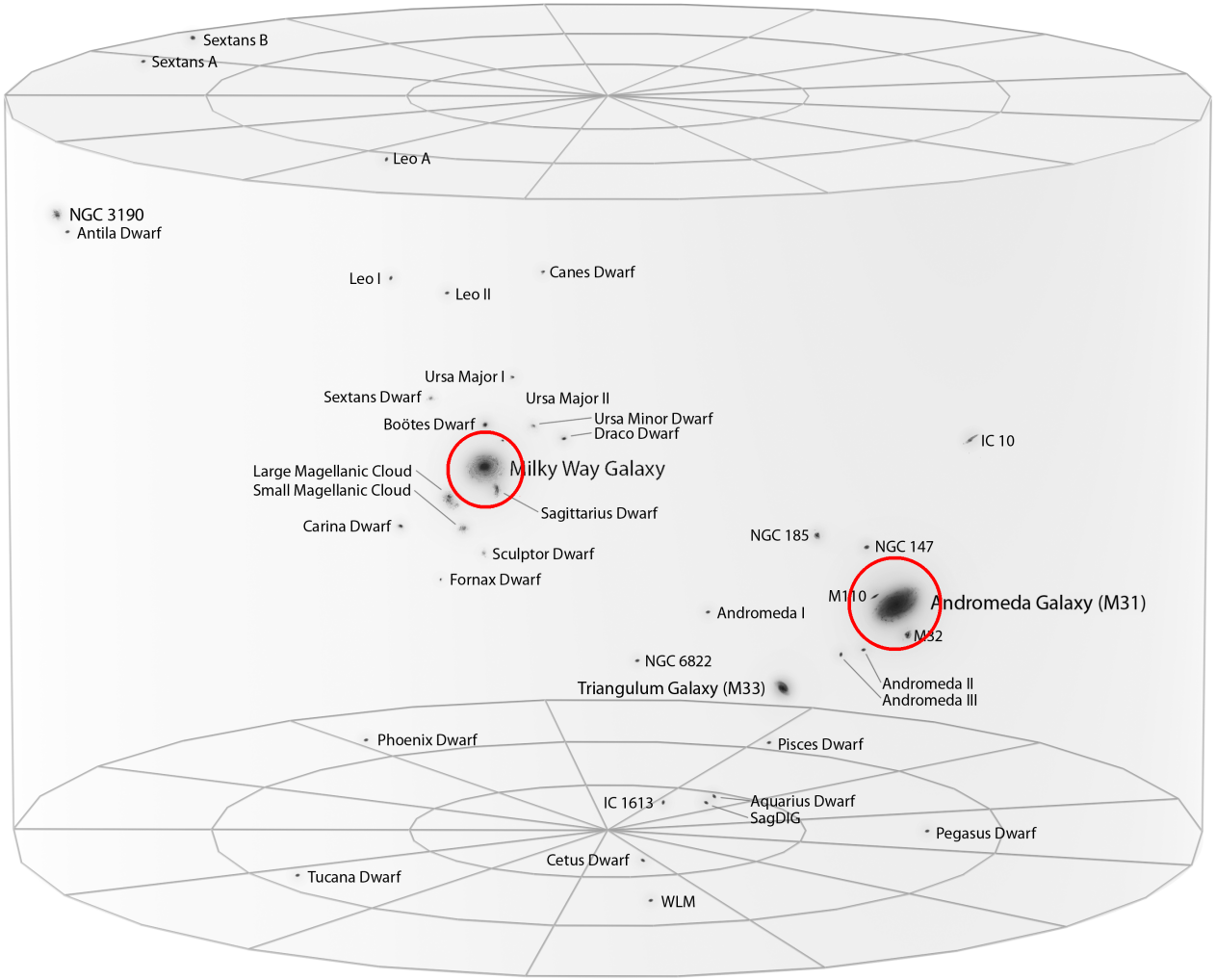
Motivation

1. Quantify the structure of the Cosmic Web.

Local Group


Sextans B
Sextans A
Leo A
NGC 3190
Antila Dwarf
Leo I
Canes Dwarf
Leo II
Ursa Major I
Sextans Dwarf
Ursa Major II
Ursa Minor Dwarf
Boötes Dwarf
Draco Dwarf
IC 10
Large Magellanic Cloud
Small Magellanic Cloud
Milky Way Galaxy
Sagittarius Dwarf
Carina Dwarf
NGC 185
NGC 147
Sculptor Dwarf
Fornax Dwarf
M110
Andromeda Galaxy (M31)
Andromeda I
M32
NGC 6822
Triangulum Galaxy (M33)
Andromeda II
Andromeda III
Phoenix Dwarf
Pisces Dwarf
IC 1613
Aquarius Dwarf
SagDIG
Pegasus Dwarf
Cetus Dwarf
Tucana Dwarf
WLM

Local Group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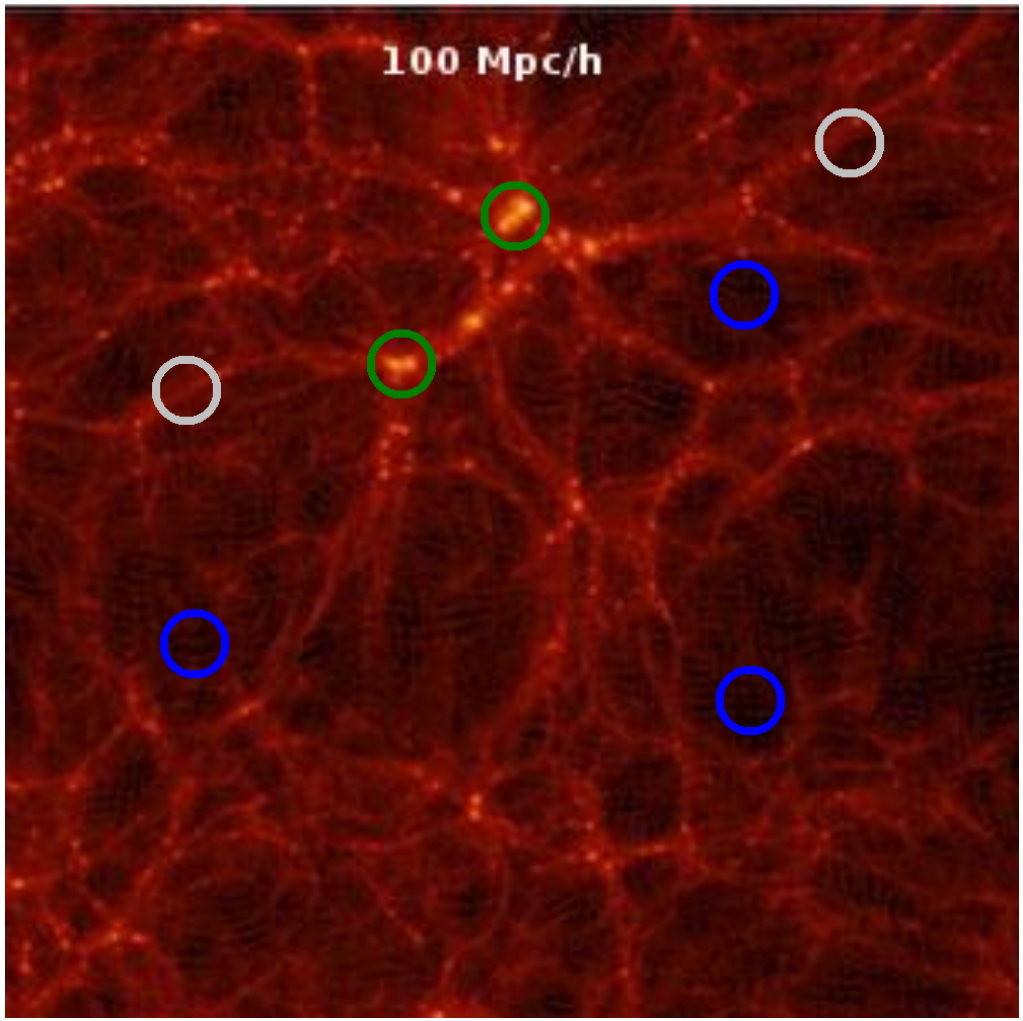
Motivation

1. Quantify the structure of the Cosmic Web.
2. Construct samples of LG-like systems in cosmological simulations.

Cosmic Web

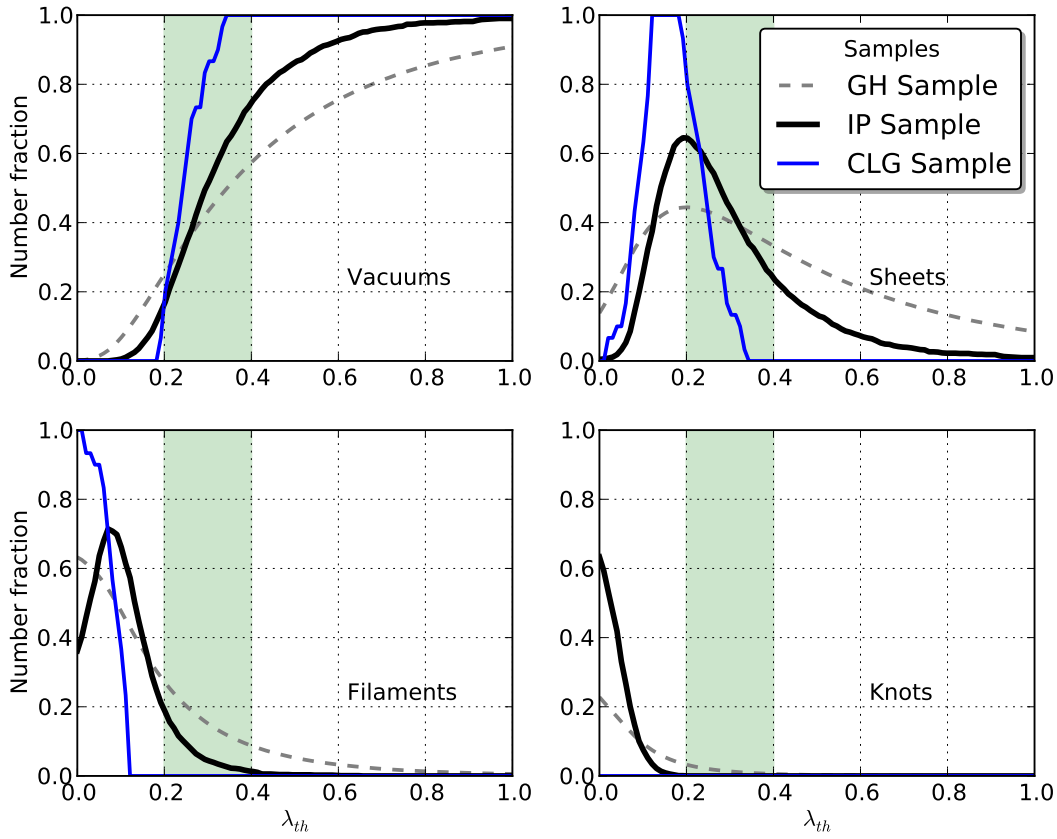


Motivation

1. Quantify the structure of the Cosmic Web.
2. Construct samples of LG-like systems in (unconstrained) cosmological simulations.
3. Find possible effects of the local environment on the physical properties of LG-like systems
4. What is the most likely host environment of LG-like systems?

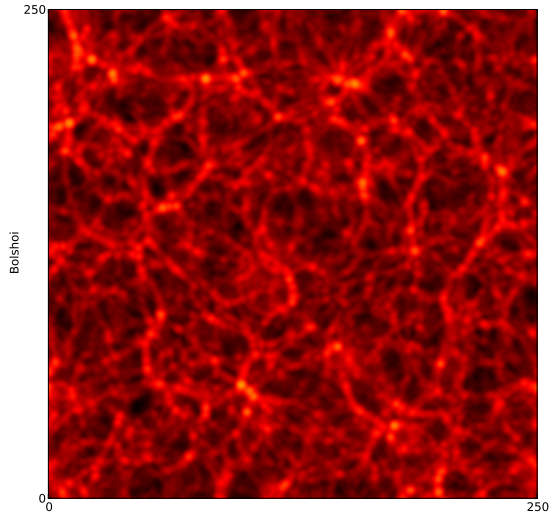
Preamble

LG-like systems lie preferentially in low density regions as vacuums and sheets.

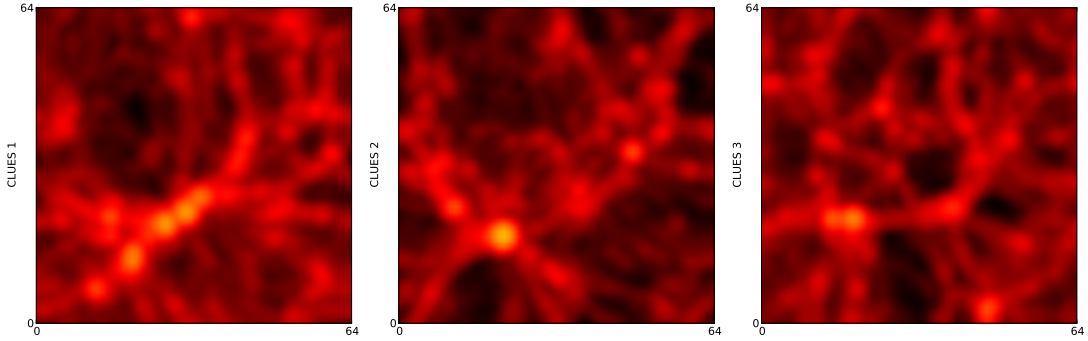


Simulations

- **Unconstrained Simulation (Bolshoi project)**
  - $250h^{-1}$Mpc
  - ΛCDM
  - WMAP7
  - 2048^3 particles
  - $1{,}35\times10^8 M_\odot/h$



- **Constrained Simulations (CLUES project)**
  - $64h^{-1}$Mpc
  - ΛCDM
  - WMAP7
  - 1024^3 particles
  - $1{,}83\times10^7 M_\odot/h$



Classification of the Cosmic Web

V-web Scheme

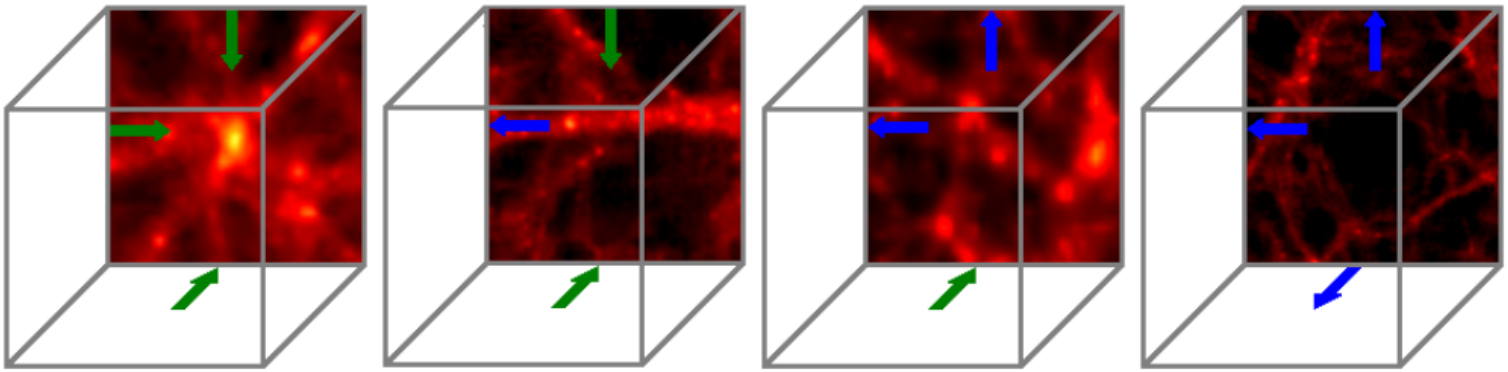
Dynamical classification scheme based on the shear velocity tensor (Hoffman et al. 2012)

$$\Sigma_{ij} = -\frac{1}{2H_0}\left(\frac{\partial v_i}{\partial r_j} + \frac{\partial v_j}{\partial r_i}\right) \tag{1}$$

This scheme is more adequate to classify the cosmic web at smaller cosmological scales ($\gtrsim 5h^{-1}$ Mpc) compared to schemes based on the density field.

Classification of the Cosmic Web

Significant improvement by introducing a threshold parameter λ_{th} (Forero-Romero et al. 2009).



knots	filaments	sheets	vacuums
$\lambda_1 > \lambda_{th}$	$\lambda_1 > \lambda_{th}$	$\lambda_1 > \lambda_{th}$	$\lambda_1 < \lambda_{th}$
$\lambda_2 > \lambda_{th}$	$\lambda_2 > \lambda_{th}$	$\lambda_2 < \lambda_{th}$	$\lambda_2 < \lambda_{th}$
$\lambda_3 > \lambda_{th}$	$\lambda_3 < \lambda_{th}$	$\lambda_3 < \lambda_{th}$	$\lambda_3 < \lambda_{th}$

And finally

Thank you!

Further information can be found in the next github repository
`https://github.com/sbustamante/Thesis`