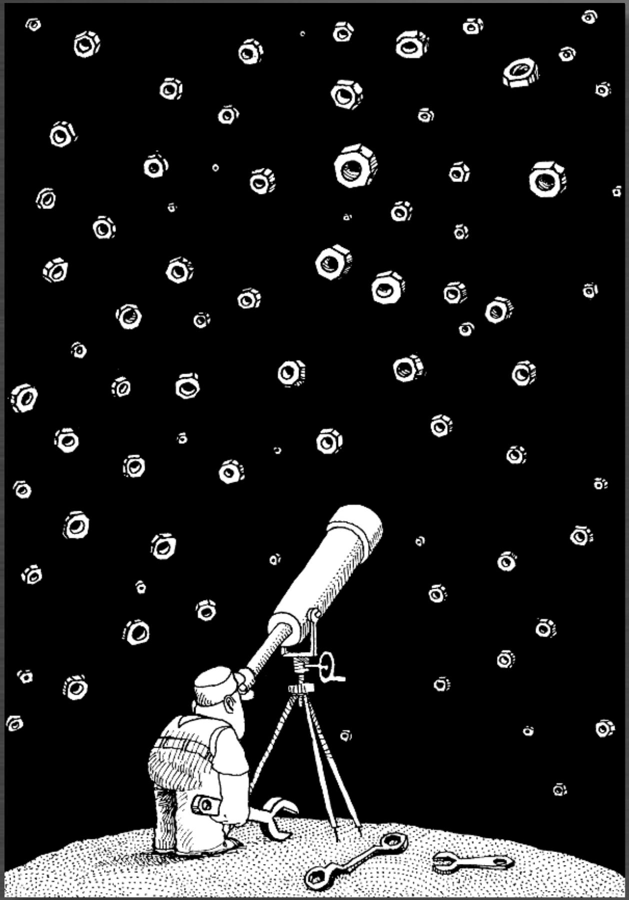
Halos and LSS
(this is not a suitable title!)

Projects that I'm involved in, and perhaps we can collaborate.
What I'm actually doing with the contributor's money?



Dante Paz
Instituto de Astronomía Teórica y Experimental
Observatorio Astronómico de Córdoba

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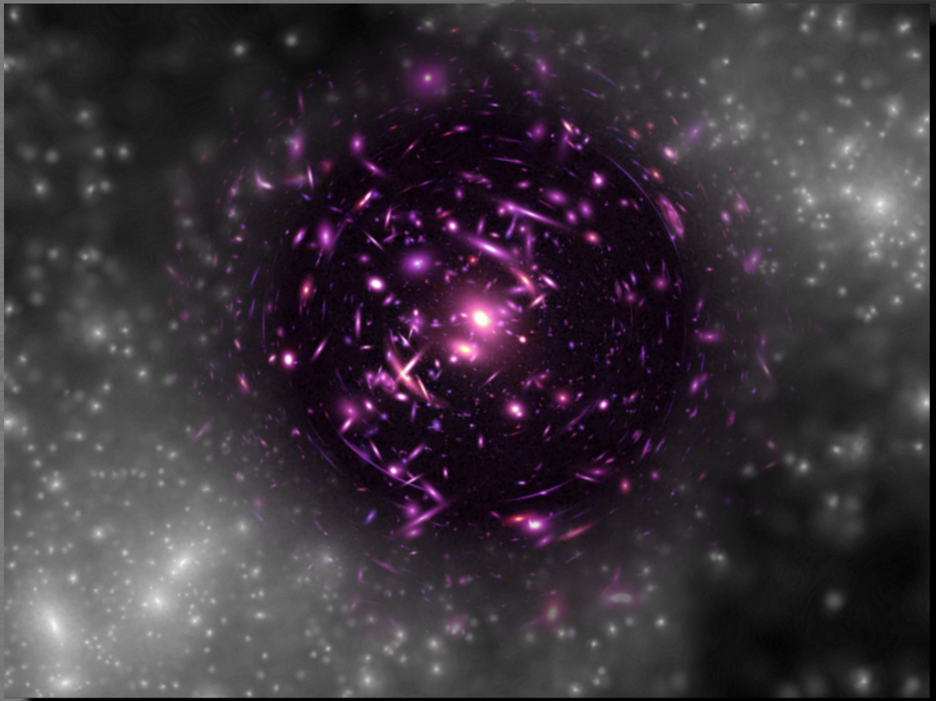

Anisotropy Halo Model

(this is the project lead by Mario, yesterday talk)

More massive halos have more elliptical and prolate shapes.

DM Halo Shapes are consistent with observed group shapes, up to some extend.

The halo shape mass relation follows a featureless power law.

(Jing y Suto 2002; Plionis et alter 2004; Paz, Padilla, Lambas & Merchan 2006).

Halos have shapes that are aligned with LSS,

the alignment “strength” follows also a featureless power law mass relation.

(Several papers, see for instance Paz, Sgró, Merchán & Padilla 2011)

Halo Angular momentum tend to be perpendicular to LSS.

Also, the alignment “strength” follows a featureless power law mass relation.

(Tidal Torque Theory, see for instance Paz, Stasyszyn & Padilla 2008)

Both alignments, are “naturally” characterized by the $\xi(r)$,

the alignment seems to be related with the Halo model of LSS.

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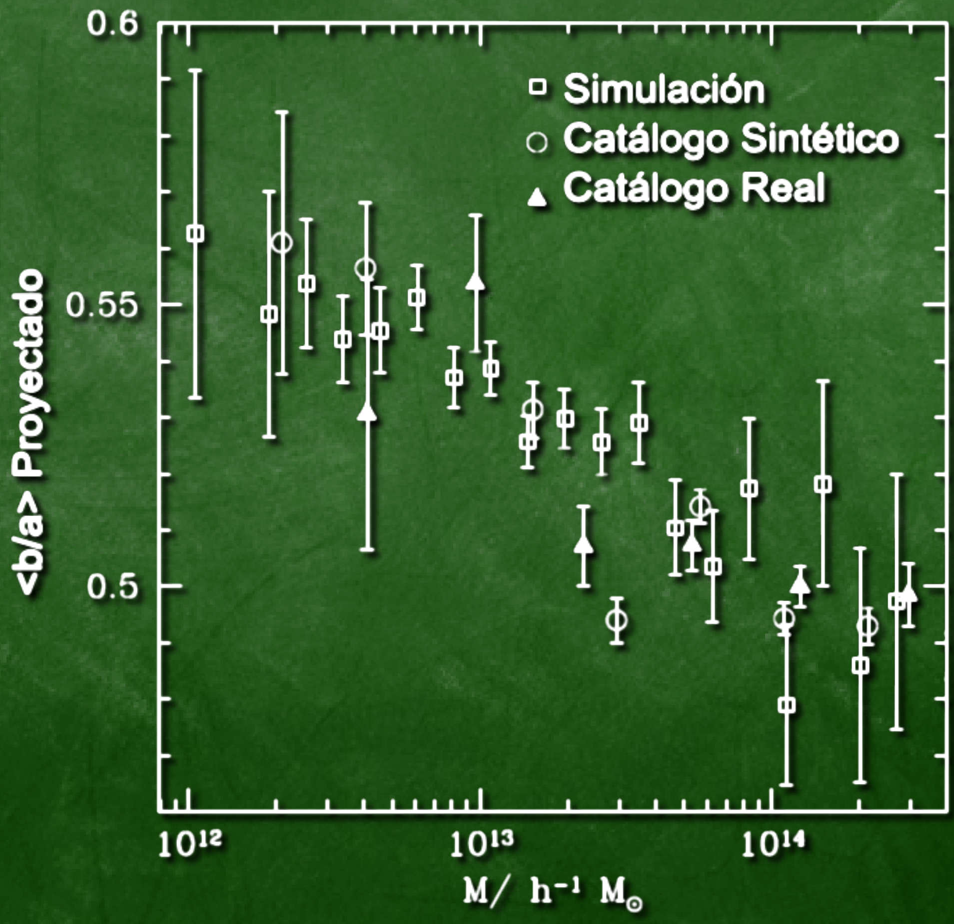

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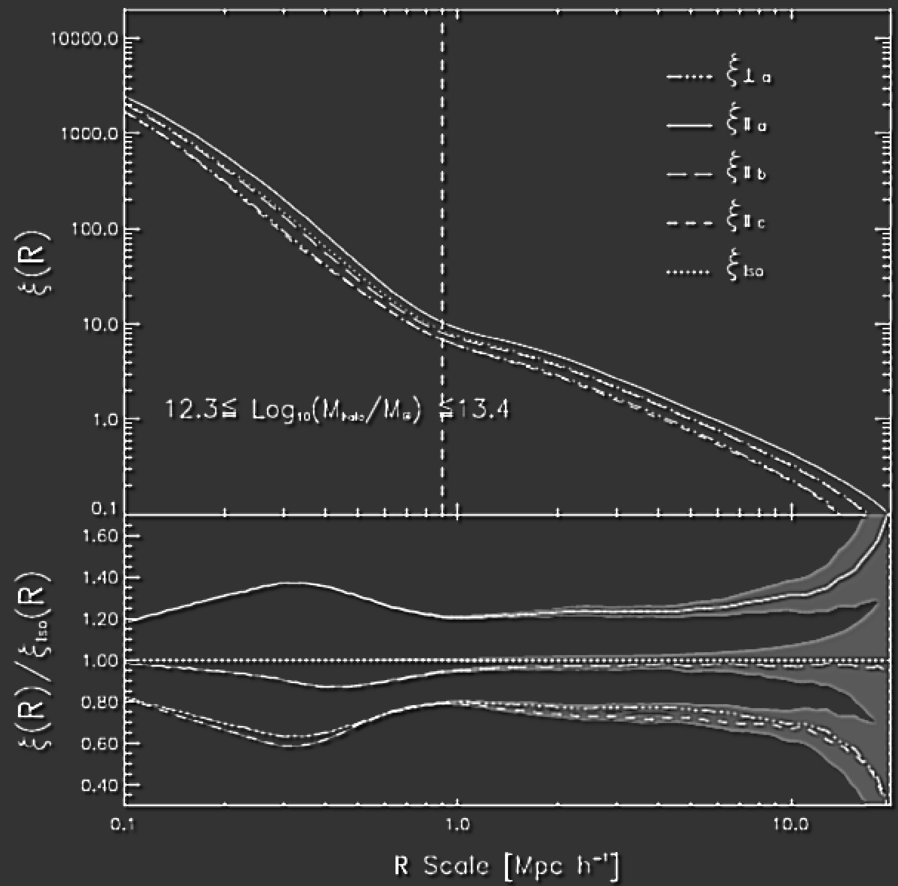
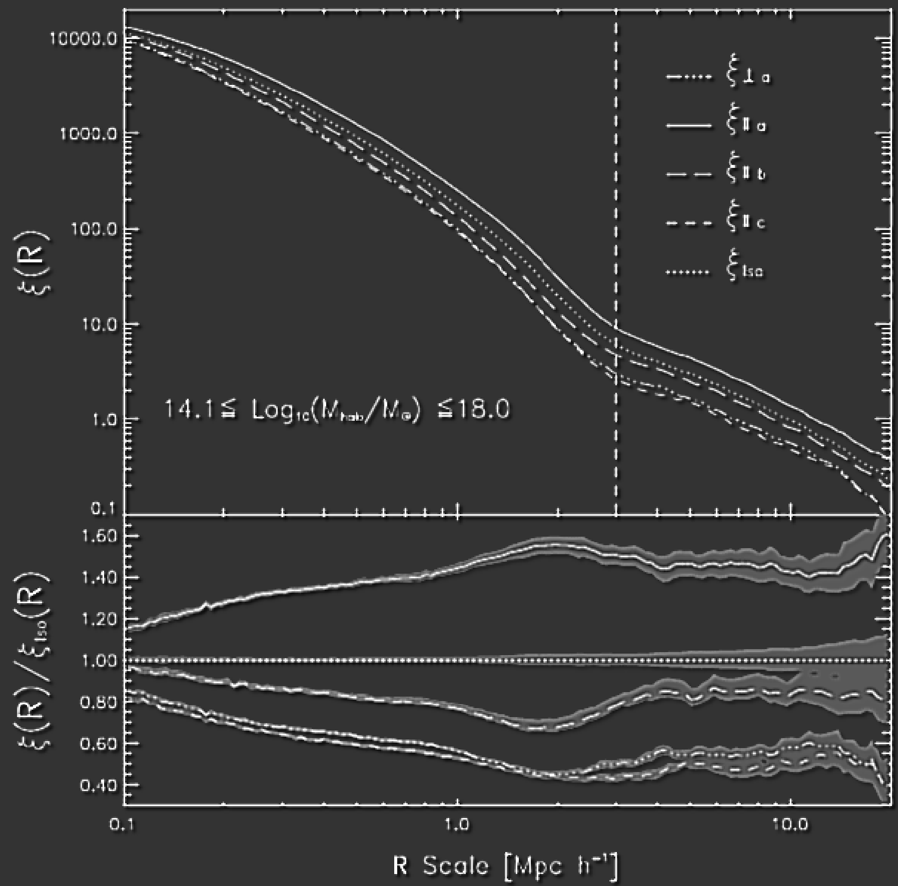
Función de Correlación · 3D



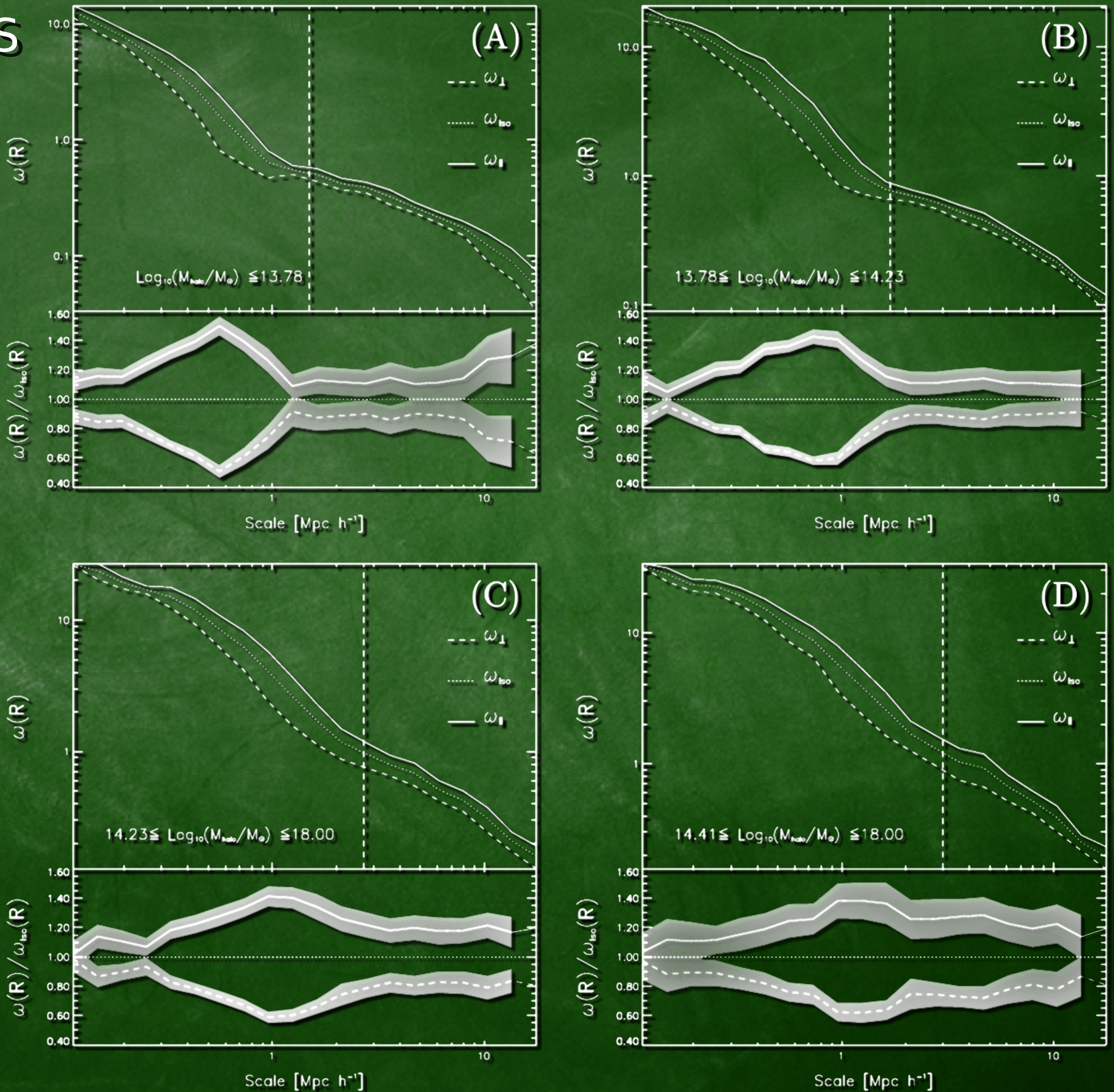


Paz, Stasyszyn & Padilla (MNRAS 2008)

Paz, Sgró, Merchán & Padilla (MNRAS in press)

OBSERVATIONS

SDSS,
MZ-GROUPS



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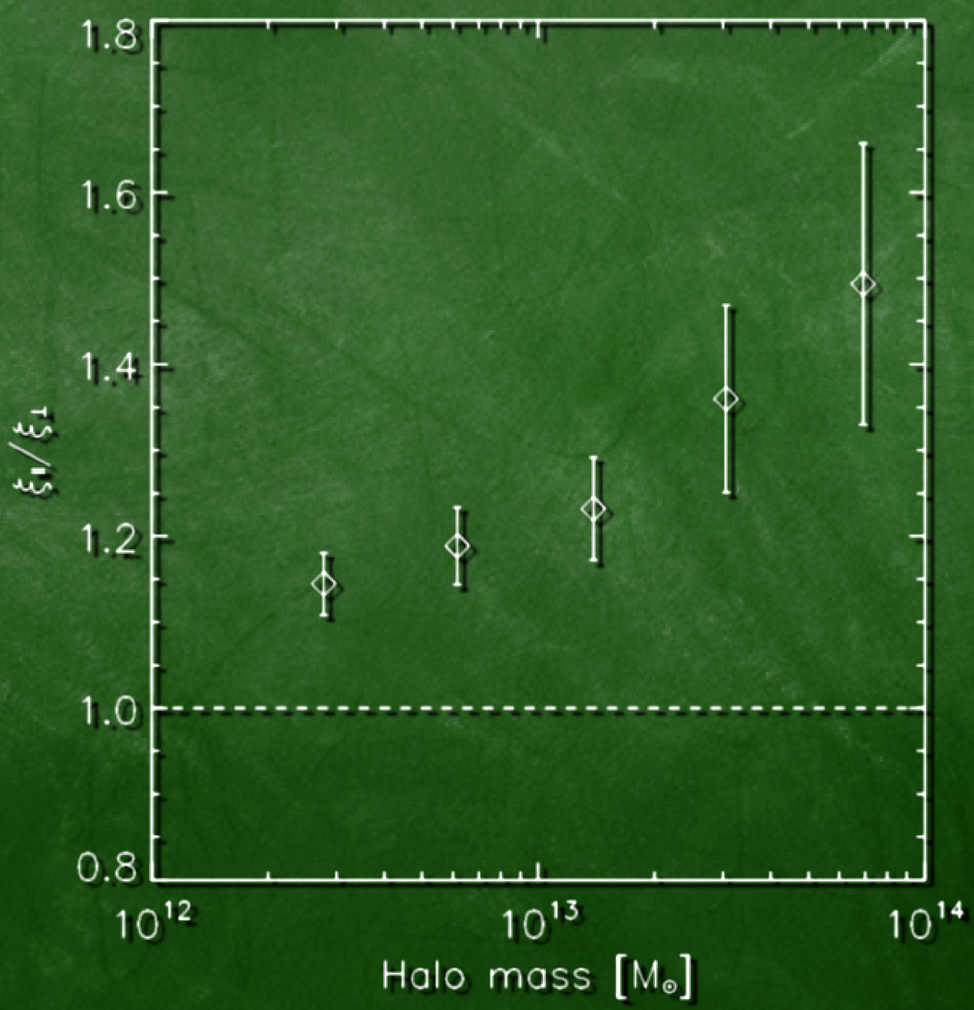

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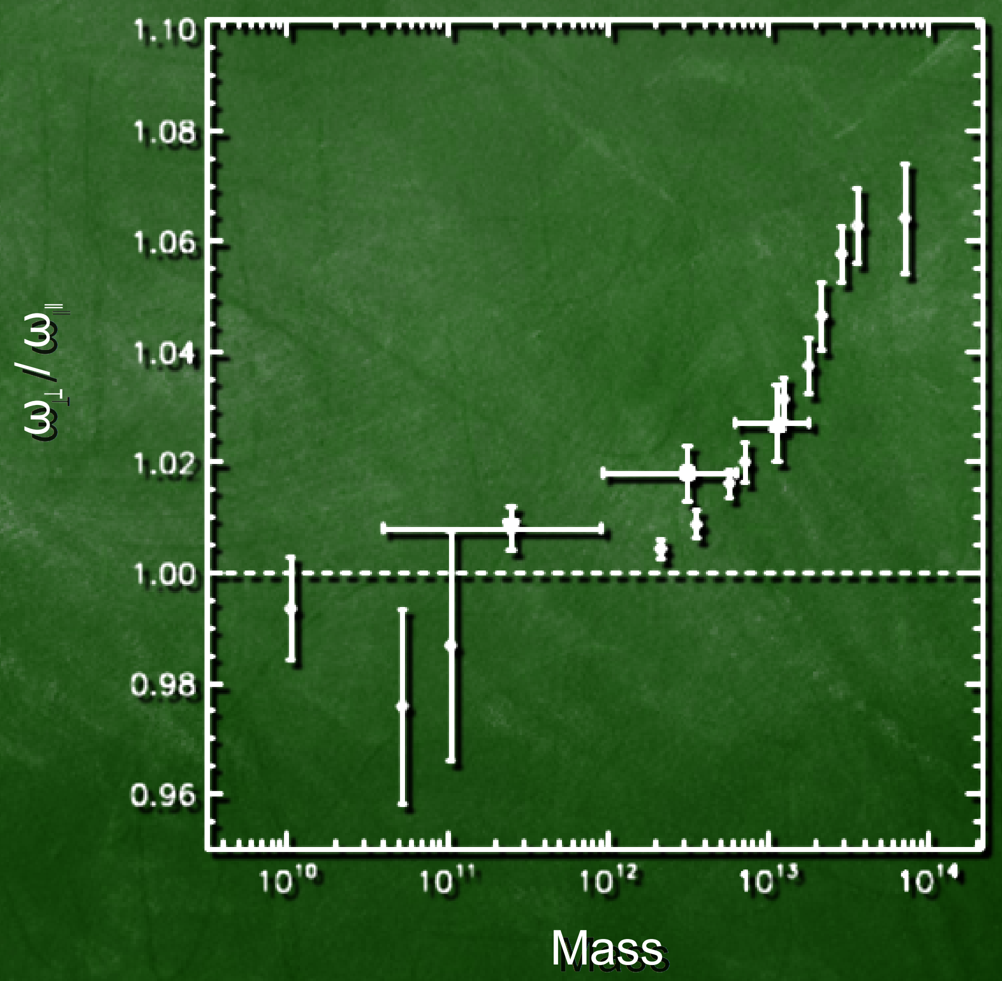

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Kinetic equation for DM Halos
(Ma & Bertschinger, 2004)

$$f_{\mathrm{K}}(\boldsymbol{r},\, \boldsymbol{v},\, t) = m \sum_i \delta_{\mathrm{D}}[\boldsymbol{r} - \boldsymbol{r}_i(t)]\delta_{\mathrm{D}}[\boldsymbol{v} - \boldsymbol{v}_i(t)]$$

$$\frac{\partial f_{\mathrm{K}}}{\partial t} + \boldsymbol{v} \cdot \frac{\partial f_{\mathrm{K}}}{\partial \boldsymbol{r}} + \boldsymbol{g}_{\mathrm{K}} \cdot \frac{\partial f_{\mathrm{K}}}{\partial \boldsymbol{v}} = 0$$

$$\boldsymbol{g}_{\mathrm{K}}(\boldsymbol{r},\, t) = -G \int d^6 w' f_{\mathrm{K}}(\boldsymbol{w}',\, t) \left(\frac{\boldsymbol{r} - \boldsymbol{r}'}{|\boldsymbol{r} - \boldsymbol{r}'|^3} + \frac{\boldsymbol{r}'}{|\boldsymbol{r}'|^3} \right)$$

$$f(\boldsymbol{w},\, t) \equiv \langle f_{\mathrm{K}}(\boldsymbol{w},\, t) \rangle$$

Kinetic equation for DM Halos

(Ma & Bertschinger, 2004)

$$\frac{\partial f}{\partial t} + \boldsymbol{v} \cdot \frac{\partial f}{\partial \boldsymbol{r}} + \boldsymbol{g}_T \cdot \frac{\partial f}{\partial \boldsymbol{v}} = -\frac{\partial}{\partial \boldsymbol{v}} \cdot \left(\mathbf{A} f - \mathbf{D} \cdot \frac{\partial f}{\partial \boldsymbol{v}} \right)$$

$$\mathbf{A}(\boldsymbol{r}, t) = 4\pi G \bar{\rho} a A_r(r, t) \hat{\boldsymbol{r}},$$

$$\mathbf{D}(\boldsymbol{r}, t) = 4\pi G \bar{\rho} a H b [D_r(r, t) \hat{\boldsymbol{r}} \otimes \hat{\boldsymbol{r}} + D_t(r, t)(\mathbf{I} - \hat{\boldsymbol{r}} \otimes \hat{\boldsymbol{r}})]$$

$$A_r(r, t) = -r\eta(r) - \frac{\bar{\eta}(0)}{\sigma_1^2} \frac{d\bar{\xi}(r)}{dr} + \frac{1}{c_r(r)} \frac{d\gamma(r)}{dr} \left\{ \frac{r\bar{\xi}(r)\bar{\eta}(r)}{\sigma_0^2} + \frac{1}{\sigma_1^2} \frac{d\bar{\xi}(r)}{dr} [\bar{\xi}(r) - 2\bar{\eta}(r)] \right\}$$

$$D_r(r, t) = c_r(r) - \frac{d\gamma(r)}{dr} = \sigma_\psi^2 - \frac{d\gamma(r)}{dr} - \left[\frac{r\bar{\eta}(r)}{\sigma_0} \right]^2 - \left[\frac{\bar{\xi}(r) - 2\bar{\eta}(r)}{\sigma_1} \right]^2$$

$$D_t(r, t) = c_t(r) - \frac{\gamma(r)}{r} = \sigma_\psi^2 - \frac{\gamma(r)}{r} - \left[\frac{\bar{\eta}(r)}{\sigma_1} \right]^2$$

$$\eta(r) = \int \frac{d^3k}{(2\pi)^3} P(k) \frac{j_1(kr)}{kr},$$

$$\gamma(r) = \int \frac{d^3k}{(2\pi)^3} P(k) \frac{j_1(kr)}{k^3},$$

$$\bar{\xi}(r) = \int \frac{d^3k}{(2\pi)^3} P(k) W_R(k) j_0(kr),$$

$$\bar{\eta}(r) = \int \frac{d^3k}{(2\pi)^3} P(k) W_R(k) \frac{j_1(kr)}{kr},$$

$$\sigma_0^2 = \int \frac{d^3k}{(2\pi)^3} P(k) W_R^2(k),$$

$$\sigma_1^2 = \frac{1}{3} \int \frac{d^3k}{(2\pi)^3} k^2 P(k) W_R^2(k),$$

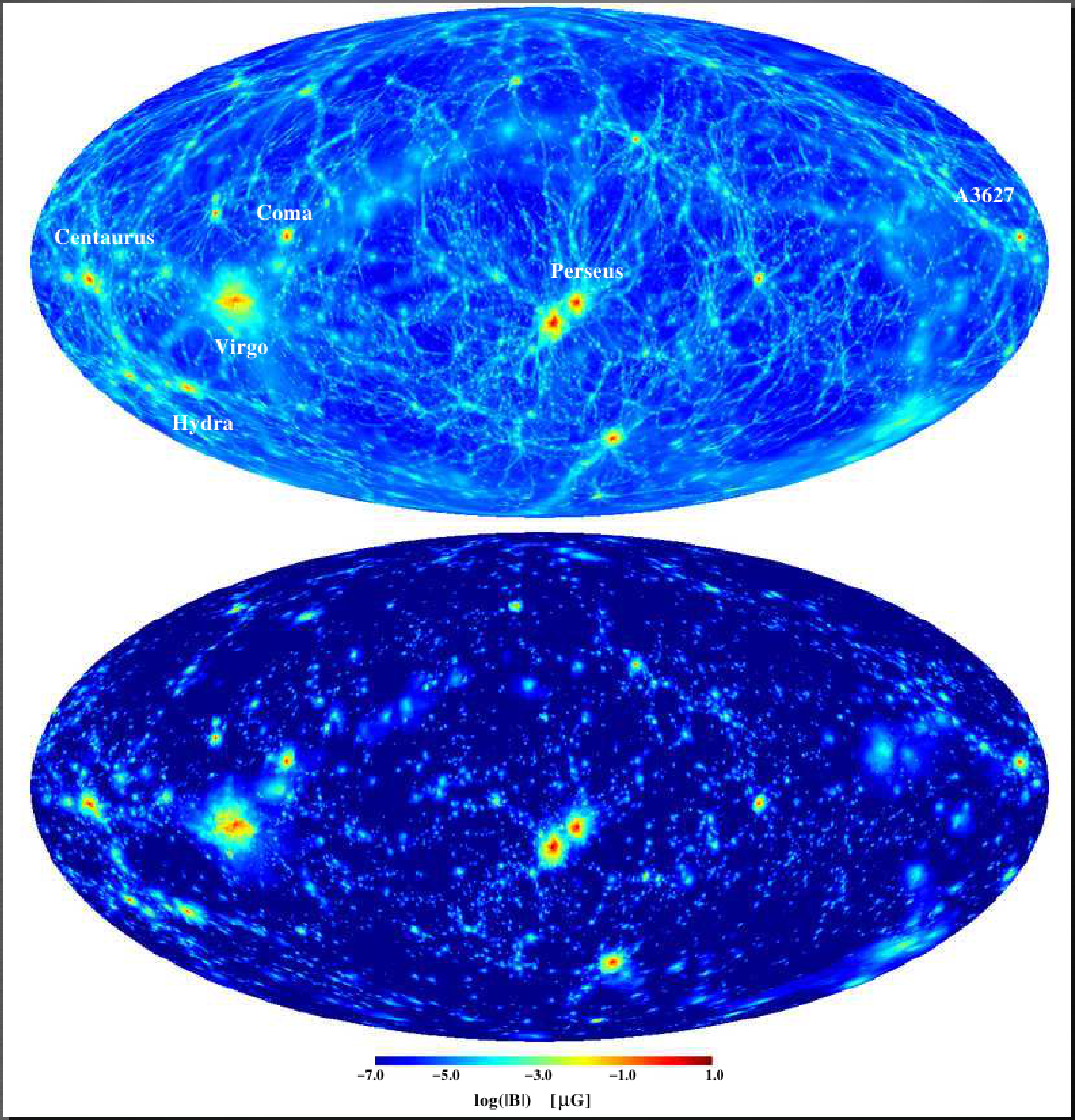
$$\sigma_\psi^2 = \frac{1}{3} \int \frac{d^3k}{(2\pi)^3} k^{-2} P(k),$$

Magnetogensis from Faraday Rotation Measurements

Federico Stasyszyn (MPA, Garching),
Sebastian Nuza (AIP)

Measuring cosmic magnetic fields by rotation measure-galaxy cross-correlations in cosmological simulations, by Stasyszyn, Nuza, Dolag, Beck & Donnert, J. (2010)

$$\chi(\mathbf{x}_\perp, \lambda) = \chi_0 + \lambda^2 \underbrace{a_0 \int_{z_s}^{\infty} dz\, n_e(\mathbf{x}_\perp, z)\, B_z(\mathbf{x}_\perp, z)}_{=\phi(\mathbf{x}_\perp)},$$



Centaurus
Coma
Virgo
Hydra
Perseus
A3627
−7.0
−5.0
−3.0
−1.0
1.0
log(|B|) [μG]

Magnetogensis from Faraday Rotation Measurments

Federico Stasyszyn (MPA, Garching),
Sebastian Nuza (AIP)

The idea is to study RM – LSS correlations by using RM public data (e.g. Taylor et al. 2009) and SDSS.

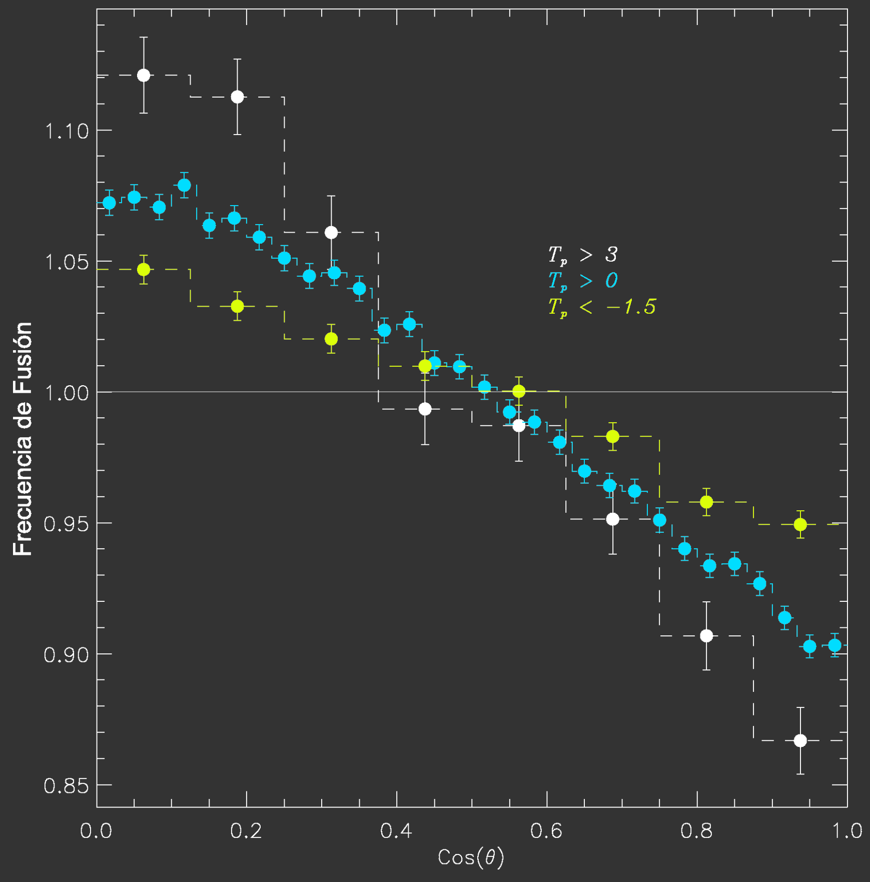
We want to compute cross correlation function between RM – galaxies, groups, and clusters.

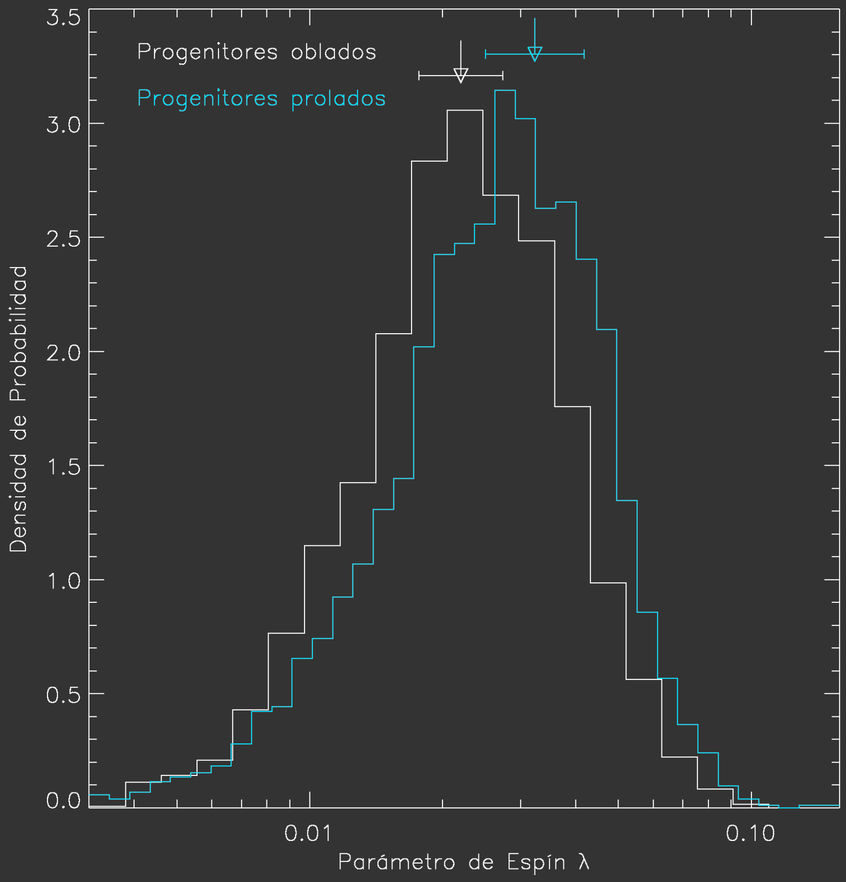
We want also to estimate RM – RM, auto correlation (aka Structure Funcion or Power Spectrum) in order to study the field phenomenolgy (ie turbulency, field saturation, equpartition, etc).

Muchas Gracias!
Preguntas?

Spin and progentiors distribution

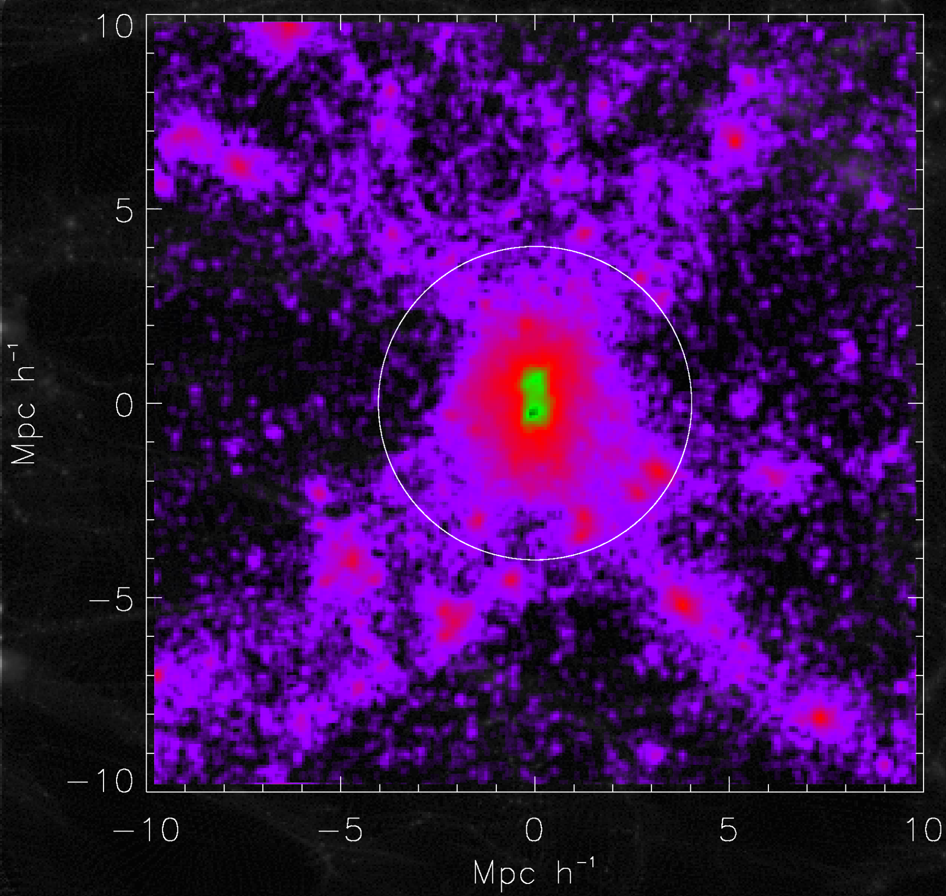
$$T_p = \ln(ca/b^2)$$

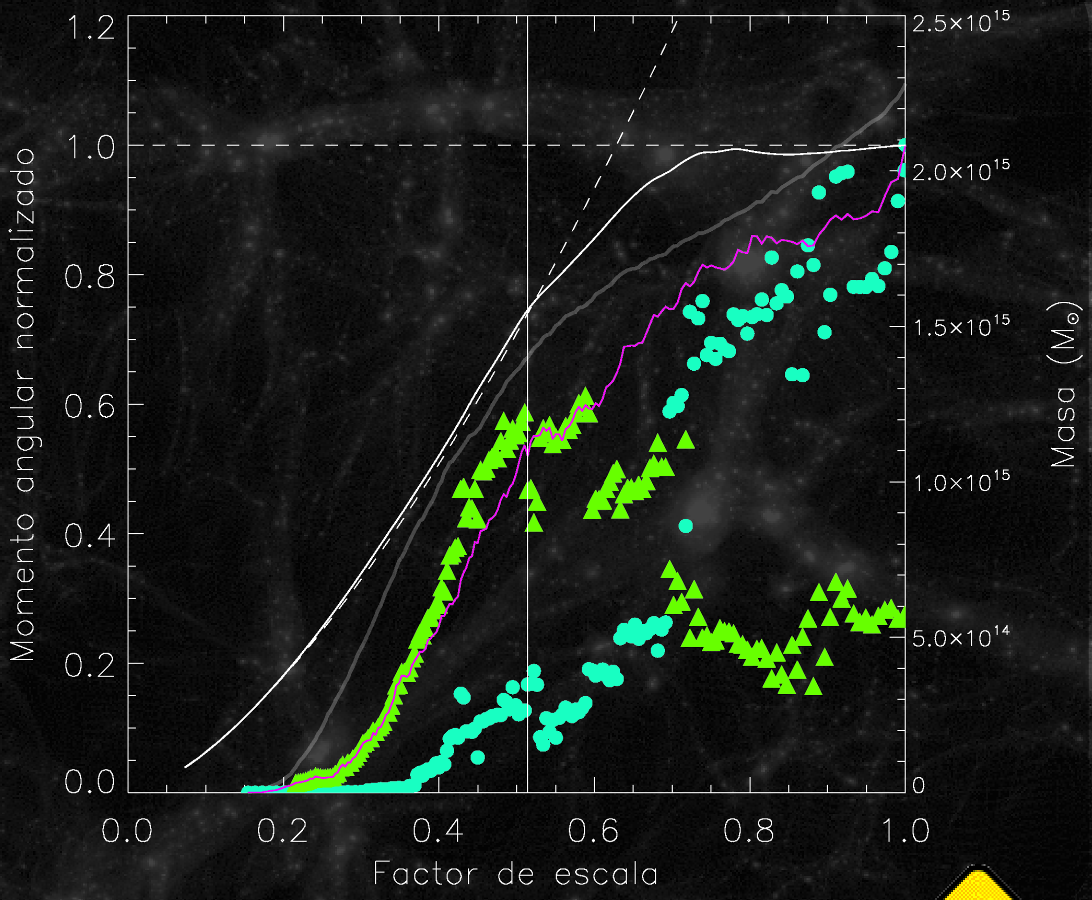


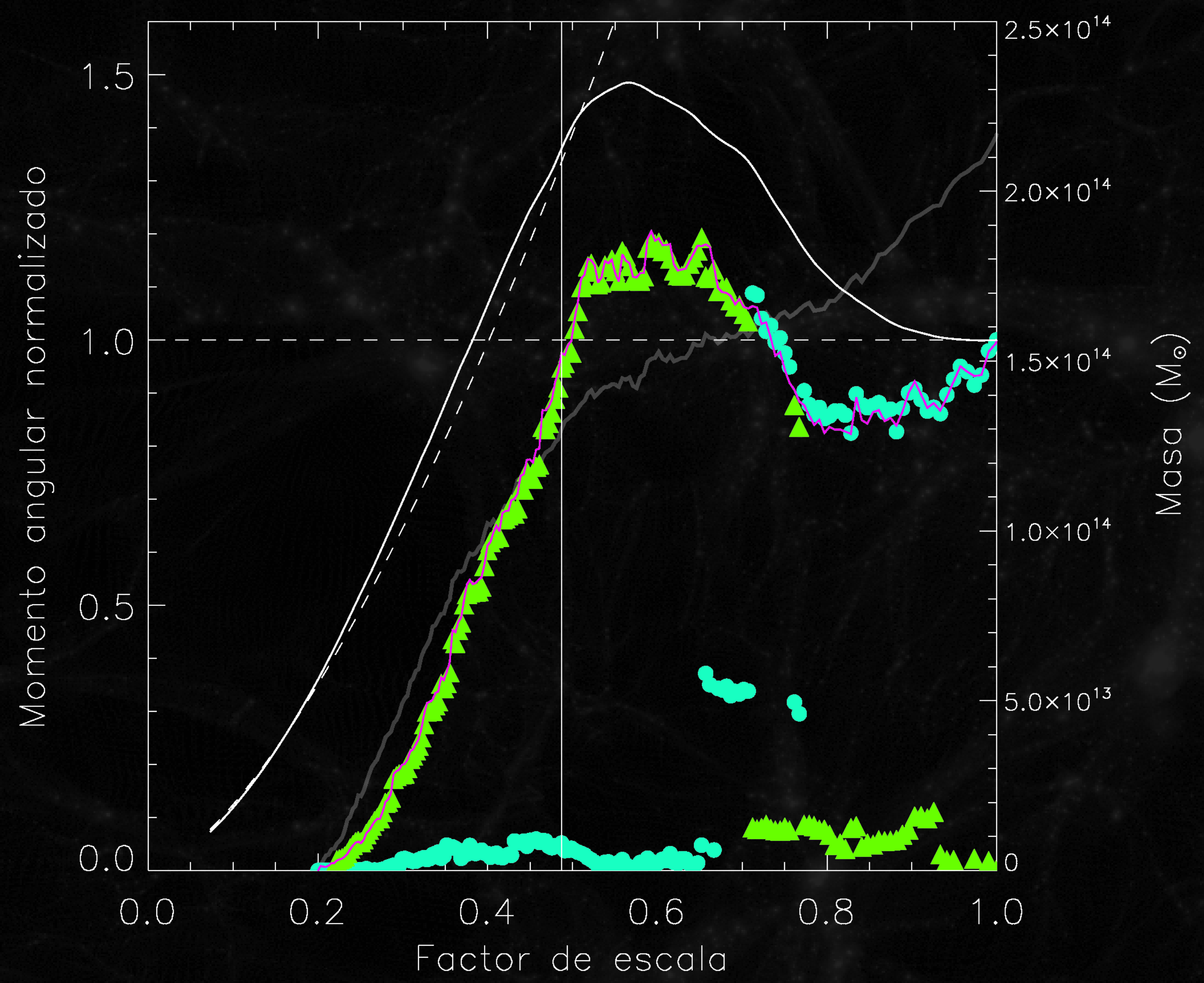


¿Cuál es el origen de las discrepancias en la teoría de torque tidal?

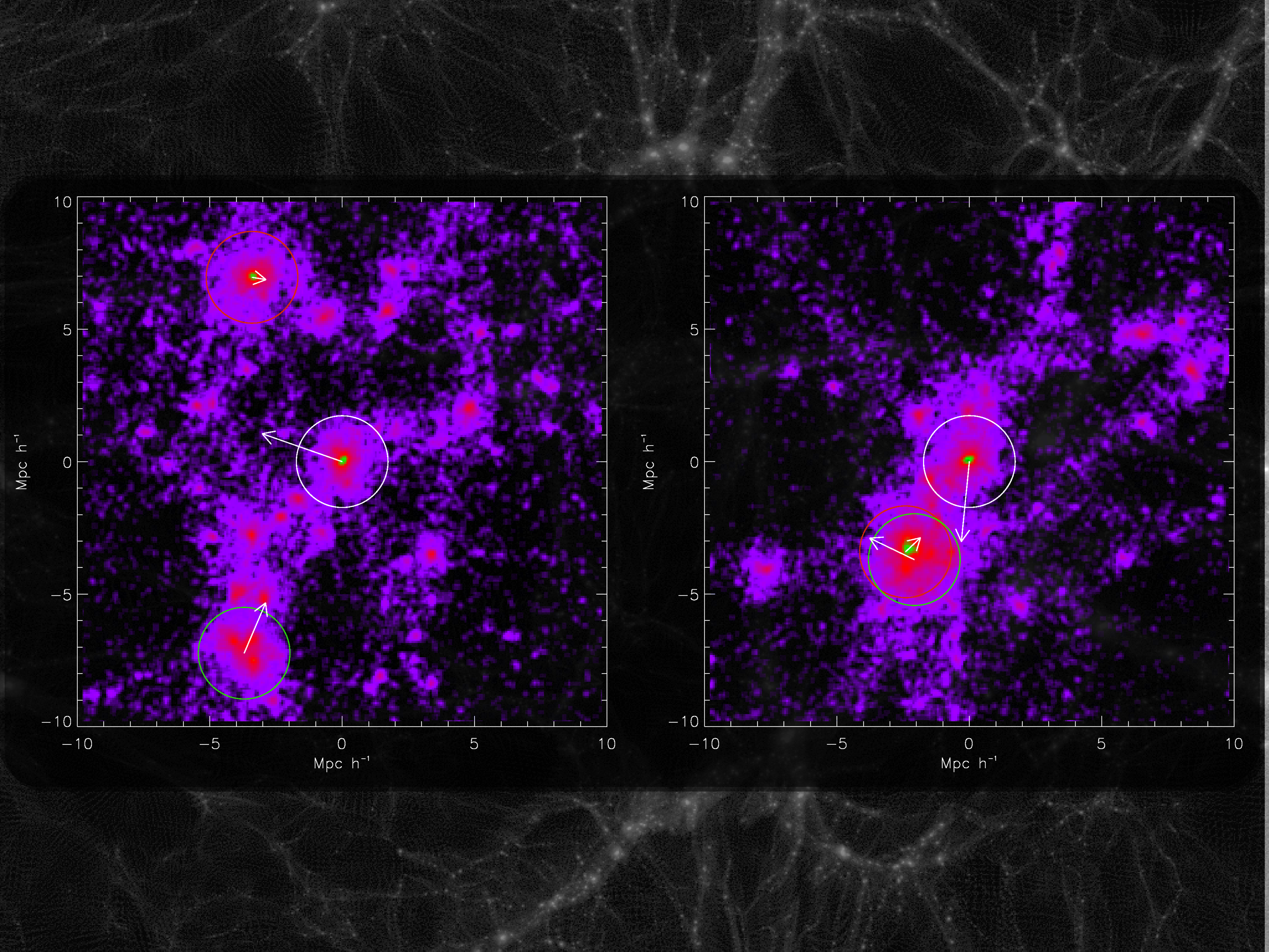
Estudio exploratorio



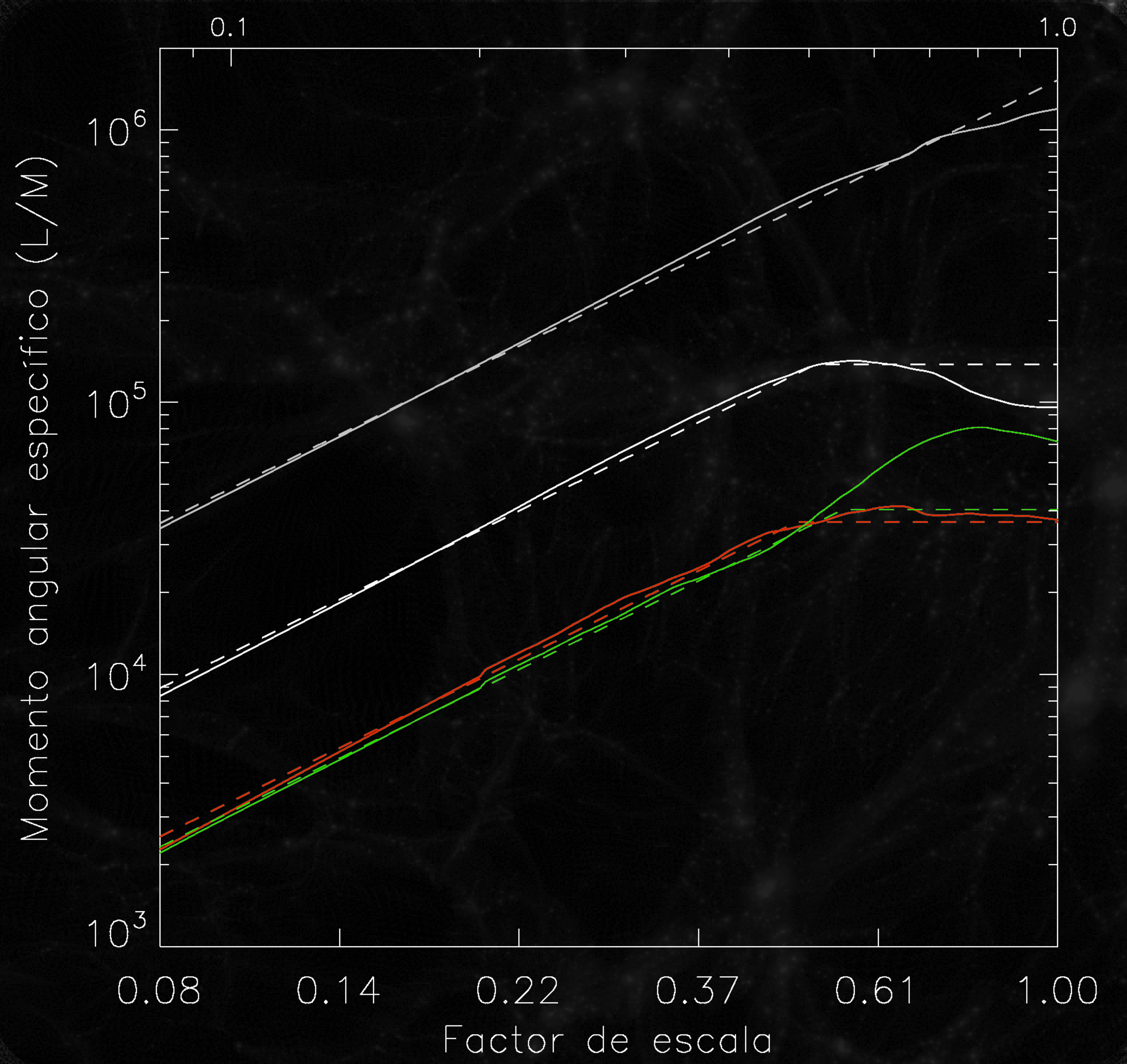




Momento angular normalizado
Factor de escala
Masa (M☉)
1.5
1.0
0.5
0.0
0.0
0.2
0.4
0.6
0.8
1.0
2.5×10^14
2.0×10^14
1.5×10^14
1.0×10^14
5.0×10^13
0



10
5
0
−5
−10
Mpc h⁻¹
−10
−5
0
5
10
Mpc h⁻¹



0.1
1.0
10^6
10^5
10^4
10^3
Momento angular específico (L/M)
0.08
0.14
0.22
0.37
0.61
1.00
Factor de escala

SIMULATION

Mock – sdss