

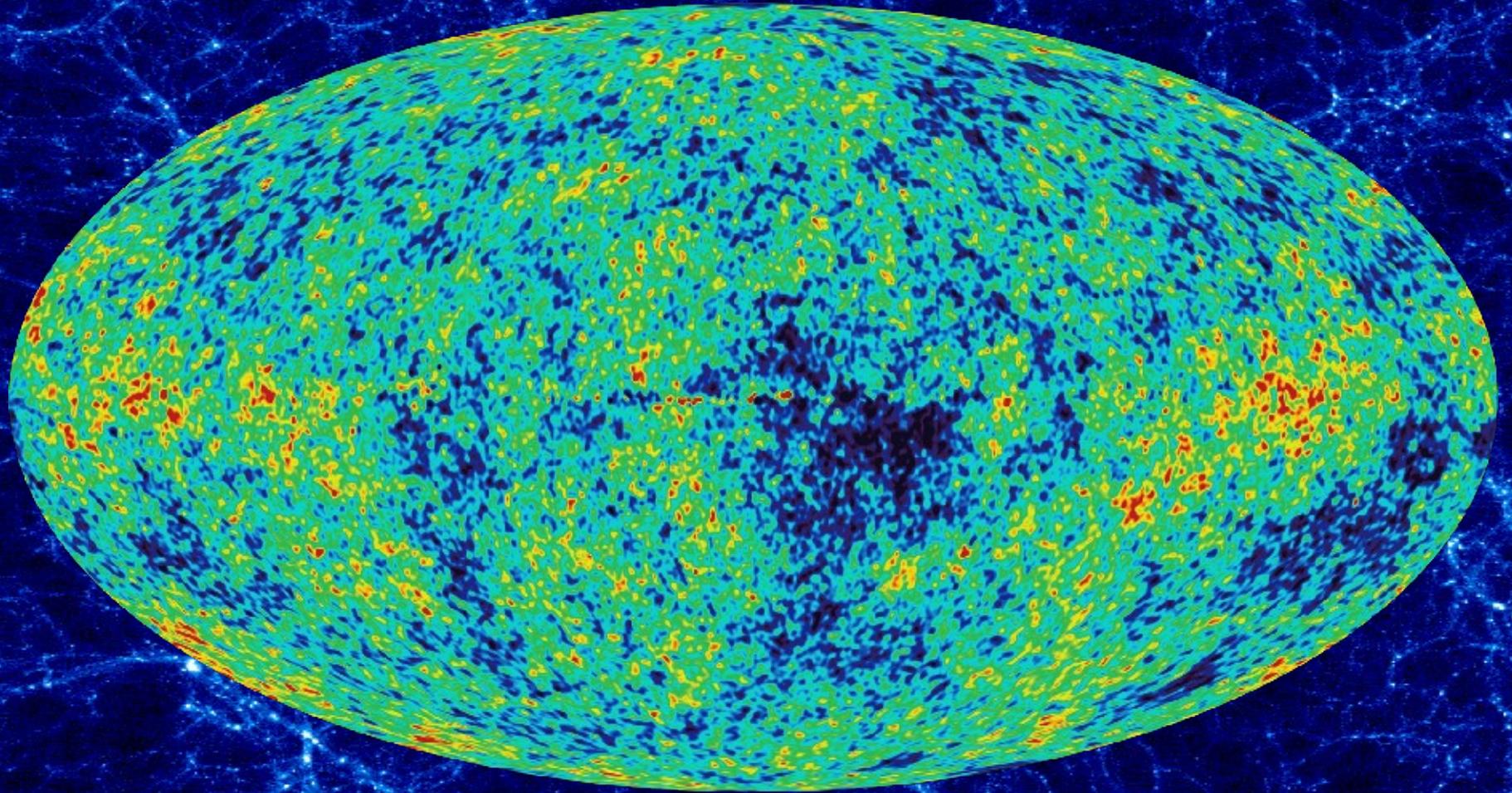
Estudio estadístico de sistemas de galaxias con la estructura en gran escala del universo

Manuel Merchán
Instituto de Astronomía Teórica y Experimental (CONICET-UNC)
Observatorio Astronómico de Córdoba

Modelo de universo

- Expansion
- Evolucion de las fluctuaciones en densidad
- Materia oscura
- Simulaciones
- Herramientas estadisticas

Espectro de potencias y funcion de correlacion



$$\delta(\vec{r}) = \frac{\rho(\vec{r}) - \bar{\rho}}{\bar{\rho}}$$

$$\delta(\vec{r}) = \int \tilde{\delta}(\vec{k}) e^{i\vec{k}\vec{x}}$$

$$P(k) = \langle \tilde{\delta}(\vec{k}) \rangle$$

Espectro de potencias

Funcion de correlacion

$$\xi(r) = \frac{1}{(2\pi)^3} \int P(k) \frac{\sin(kr)}{kr} 4\pi k^2 dk$$

$$dP = \bar{n} (1 + \xi(r)) dV$$

$$dP_{12} = \bar{n}^2 (1 + \xi(r)) dV_1 dV_2$$

$$\xi(r) = \frac{DD}{RR} - 1$$

$$\xi(r) = \frac{DD - 2DR + RR}{RR} - 1$$

Teoría de Torque Tidal

(exacta)
$$\vec{L}(t) = \int_{V_L} [\vec{r}(\vec{q}) - \vec{r}_{\text{cm}}] d^3q \times \vec{v}(\vec{q}, t) \rho_b a(t)^3$$

(1^{er} orden)
$$\vec{L}(t) = a^2 \dot{D} \epsilon_{ijk} T_{jl} I_{lk}$$

$$I_{ij} \equiv \int_{V_L} (q^i - q_{\text{cm}}^i)(q^j - q_{\text{cm}}^j) \rho_b a^3 d^3q$$

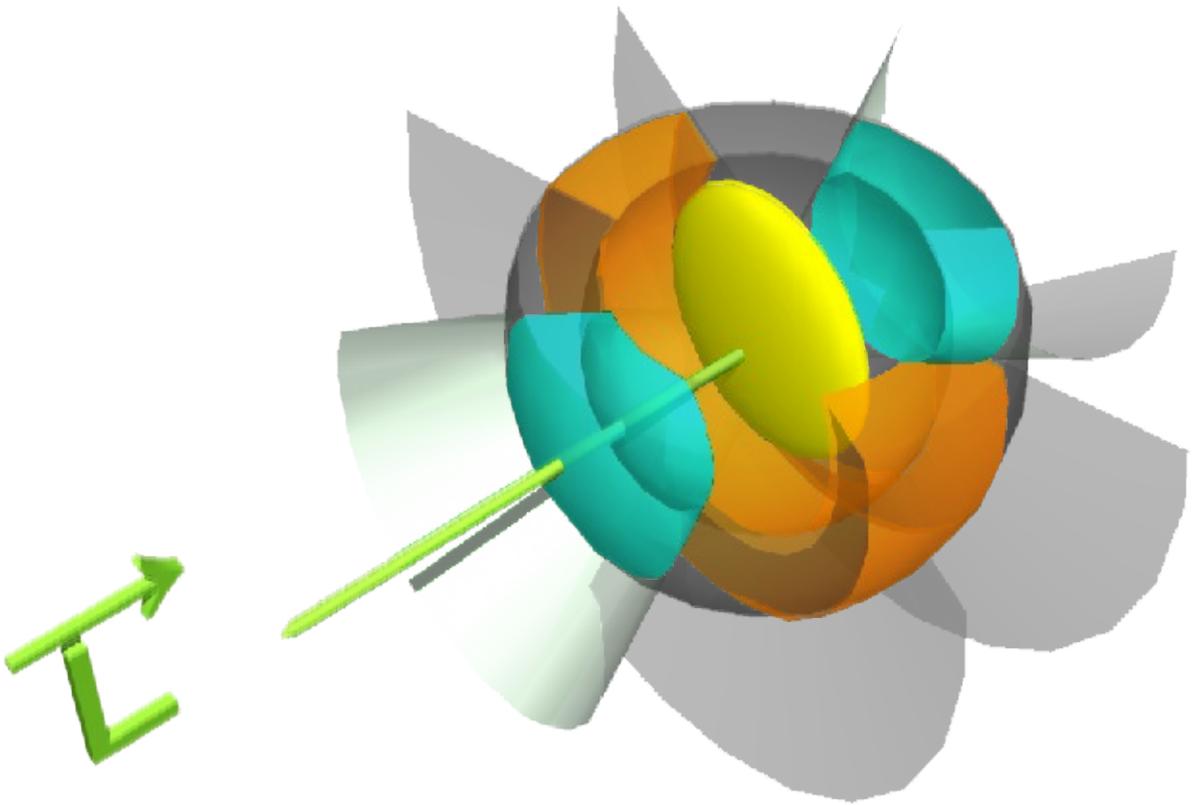
$$T_{ij} \equiv \left. \frac{\partial^2 \Phi}{\partial q_j \partial q_l} \right|_{\vec{q}_{\text{cm}}}$$

> Crecimiento del momento angular es lineal en un model Einstein-de Sitter

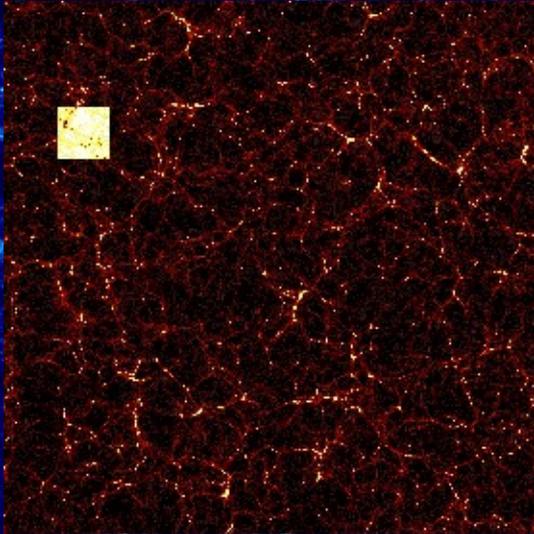
$$a, D \propto t^{2/3} \rightarrow L \propto t$$

> El Torque Tidal implica alineamientos con el entorno.

$$I_{ij} = \sum_{k=1}^N x_{ki} x_{kj} \Rightarrow a, b, c$$

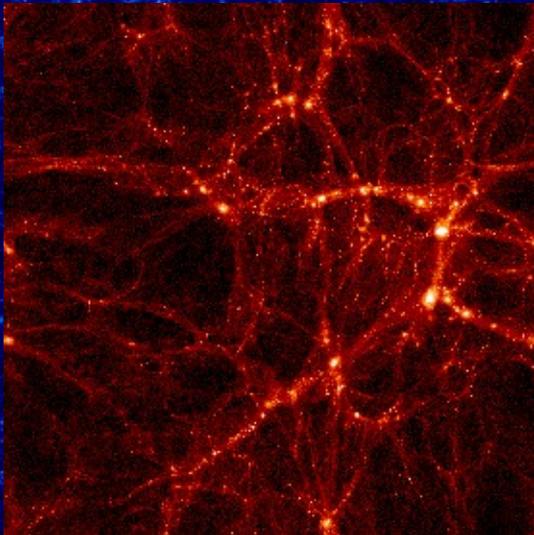
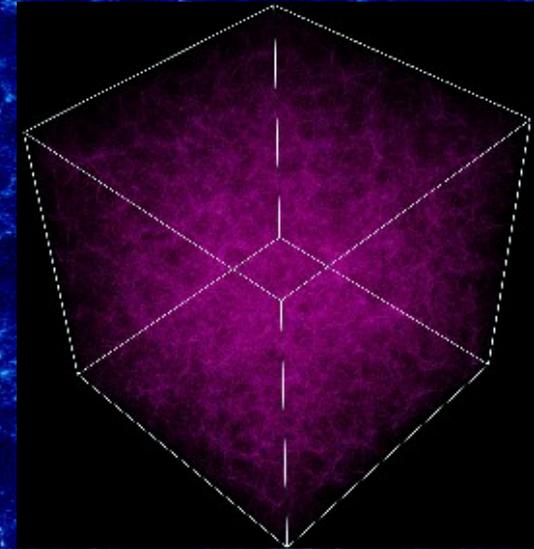


Simulaciones Numéricas

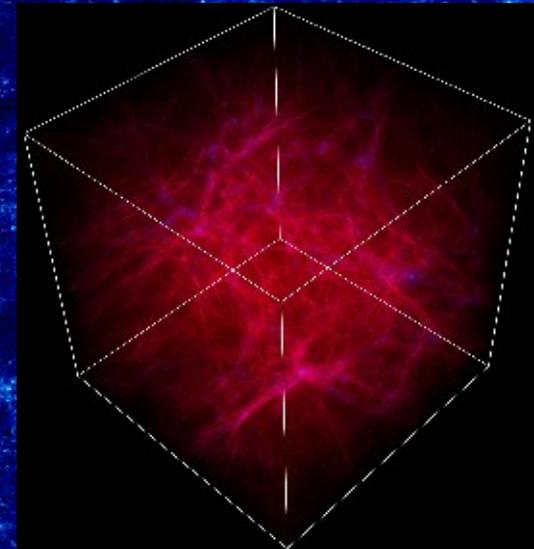


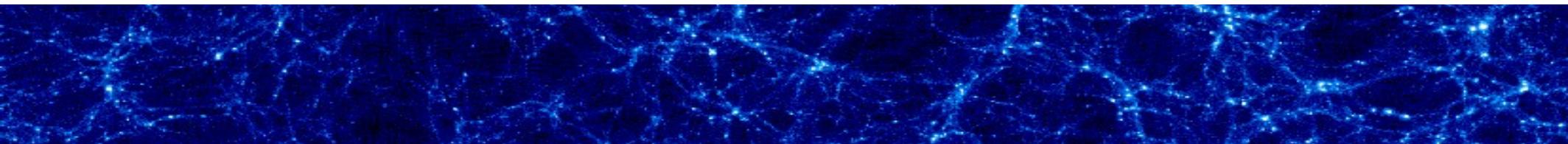
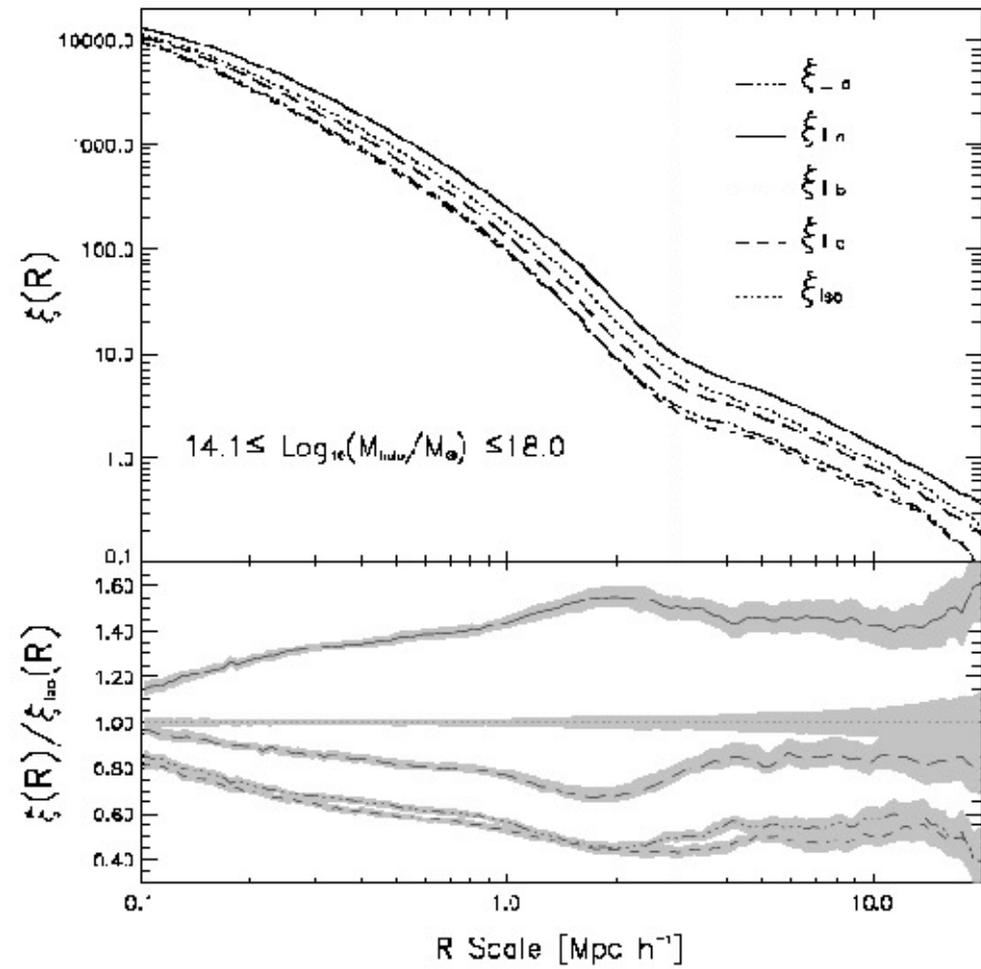
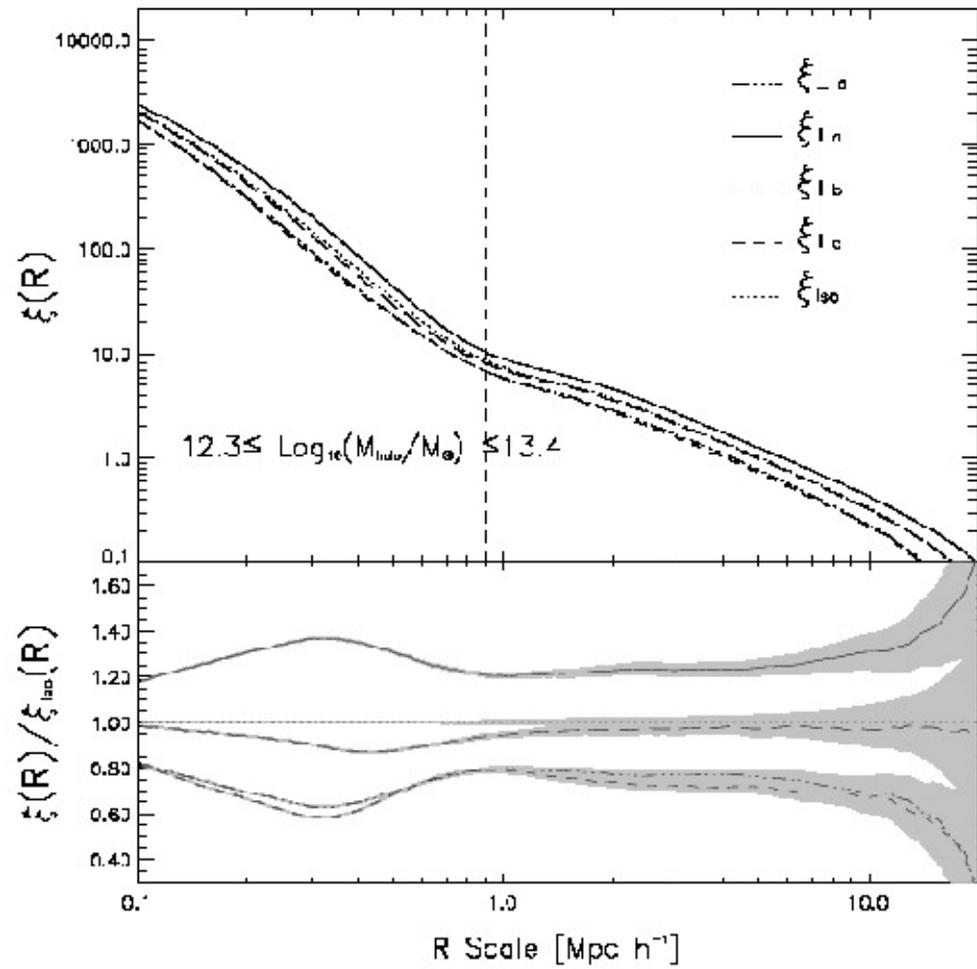
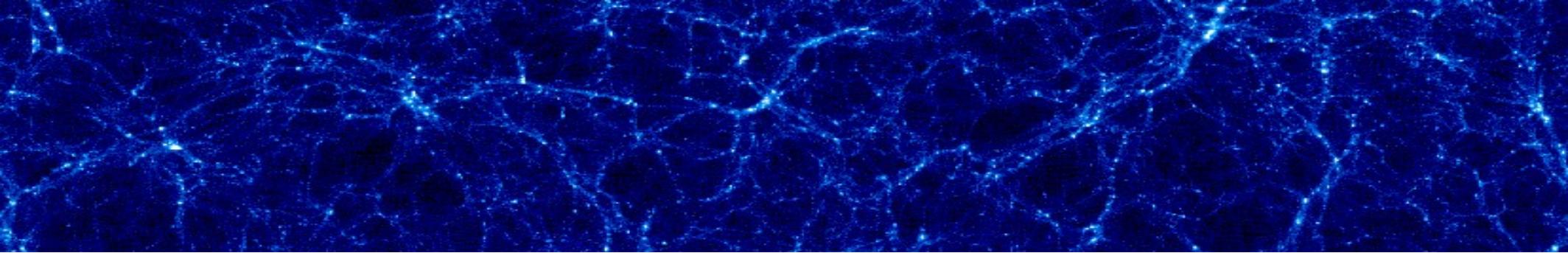
$$\Omega_m = 1 - \Omega_\Lambda = 0.3$$
$$H = 70 \text{ km s}^{-1} \text{ Mpc}^{-1}$$
$$\sigma_8 = 0.8$$

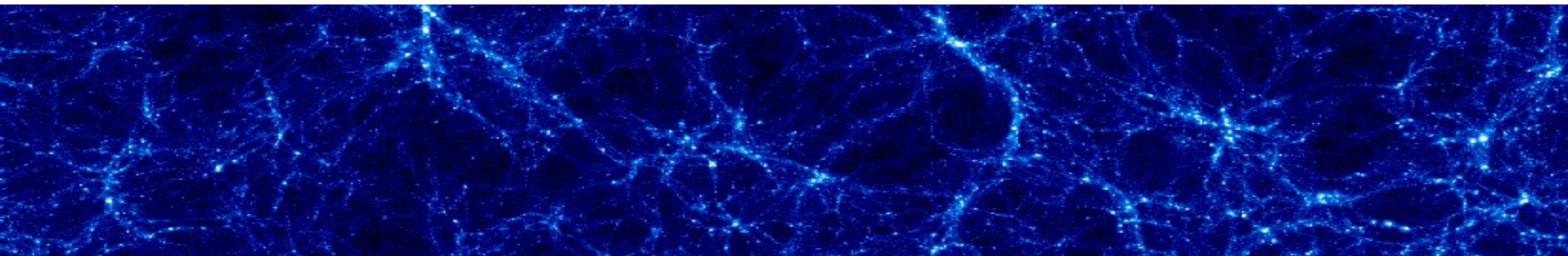
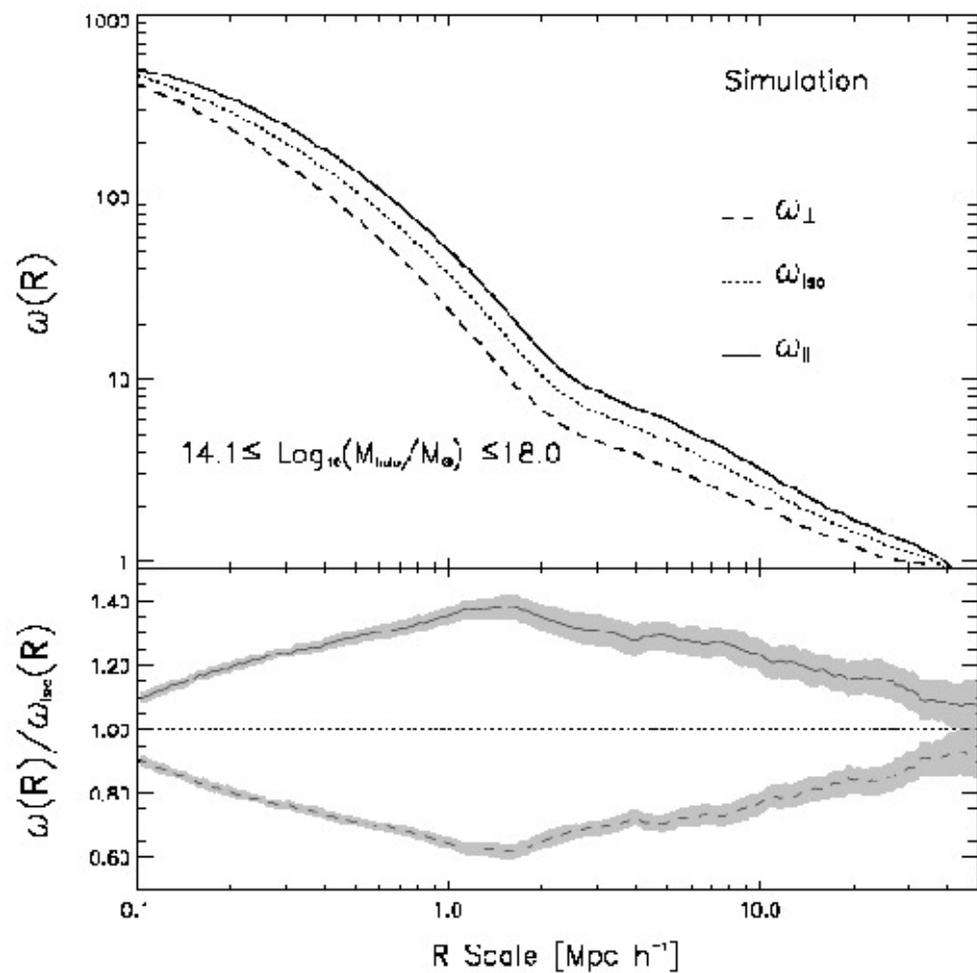
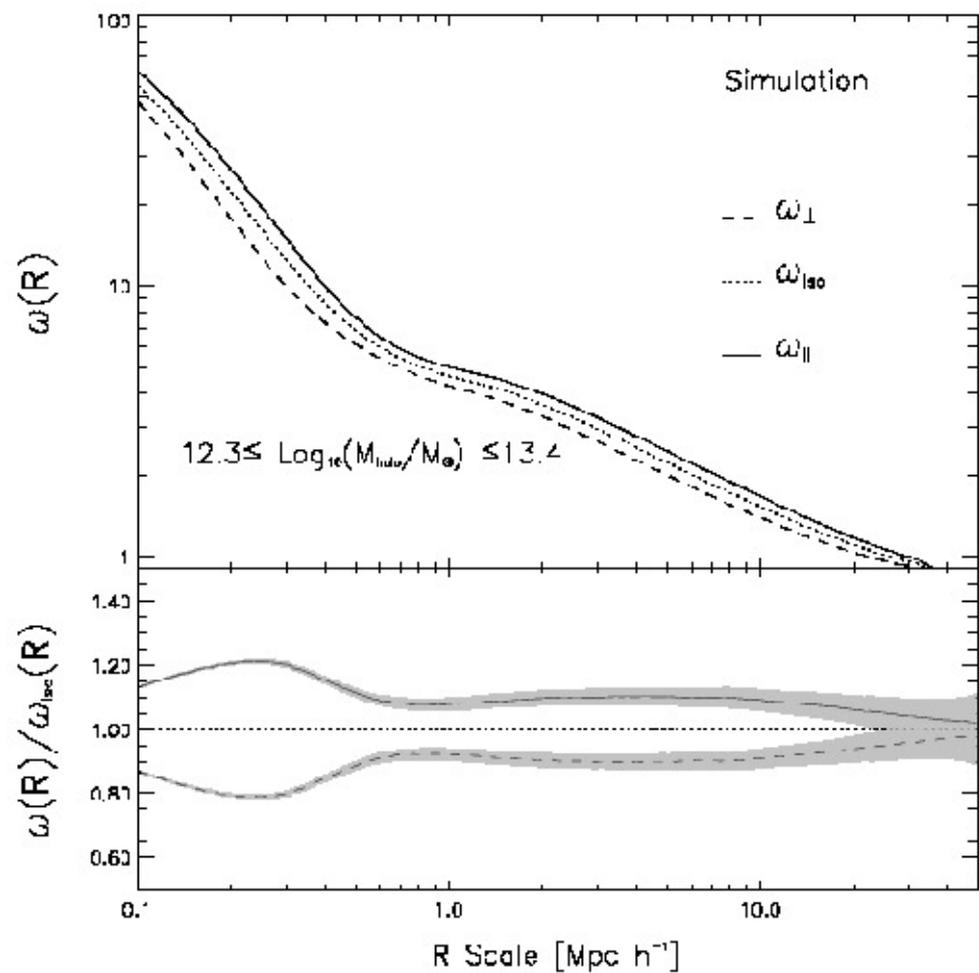
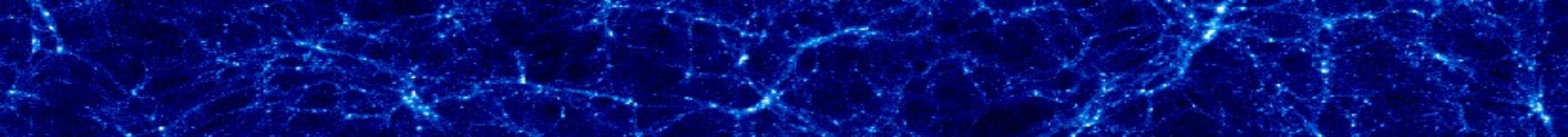
$$500 \text{ Mpc h}^{-1}$$
$$M_p \geq 7.2 \times 10^{10} h^{-1} M_\odot$$

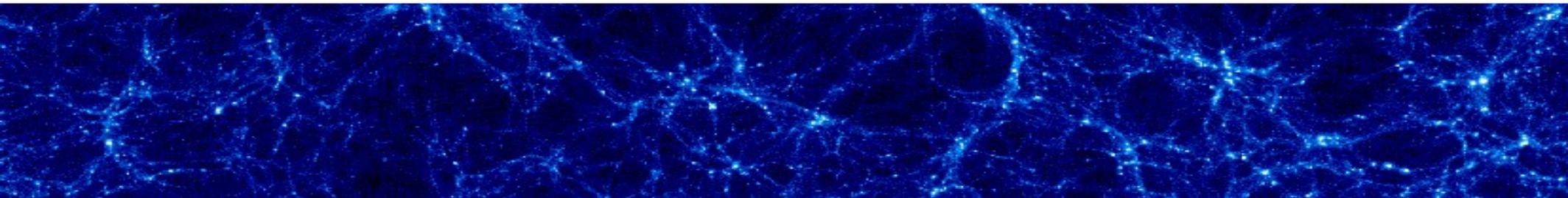
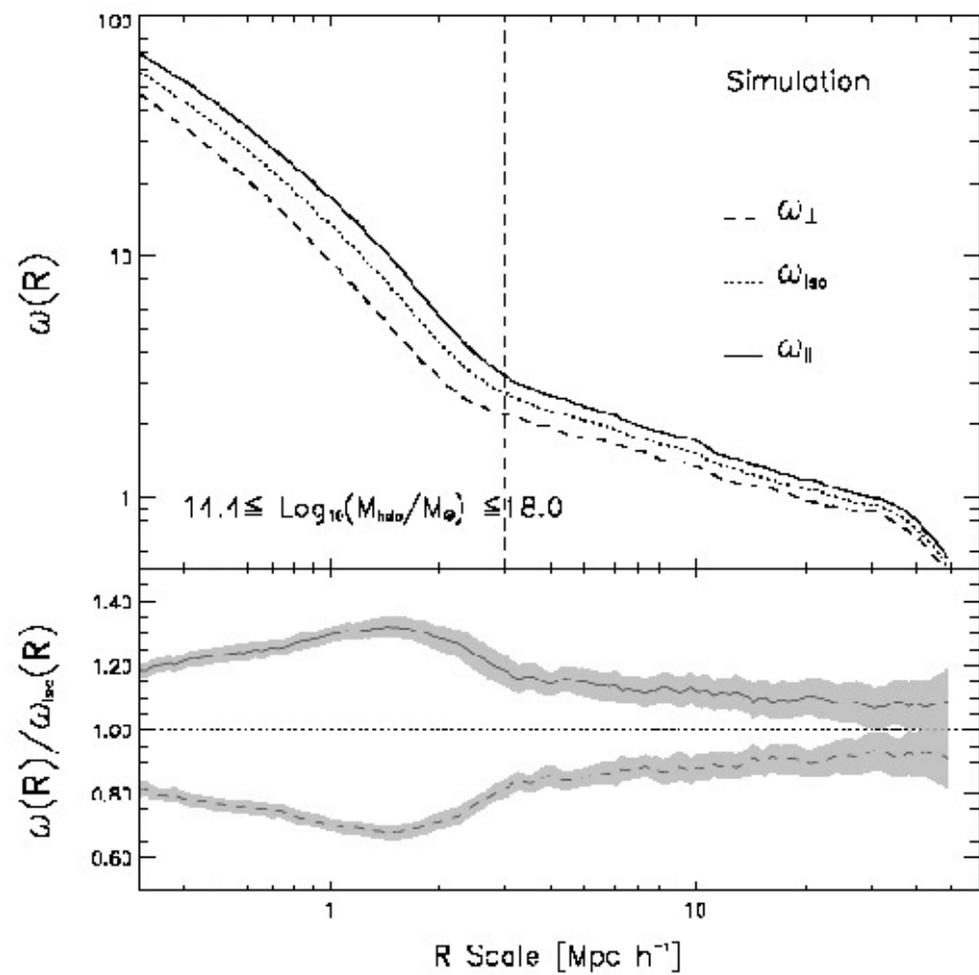
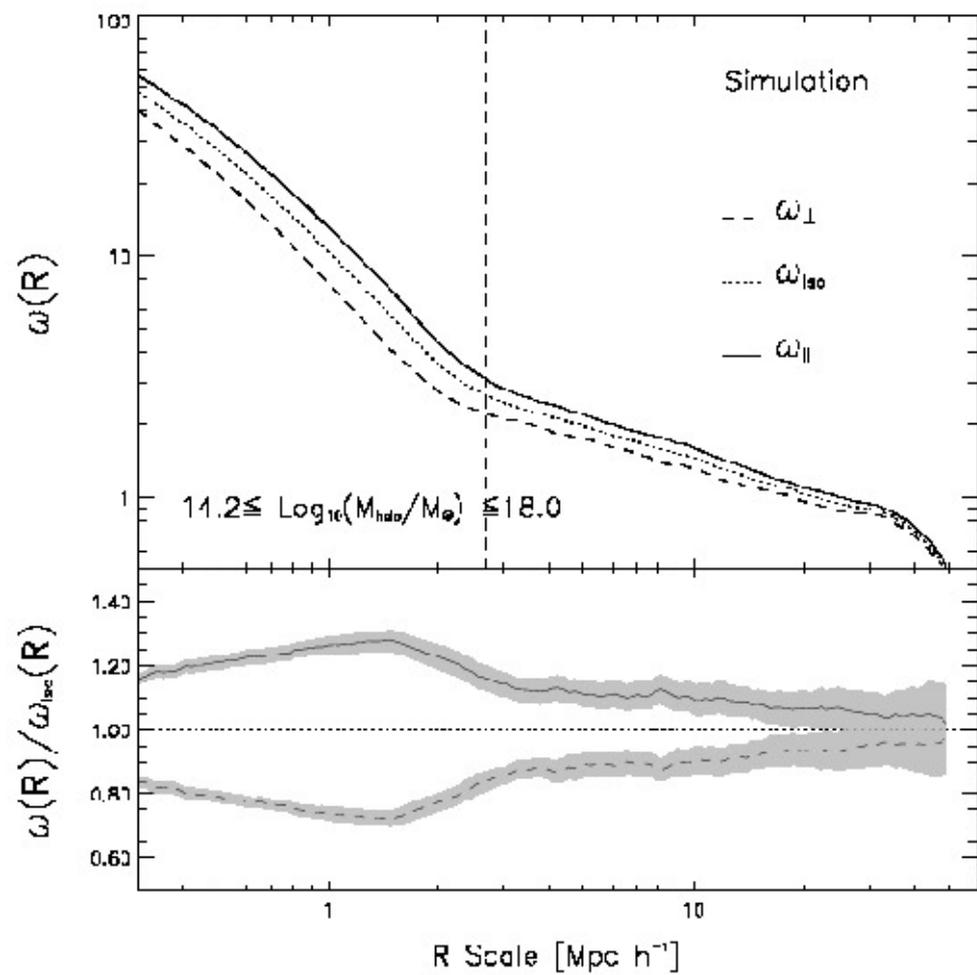
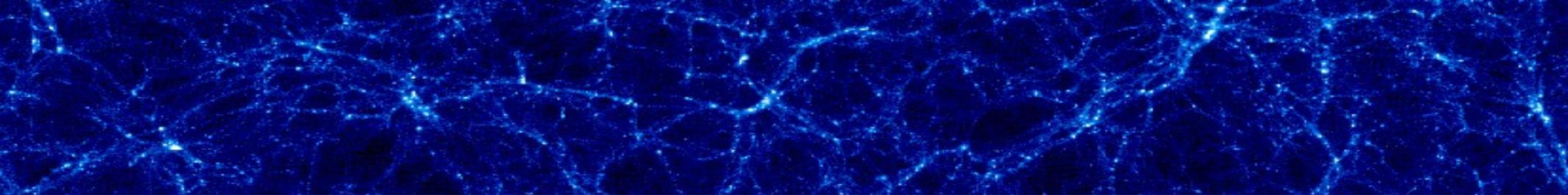


$$60 \text{ Mpc h}^{-1}$$
$$M_p \geq 1.2 \times 10^8 h^{-1} M_\odot$$







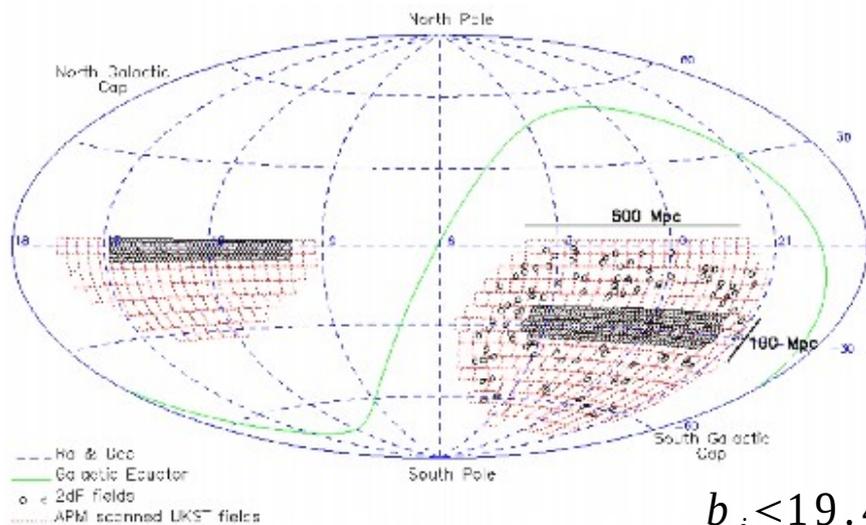


Identificación

Catálogos

2dF Galaxy Redshift Survey

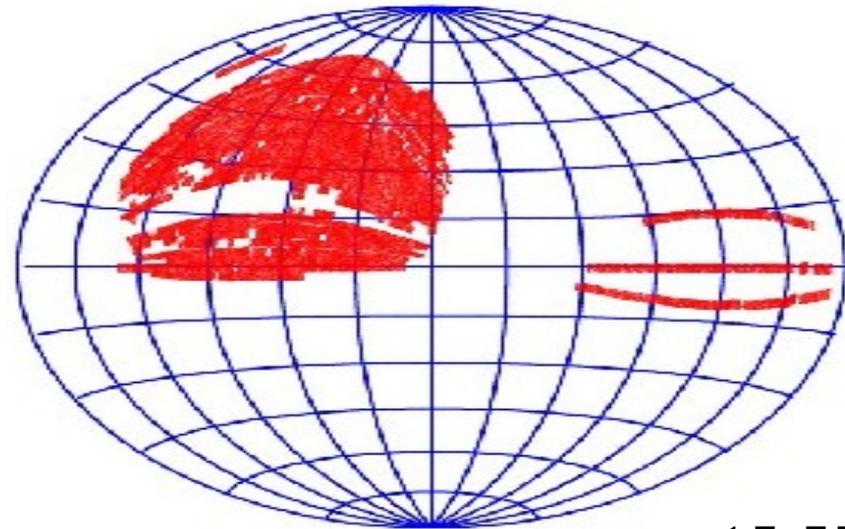
número de galaxias: ~ 200000



$b_j < 19.45$

Sloan Digital Sky Survey

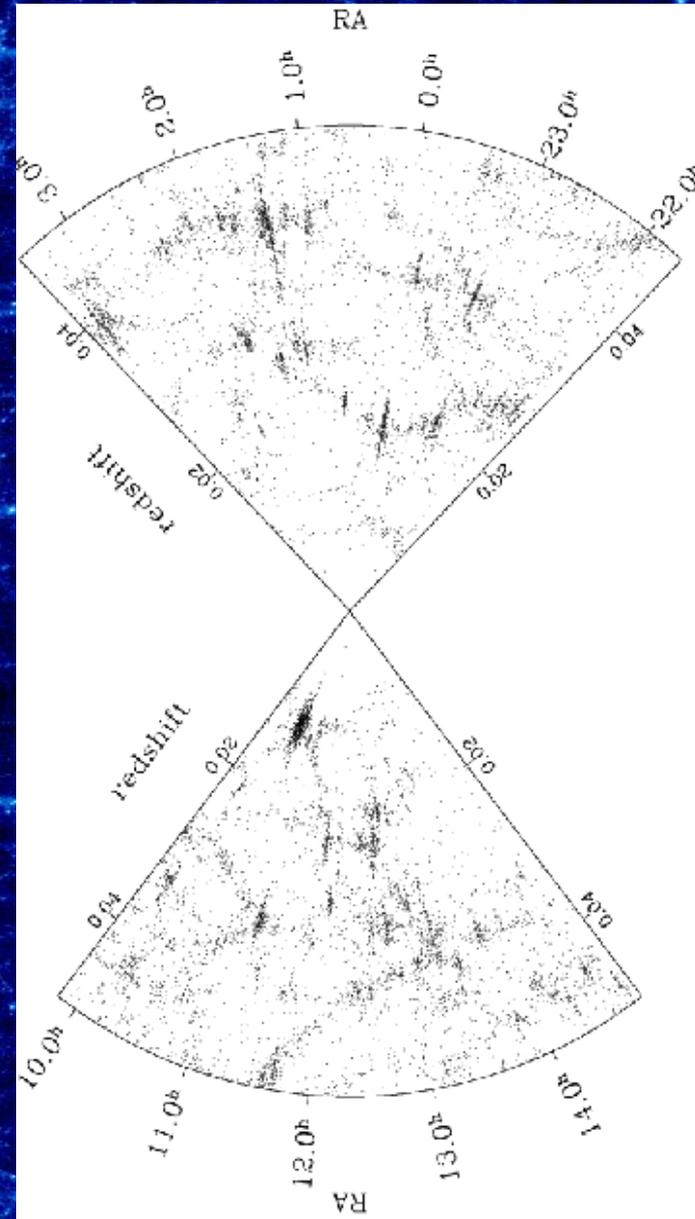
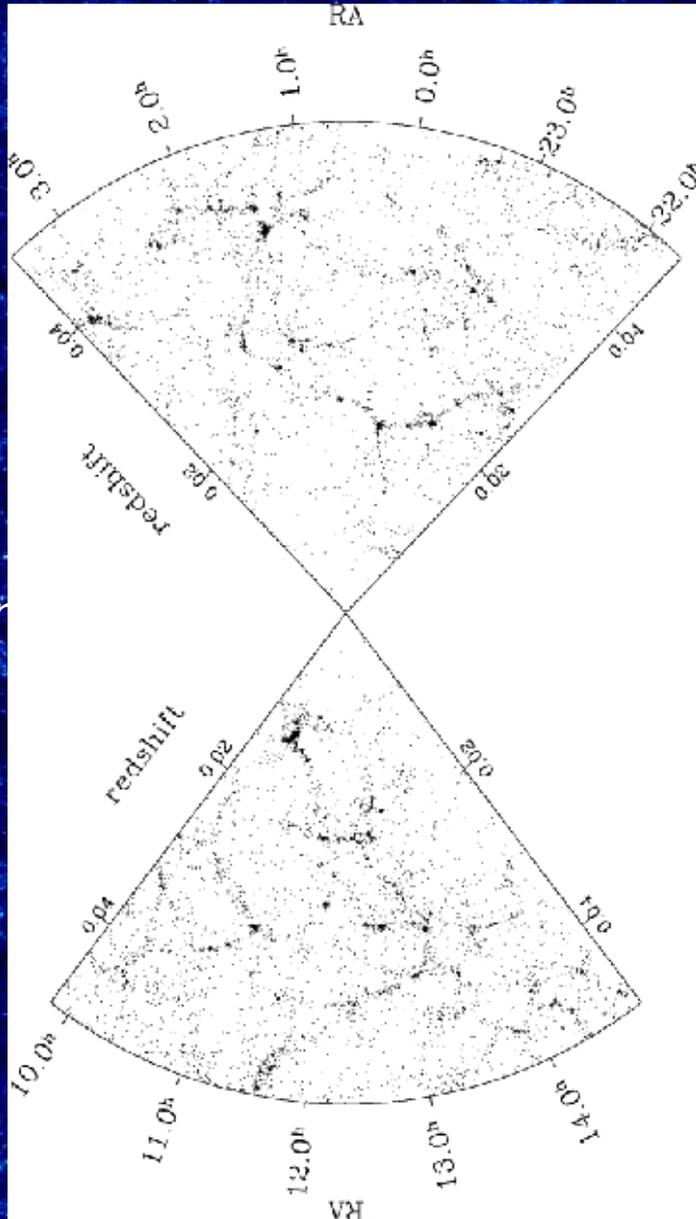
número de galaxias: ~ 600000



$r < 17.77$

Método:

Problemas

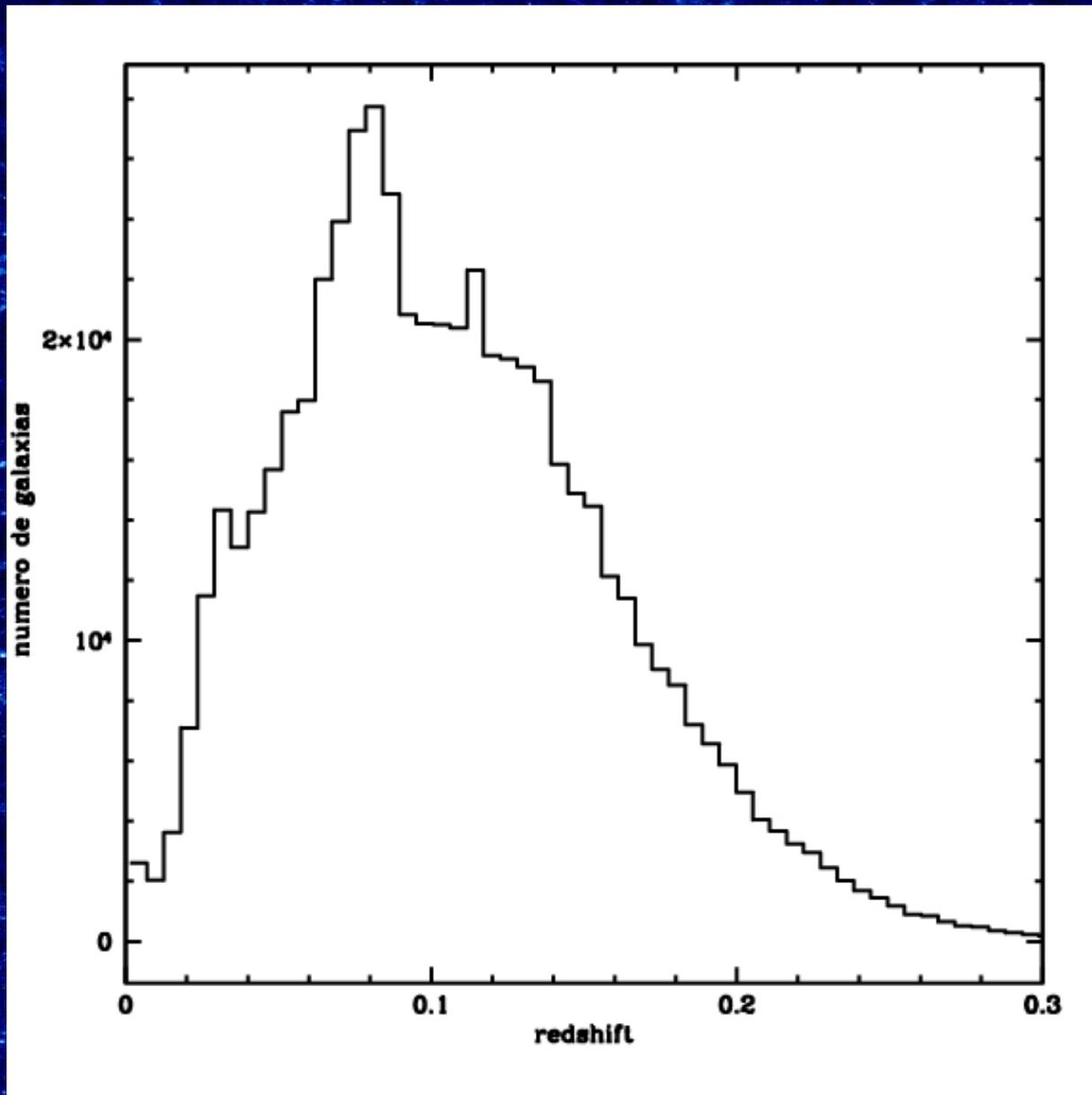


Sin distorsión

Con distorsión

Método:

Problemas



Distribución de redshifts del SDSS

Método:

Soluciones

$$D_{12} = 2 \sin\left(\frac{\theta_{12}}{2}\right) \frac{(V_1 + V_2)}{2H_0} < D_L = D_0 R$$

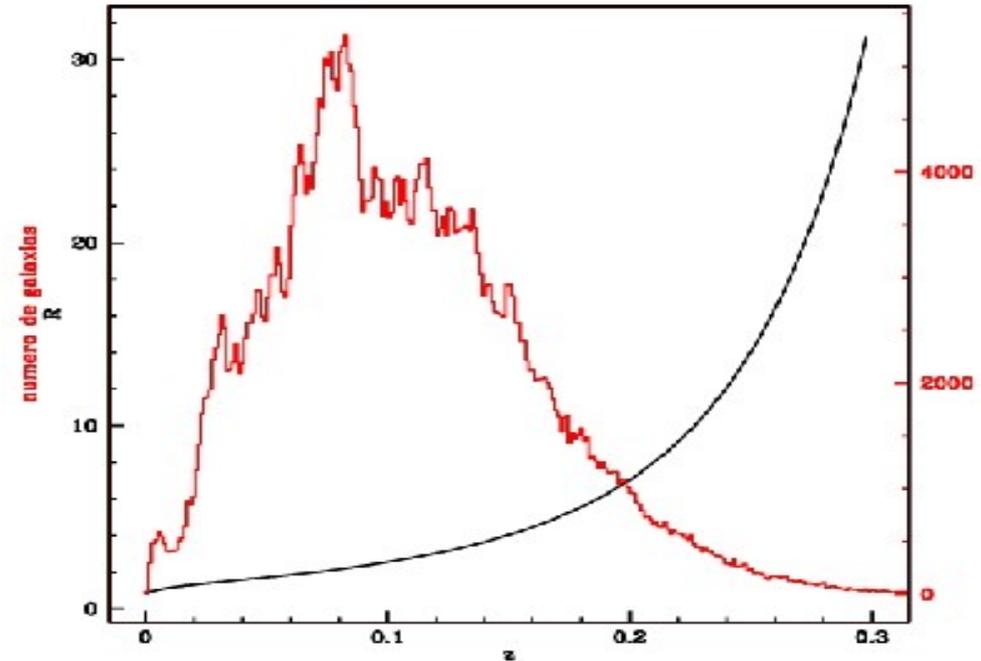
$$V_{12} = |V_1 - V_2| < V_L = V_0 R$$

donde

$$R = \frac{\int_{-\infty}^{M_{12}} \Phi(M) dM}{\int_{-\infty}^{M_l} \Phi(M) dM} \frac{(C(\alpha_1, \delta_1) + C(\alpha_2, \delta_2))}{2} \left. \vphantom{\frac{\int_{-\infty}^{M_{12}} \Phi(M) dM}{\int_{-\infty}^{M_l} \Phi(M) dM}} \right] \frac{1}{3}$$

$$M_{lim} = \bar{m}_{lim} - 25 - 5 \log(V_f / H_0)$$

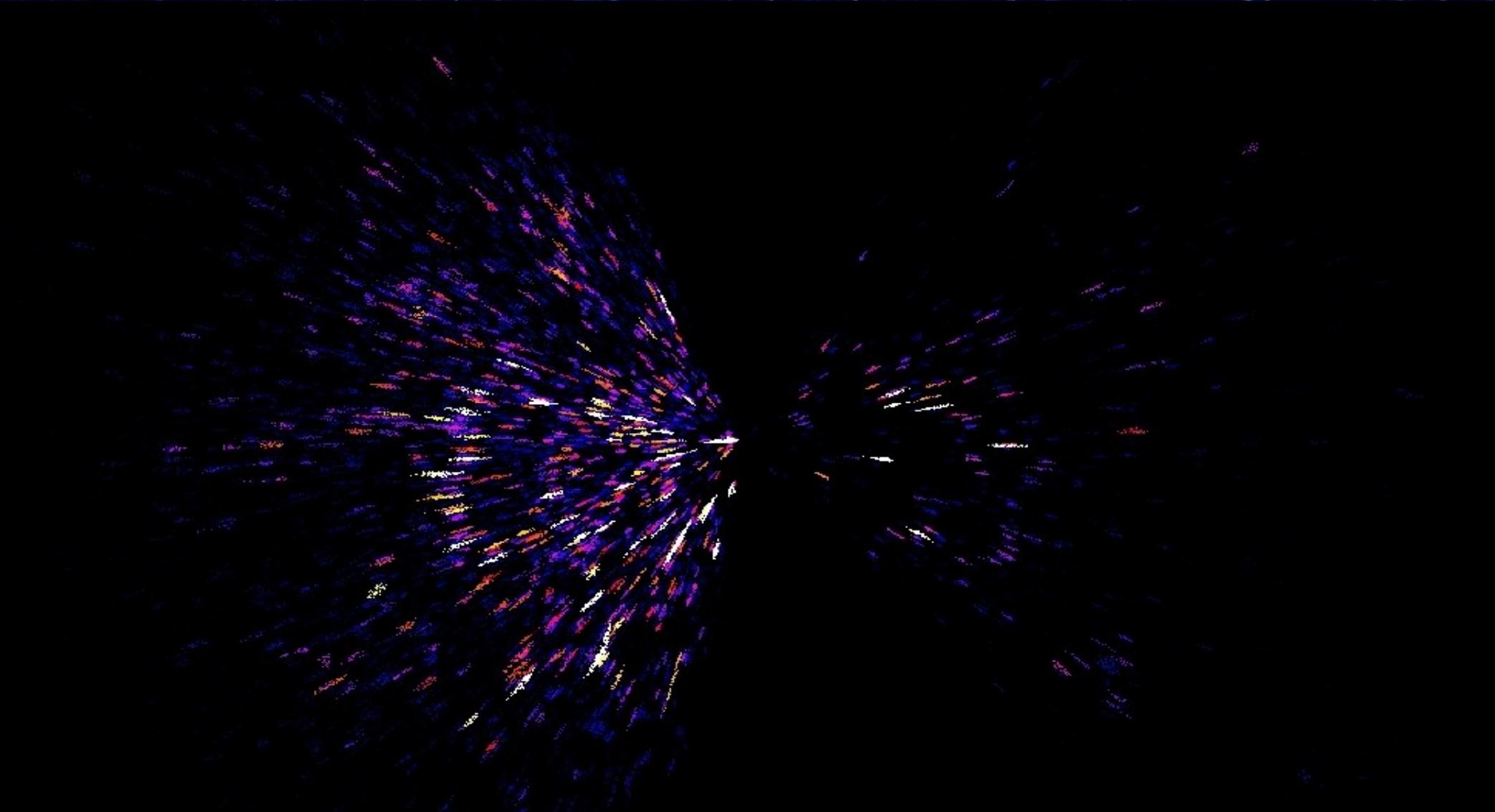
$$M_{12} = \bar{m}_{lim} - 25 - 5 \log((V_1 + V_2) / 2H_0)$$



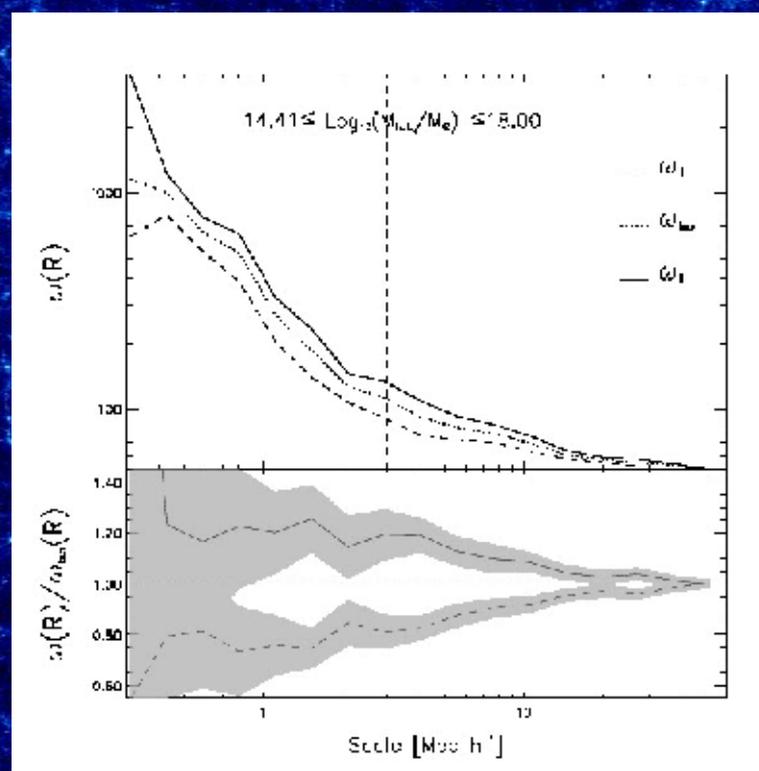
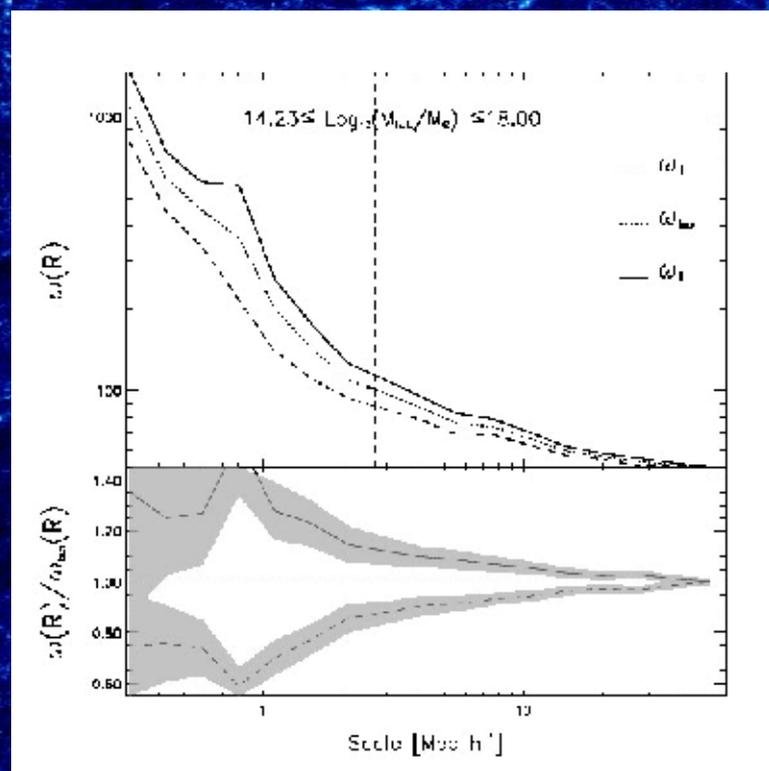
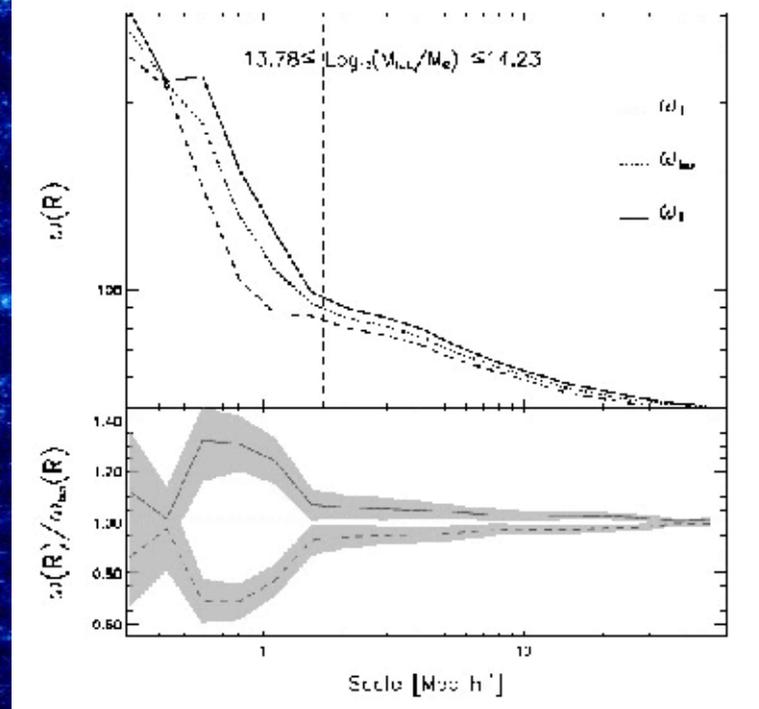
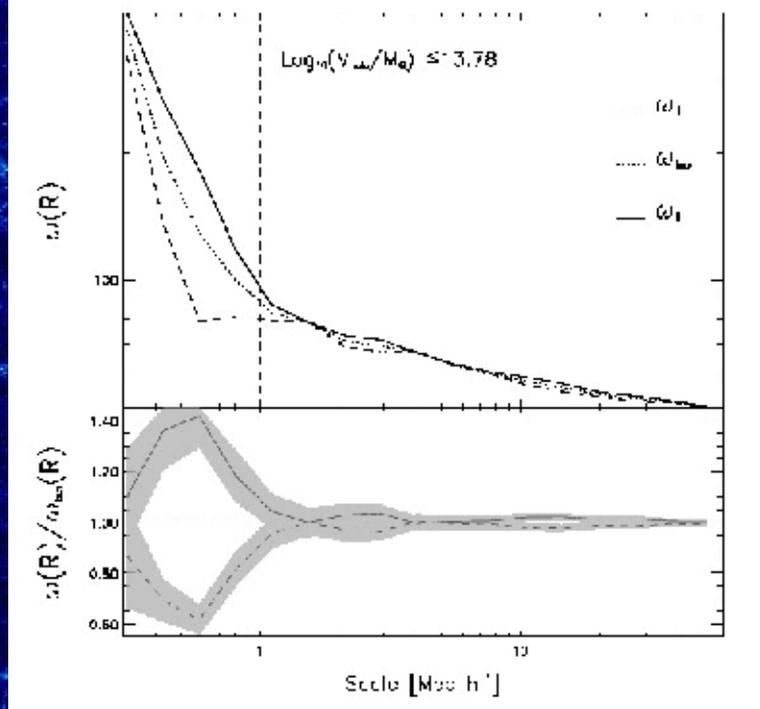
$$\bar{m}_{lim} = \frac{m_{lim}(\alpha_1, \delta_1) + m_{lim}(\alpha_2, \delta_2)}{2}$$

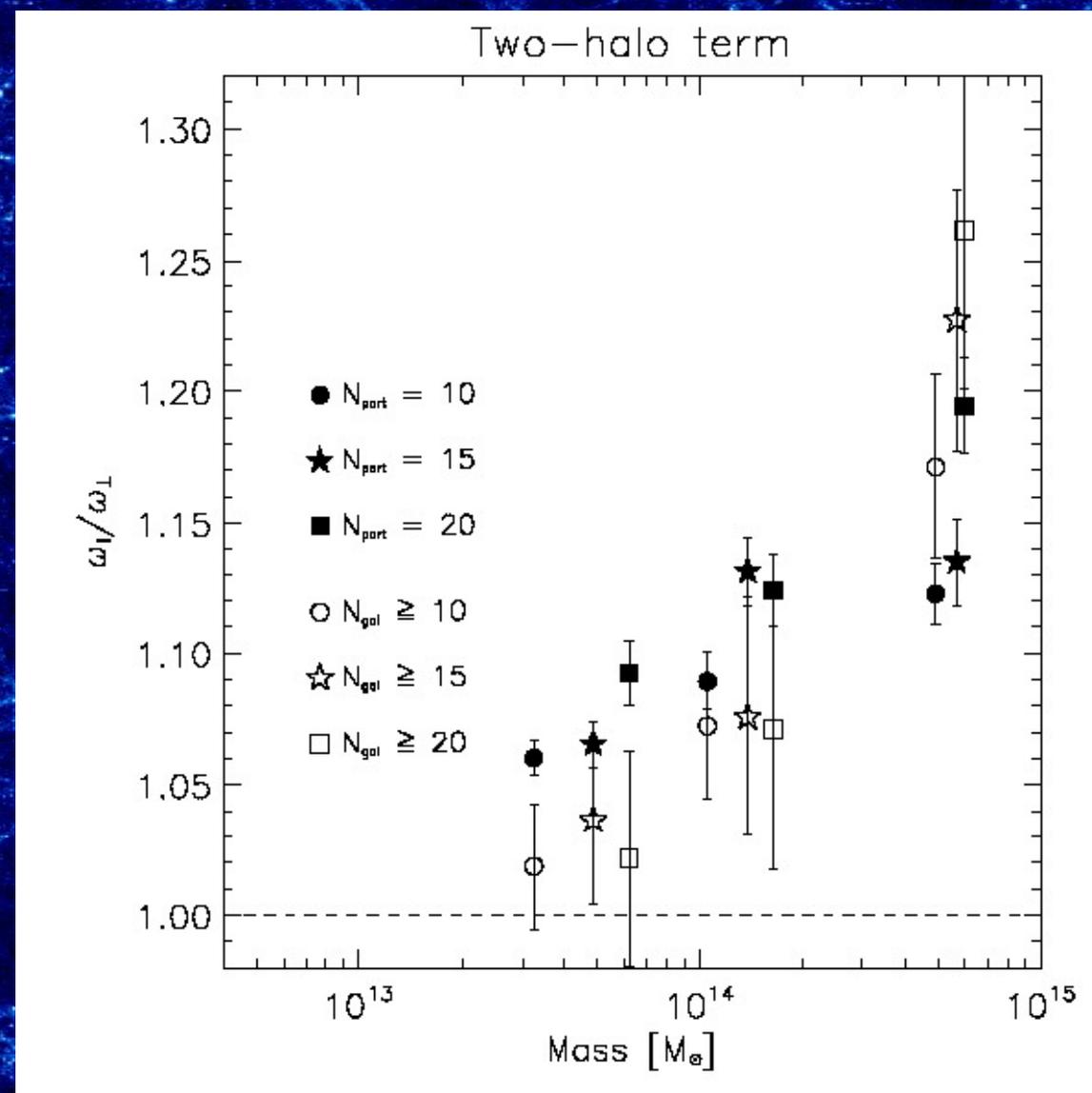
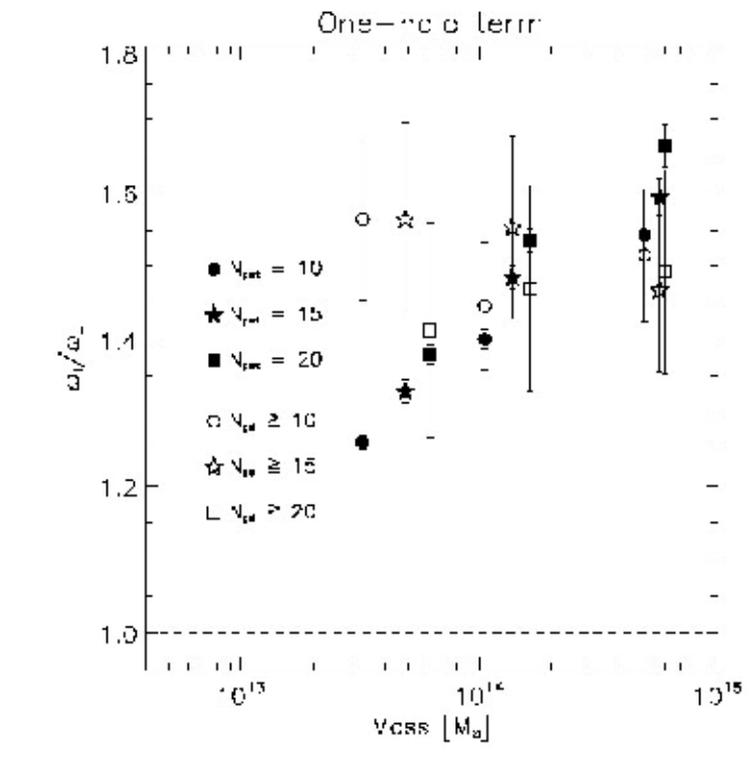
Método:

Resultado



Grupos SDSS Release 6





FIN