The 3-point function in large scale structure: redshift distortions and galaxy bias

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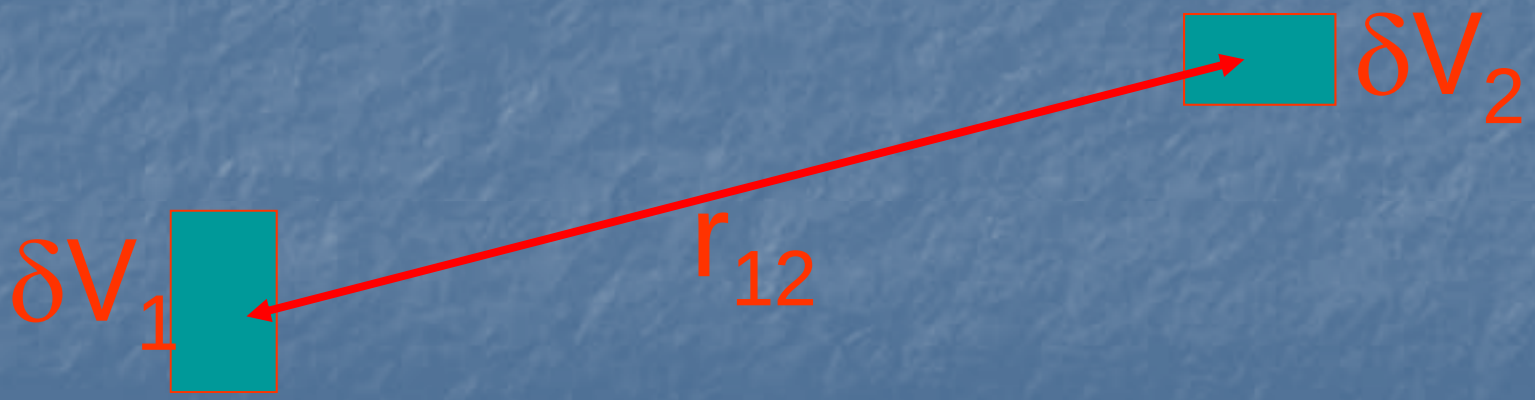
astro-ph/0501637

Definitions

- Two-point function:

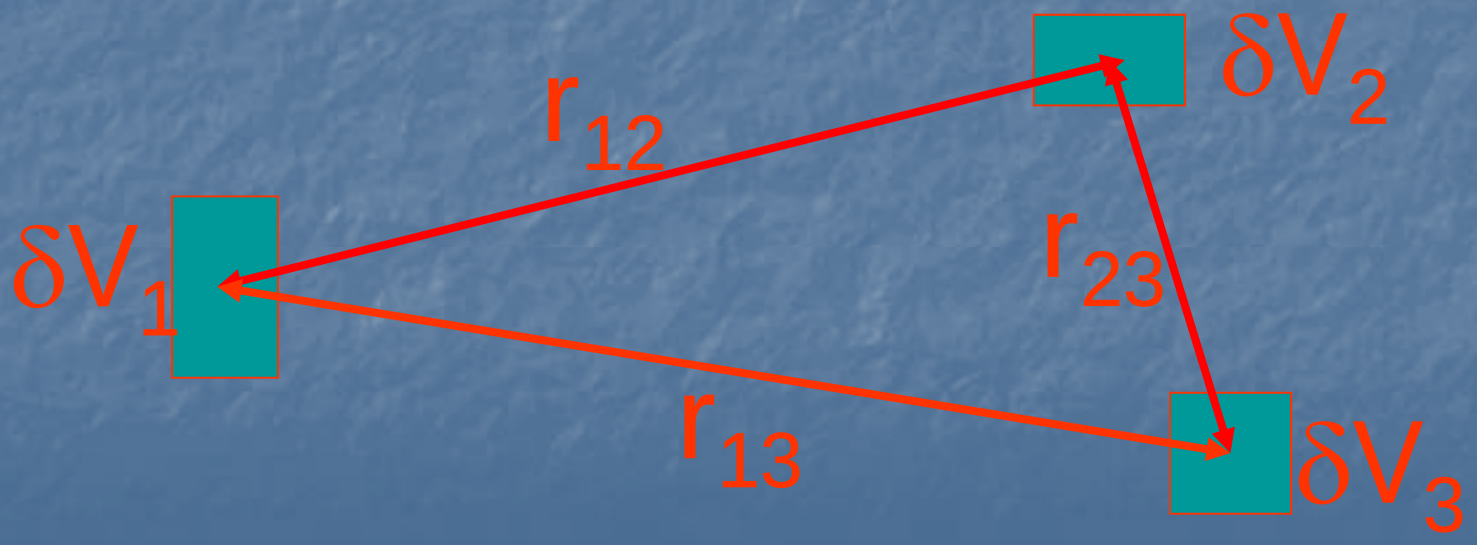
$$\delta P_2 = \bar{\rho}^2 \left[1 + \xi(r_{12})\right] \delta V_1 \delta V_2$$



Definitions

- Three-point function:

$$\delta P_3 = \bar{\rho}^3 \left[1 + \xi(r_{12}) + \xi(r_{23}) + \xi(r_{13}) + \zeta(r_{12}, r_{23}, r_{13})\right] \delta V_1 \delta V_2 \delta V_3$$



Definitions

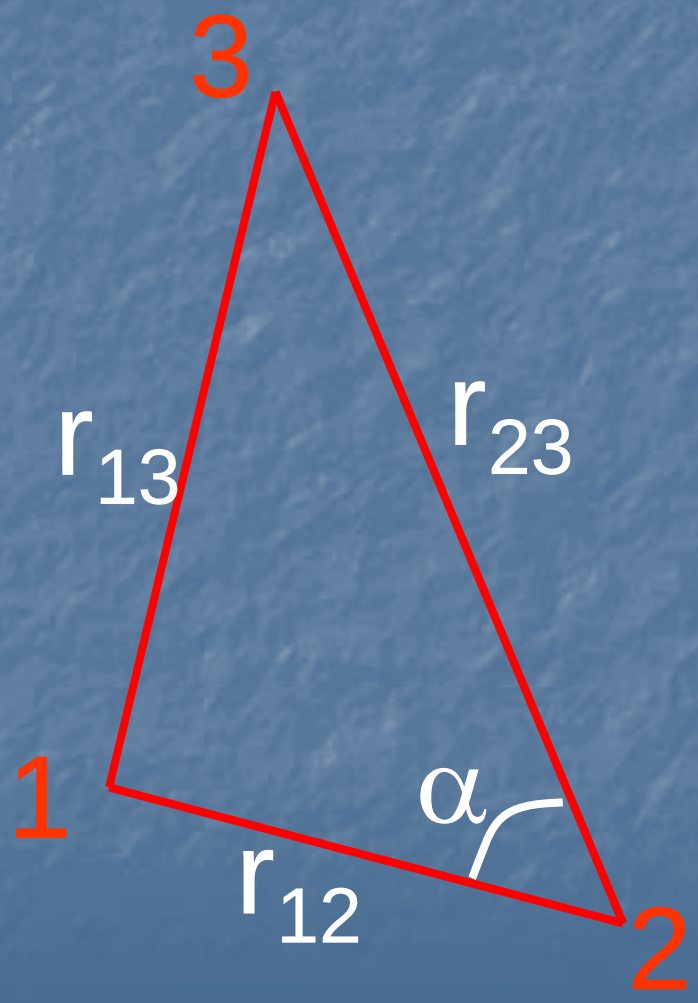
- Q_3 parameter (Groth & Peebles 1977):

$$Q_3 = \frac{\zeta(r_{12}, r_{23}, r_{13})}{\zeta_{\mathrm{H}}(r_{12}, r_{23}, r_{13})}$$

- Hierarchical 3-point function:

$$\zeta_{\mathrm{H}} = \xi(r_{12})\xi(r_{23}) + \xi(r_{12})\xi(r_{13}) + \xi(r_{23})\xi(r_{13})$$

Parametrizations

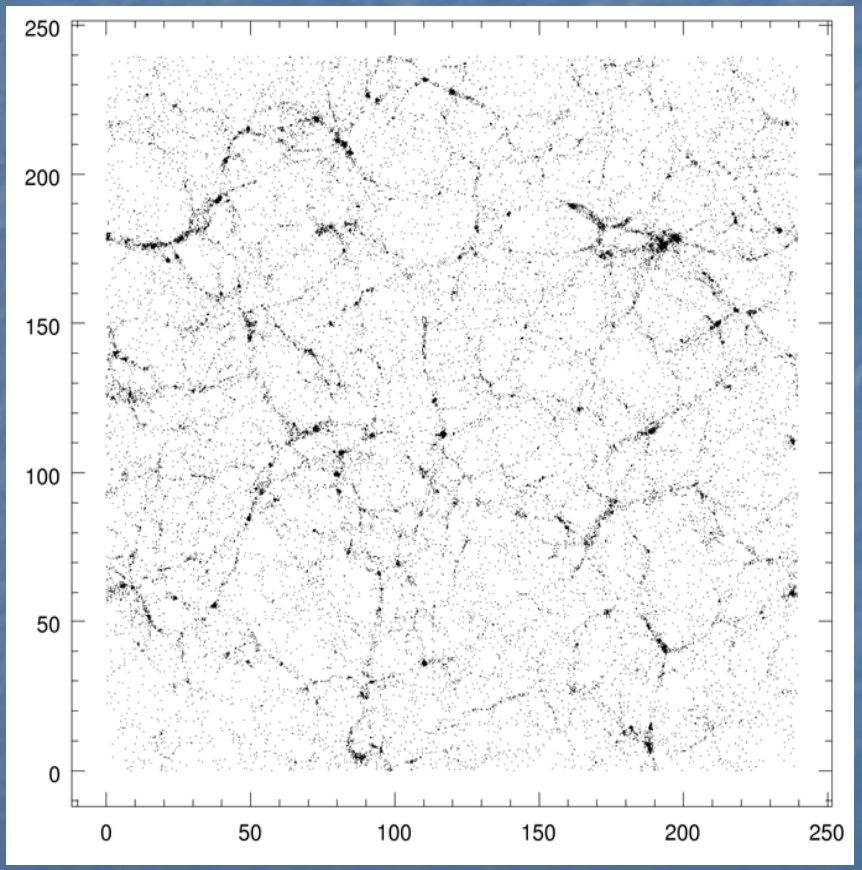


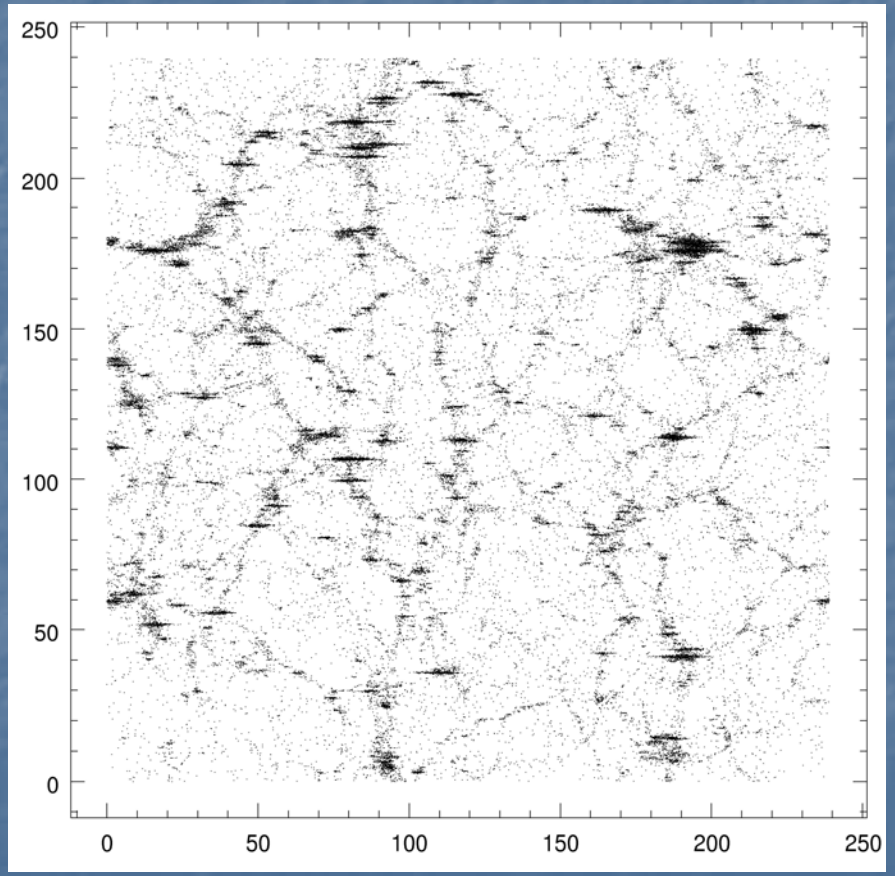
- (r_{12}, r_{23}, r_{13})
- (r_{12}, r_{23}, α)
- (r_{12}, u, v)

$$u = r_{23} / r_{12}$$

$$v = \frac{r_{31} - r_{23}}{r_{12}} = \sqrt{u^2 - 2u\cos\alpha + 1} - u$$

Redshift Space

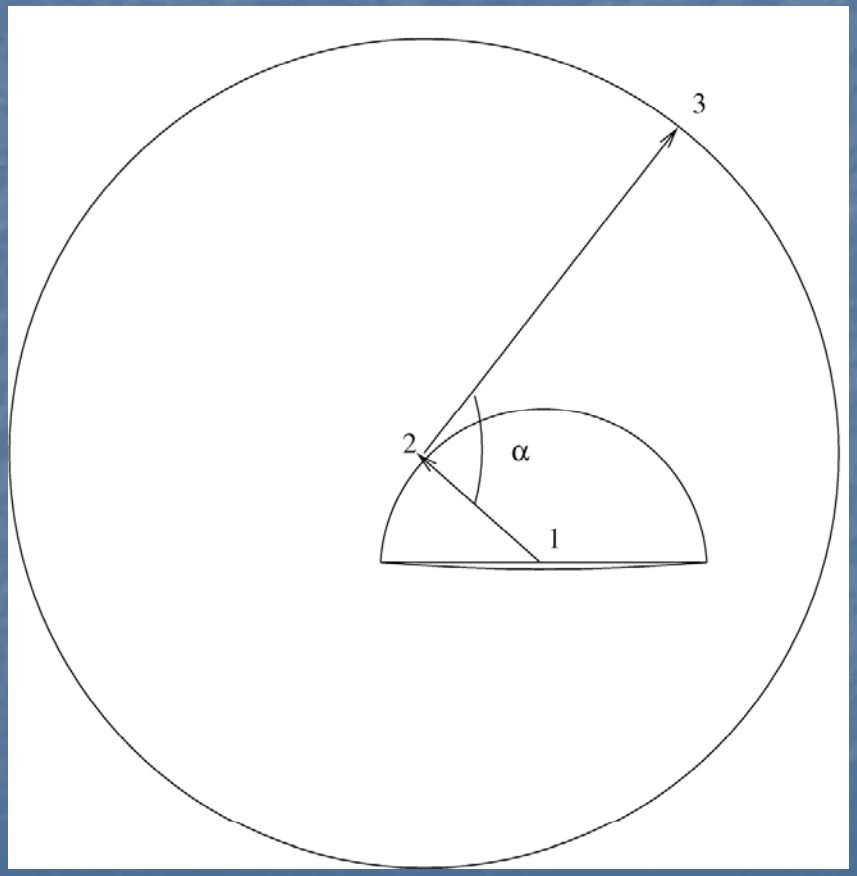




Algorithm

- Discretize simulation onto a lattice.
- Precalculate list of neighbours to any node on the lattice (within a spherical shell of some width).
- Count each pair only once (ordering not relevant).

Algorithm



- Sum over pairs in hemispherical shell.
- For each such pair, sum over pairs in spherical shell.

$$\xi(r_{12}) = \sum_{i,j} \delta_i \delta_j \Big/ \sum_{i,j} 1$$

$$\zeta(r_{12}, r_{23}, r_{13}) = \frac{\sum_{i,j,k} \delta_i \delta_j \delta_k}{\sum_{i,j,k} 1}$$