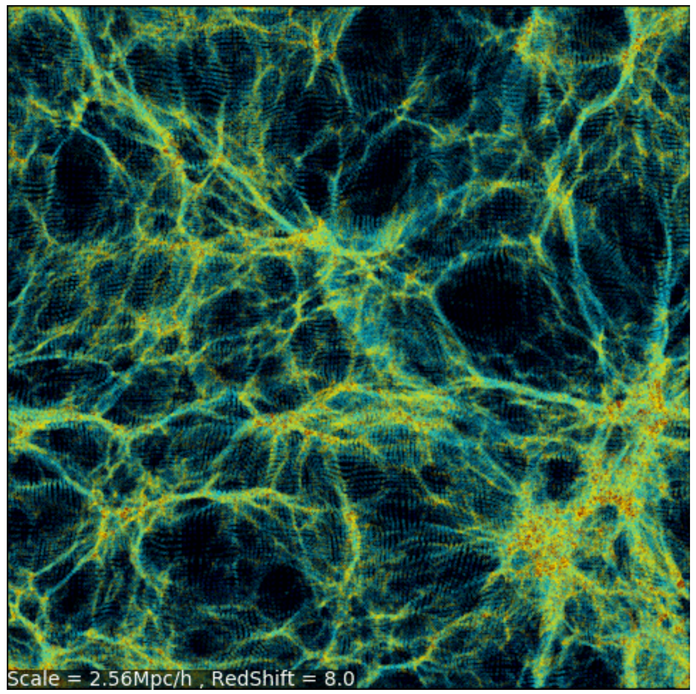
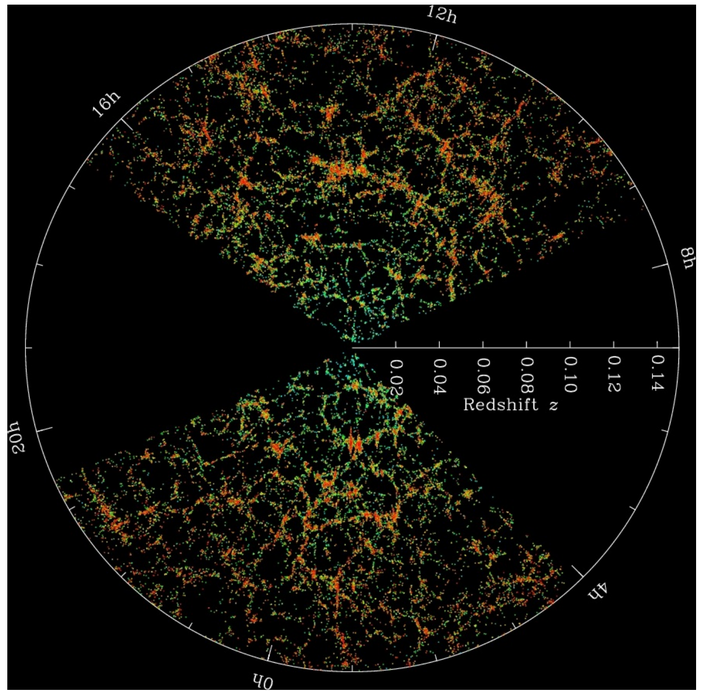
Large-Scale Structure

4. Zel'dovich approximation & Redshift Space Distortions

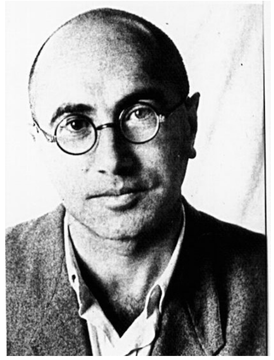




Aseem Paranjape

ICTP Summer School on Cosmology, July 2022

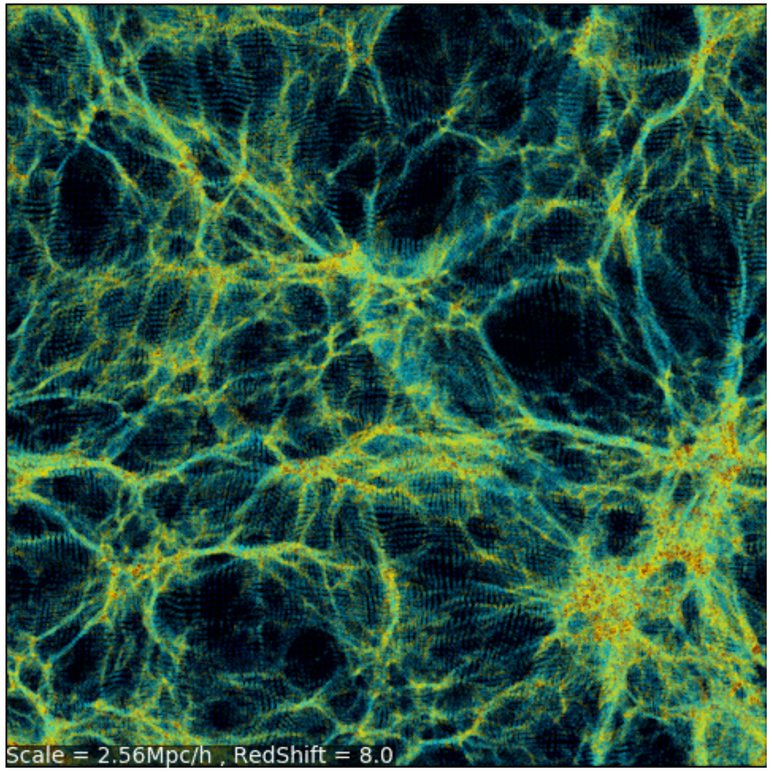
Zel'dovich Approximation (1970)



Ya. B. Zel'dovich

"Straight line motion"

$$\mathbf{v}(t, \mathbf{q}) = f(t)\, \nabla\psi(\mathbf{q})$$



determined by initial conditions

determined by linear perturbation theory
(~ dD_1/dt)

(Movie: courtesy Sujatha Ramakrishnan)

Redshift Space Distortions

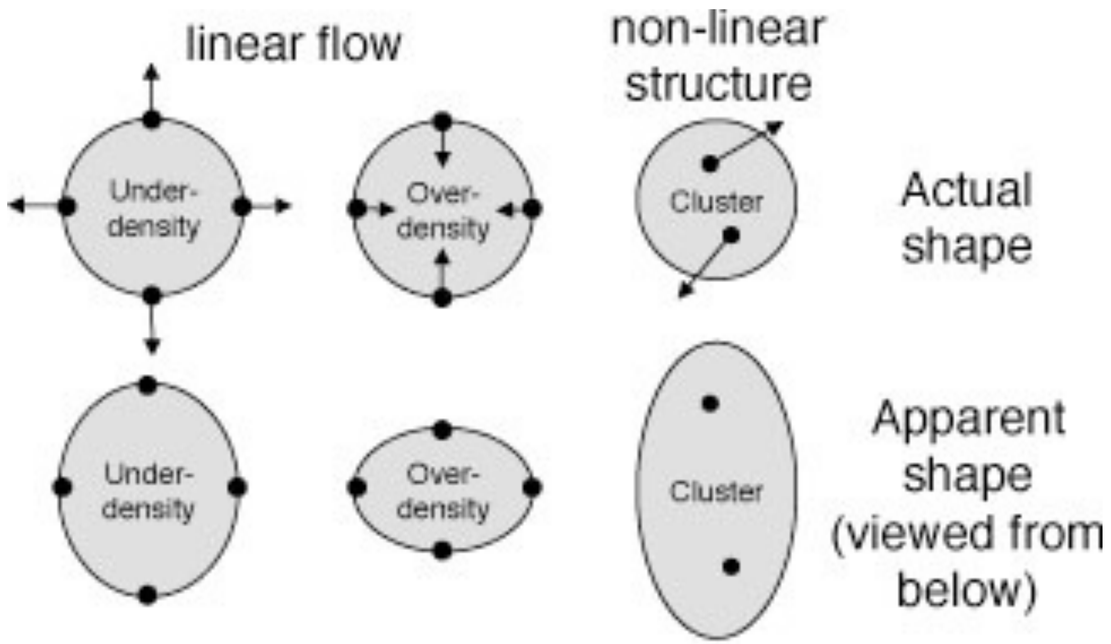


image courtesy: Percival (2013)

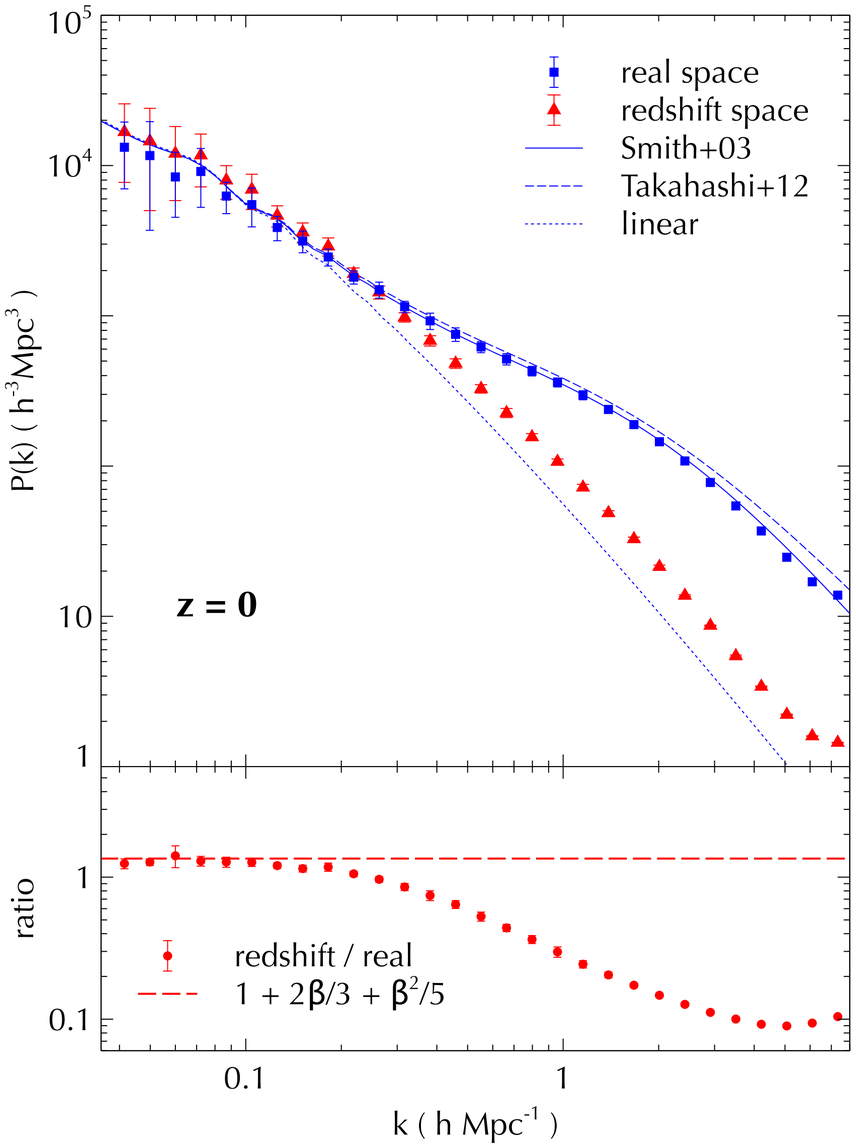
RSD: Linear Theory

Linear theory power spectrum in redshift space *[Kaiser 1987]*

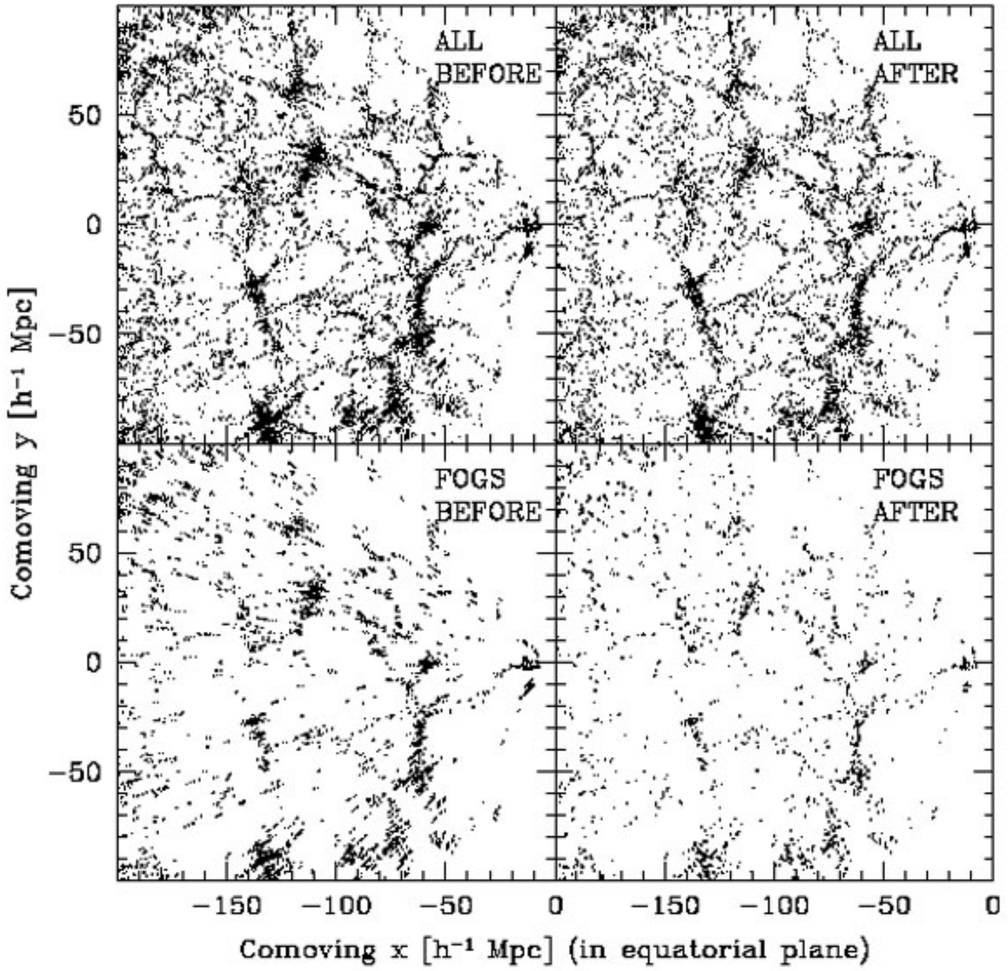
$$P_s(k,\mu) = \left(1 + f\mu^2\right)^2 P(k)$$

Averaging over angles,

$$P_s(k) = \left(1 + \frac{2}{3}f + \frac{1}{5}f^2\right) P(k)$$



Nonlinear effects: `Fingers-of-God'



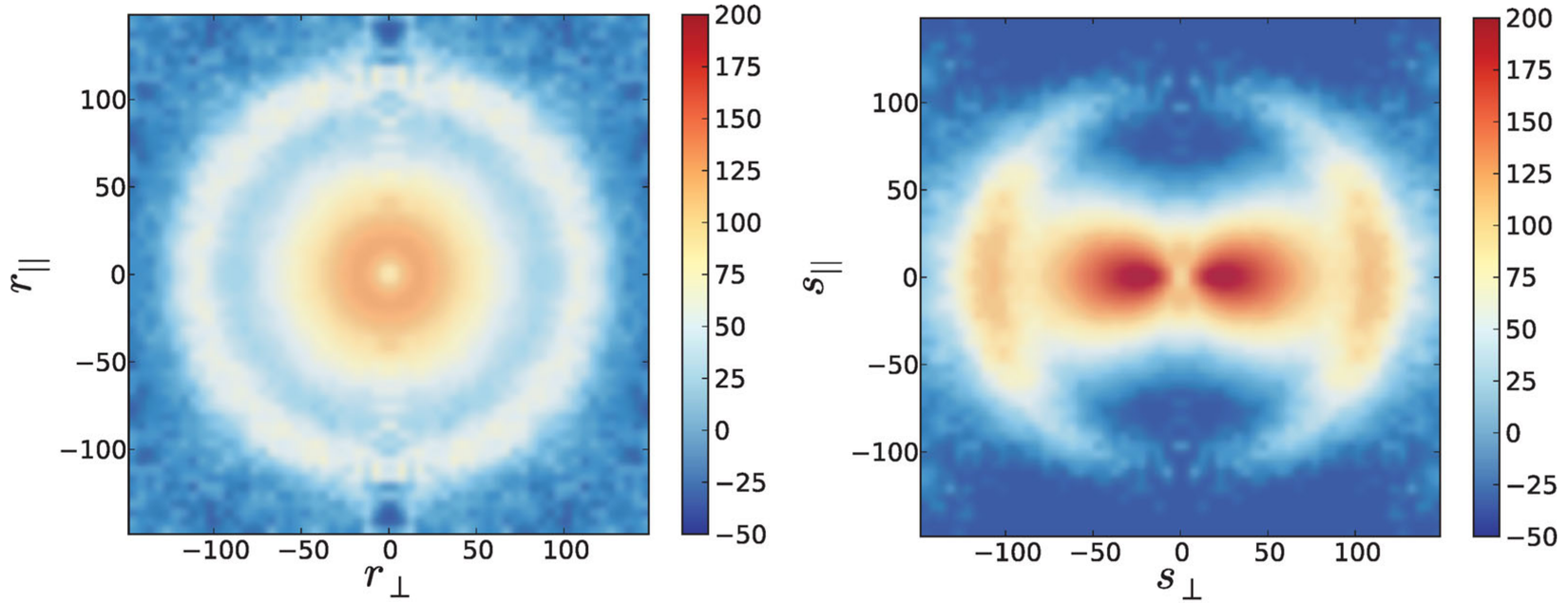
Tegmark+ (2004) [SDSS]

Anisotropic Correlation Function

Power spectrum, and hence correlation function, is anisotropic.

Anisotropy can be characterised in several ways. Common choices are:

- Multipole moments
- Dependence on $r_{||}$ and $r_{\perp}$
- Clustering wedges



Padmanabhan+ (2012) [LasDamas **SIMULATIONS***]*