THEORETICAL MODELS FOR THE GALAXY ANGULAR CORRELATION FUNCTION

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The spatial two point galaxy correlation function, $\xi(r)$, is, at present, the most useful statistic for comparing theoretical models to observational data. We have derived expressions for the dynamical evolution of ξ for structures arising from Gaussian initial conditions under the assumption that non-linear evolution may be described by the Zel'dovich approximation. The observed angular correlation function, $w(\theta)$, places constraints on the spectrum of initial fluctuations on large scales.

Dynamical evolution may be described by the Zel'dovich approximation—$\mathbf{x}(\mathbf{q},t) = \mathbf{q} - D(t)\mathbf{s}(\mathbf{q})$ where $\mathbf{q}$ and $\mathbf{x}$ are a particle's initial and final positions and $\mathbf{s} \propto \mathbf{v}_{peculiar}(\mathbf{q})$. We find

$$1 + \xi_{gZ} = \int d^3\mathbf{q}\, d^3\mathbf{s}\, \mathrm{P}(\mathbf{x}|\mathbf{q},\mathbf{s})\mathrm{P}(\mathbf{s}|\mathbf{q})\mathrm{P}(\mathbf{q}) \qquad (1)$$

The first probability is deterministic for the Zel'dovich approximation whilst the second is a Gaussian distribution. A similar result obtains for 'biassed' galaxy formation schemes.

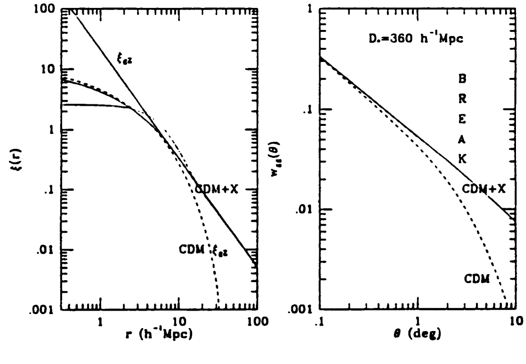

Figure 1. ξ_{gZ} for the biassed CDM spectrum and for a variant with extra large-scale power (+X) with the corresponding $w(\theta)$; D_* is the depth of the Shane–Wirtanen catalogue. The spectra are filtered at $3h^{-1}$ Mpc to ensure the validity of the Zel'dovich map by preventing excessive orbit crossing. Evolution on smaller scales is modeled by attaching a power-law as predicted by N-body simulations. The confirmation of the Groth–Peebles 3° break supports the standard CDM spectrum and seems to contradict the observed cluster-cluster correlation function. ($\Omega = 1$, $h = 0.5$.)

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