Cosmological Streaming Velocities & Large-Scale Density Maxima

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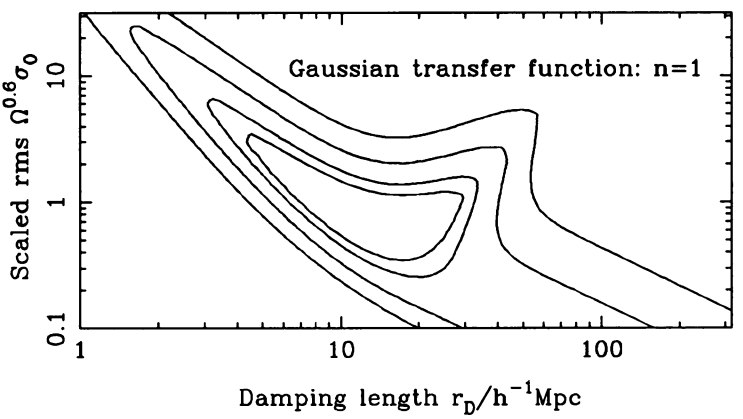
ABSTRACT. We consider the statistical testing of models for galaxy formation against the observed peculiar velocities on 10–100 Mpc scales (the Rubin–Ford effect). If we assume that observers are likely to be sited near maxima in the primordial field of density perturbations (Peacock & Heavens 1985: MNRAS 217, 805; Bardeen et al. 1986: Ap. J. 304, 15), then the observed filtered velocity field will be biased to low values by comparison with a point selected at random. The streaming-velocity data constrain models for galaxy formation with large-scale damping (adiabatic perturbations) to have a damping length close to the Rubin–Ford scale ($r_D \sim 20\ h^{-1}$ Mpc) and are mildly non-linear ($\Omega^{0.6}\ \sigma_o \sim 1$), where σ_o is the current fractional rms density variation. The Figure illustrates the regions of parameter space allowed at the 10,5,1 & 0.1 % levels; the results are nearly independent of n, the power index of the primordial spectrum. Thus, both purely baryonic universes and universes dominated by massive neutrinos can account for the observed velocities, provided $0.1 \lesssim \Omega \lesssim 1$. In particular, the canonical $\Omega = 1$ massive-neutrino model yields the required velocities quite naturally (in contradiction to the conclusion of Vittorio et al. 1986: Nature 323, 132), while not violating the constraints on the isotropy of the microwave background. For further details of this work, see Peacock, Lumsden & Heavens 1987: MNRAS in press.



J. Audouze et al. (eds.), Large Scale Structures of the Universe, 551.