Theory Seminar

Monday, April 20, 2009 2:10 PM 831 Pupin Hall

"Flow on 100 Mpc/h Scales and the Amplitude of Density Fluctuations in the Universe"

The bulk flow is a sensitive probe of matter density fluctuations on large scales. We introduce a new method of calculating bulk flow moments where velocities are weighted to give an optimal estimate of the bulk flow of an idealized survey, with the variance of the difference between the estimate and the actual flow being minimized. These ``minimum variance'' estimates can be designed to estimate the bulk flow on a particular scale with minimal sensitivity to small scale power, and are comparable between surveys. We compile all major peculiar velocity surveys and estimate the bulk flow on 100 Mpc/h scales to be ~400 km/s which indicates that there are significant density fluctuations on very large scales. The WMAP5-normalized LCDM cosmology, predicts a r.m.s. velocity of ~100 km/s. The discrepancy in the amplitude of cosmological density fluctuations is not confined only to large scales. The estimates of the fluctuations on 8 Mpc/h scales (sigma_8) also vary considerably between various probes. However, different estimators examine the value on different cosmological scales and do not take into account the nonlinear evolution of the parameter at late times. We show that estimates of the fluctuations amplitude derived from cosmic flows are systematically higher than those inferred at early epochs because of nonlinear evolution at later times. Here we derive corrections to the value of sigma_8 from both perturbation theory and numerical simulations and compare amplitudes after accounting for this effect.

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