U16a Intrinsic alignments of halo orientations with velocity field and the baryon acoustic oscillation features

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The kinematic Sunyaev-Zel'dovich effect enables us to directly probe the density-weighted velocity field up to very large cosmic scales. We investigate the effects of intrinsic alignments (IA) of dark-matter halo shapes on cosmic density and velocity fields on such large scales. In literature IA have been detected up to ~ 100 Mpc/h using the gravitational shear-intrinsic ellipticity (GI) correlation and the alignment correlation function. In this talk we introduce the corresponding various velocity statistics: the (density-weighted) velocity-intrinsic ellipticity (VI) correlation as well as the alignment pairwise infall momentum, momentum correlation function, and density-weighted pairwise velocity dispersion. We derive theoretical expressions for these velocity alignment statistics for the first time based on the assumption that the density fluctuation is a Gaussian random field. Using large-volume, high-resolution N-body simulations, we measure the alignment statistics of density and velocity fields. Behaviors of IA in the velocity statistics are similar to those in the density statistics, except that the halo orientations are aligned with the velocity field up to scales larger than those with the density field, $r \gg 100$ Mpc/h. We show that the detected IA of the velocity field can be well predicted by the linear alignment model. We also demonstrate that the baryon acoustic oscillation features can be detected in both the conventional and alignment velocity statistics. Our results indicate that observations of IA with the velocity field on large scales can provide additional information on cosmological models.