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We present our first attempt at understanding the dual impact of the large-scale density and velocity environment on the formation of very first astrophysical objects in the Universe. Following the recently developed quasi-linear perturbation theory on this effect, we introduce the publicly available initial condition generator of ours, BCCOMICS (Baryon Cold dark matter COsMological Inital Condition generator for Small scales), which provides so far the most self-consistent treatment of this physics beyond the usual linear perturbation theory. From a suite of uniform-grid simulations of N-body+hydro+BCCOMICS, we find that the formation of first astrophysical objects is strongly affected by both the density and velocity environment. Overdensity and streming-velocity (of baryon against cold dark matter) are found to give positive and negative impact on the formation of astrophysical objects, which we quantify in terms of various physical variables.

[구 CD-03] Current status of an interacting dark sector with cosmological observations

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The cosmic dark sector, composed of dark energy and dark matter, might be coupled, and hence mediate a fifth-force which gives rise to distinctive cosmological signatures. I will consider an interacting dark sector, in which dark energy and dark matter are coupled via specific well-motivated coupling functions. After an overview of these coupled dark energy models, I will discuss the current model parameter constraints derived from the latest cosmological observations which probe the expansion history, and the growth of cosmic structures of our Universe. Moreover, I will demonstrate how different measurements of the Hubble constant, including the GW170817 measurement, influence the inferred constraints on the dark coupling. I will further discuss how one could put tighter constraints on such a dark sector coupling with the upcoming large-scale radio surveys.

[구 CD-04] Cosmological Parameter Estimation from the Topology of Large Scale Structure

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The genus of the matter density eld, as traced by galaxies, contains information regarding the nature of dark energy and the fraction of dark matter in the Universe. In particular, this topological measure is a statistic that provides a clean measurement of the shape of the linear matter power spectrum. As the genus is a topological quantity, it is insensitive to galaxy bias and gravitational collapse. Furthermore, as it traces the linear matter power spectrum, it is a conserved quantity with redshift. Hence the genus amplitude is a standard population that can be used to test the distance-redshift relation. In this talk, I present measurements of the genus extracted from the SDSS DR7 LRGs in the local Universe, and also slices of the BOSS DR12 data at higher redshift.

I show how these combined measurements can be used to place cosmological parameter constraints on m, wde.

[구 CD-05] A Deep Convolutional Neural Network approach to Large Scale Structure

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Recent work by Ravanbakhsh et al. (2017), Mathuriya et al. (2018) showed that convolutional neural networks (CNN) can be trained to predict cosmological parameters from the visual shape of the large scale structure, i.e. the filaments, clusters and voids of the cosmic density field. These preliminary works used the dark matter density field at redshift zero. We build upon these works by considering realistic mock galaxy catalogues that mimic true observations. We construct light-cones that span the redshift range appropriate for current and near future cosmological surveys such as LSST, EUCLID, WFIRST etc.

In summary, we propose a novel multi-image input CNN to track the evolution in the morphology of large scale structures over cosmic time to constrain cosmology and the expansion history of the Universe.

[구 CD-06] Matter Density Distribution Reconstruction of Local Universe with Deep Learning

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