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] Falsifying LCDM: model-independent tests of the concordance model of cosmology

Benjamin L'Huillier
Korea Astronomy & Space Science Institute

The concordance LCDM model has been very successful at reproducing a wide range of observations.

However, the nature of its main components, such as dark energy, dark matter, and inflation, are still unkown.

Therefore, it is of prime importance to question the underlying hypotheses of the model and tests there prediction.

While most constraints have been obtained assuming a LCDM universe, model-independent approaches, which do not make assumptions regarding the model, are a powerful approach.

To falsify the LCDM model, I applied model-indepedent methods to the latests available data to test different aspects of the concordance model, such as the FLRW metric, the curvature, dark energy as the cosmological constant, and gravity as general relativity.

The Universe is consistent with flat-LCDM with GR. However, at z>1, tensions start to appear, and more data are required.

[구 CD-04] Cosmological constraints using BAO - From spectroscopic to photometric catalogues

Srivatsan Sridhar
Korea Astronomy and Space Science Institute

Measurement of the location of the baryon acoustic oscillation (BAO) feature in the clustering of galaxies has proven to be a robust and precise method to measure the expansion of the Universe. The best constraints so far have been provided from spectroscopic surveys because the errors on the redshift obtained from spectroscopy are minimal. This in turn means that the errors along the line-of-sight are reduced and so one can expect constraints on both angular diameter distance D_A and expansion rate H^{-1}.

But, future surveys will probe a larger part of the sky and go to deeper redshifts, which correspond to more number of galaxies. Analysing each galaxy using spectroscopy, which is a time consuming task, will not be practically possible. So, photometry will be the most convenient way to measure redshifts for future surveys such as LSST, Euclid, etc. The advantage of photometry is measuring the redshift of vast number of galaxies in a single exposure, but the disadvantage are the errors associated with the measured redshifts.

Using a wedge approach, wherein the clustering is split into different wedges along the line-of-sight π and across the line-of-sight σ, we show that the BAO information can be recovered even for photometric catalogues with errors along the line-of-sight. This means that we can get cosmological distance constraints even if we don't have spectroscopic information.

[구 CD-05] H1R4: Mock 21cm intensity mapping maps for cross-correlations with optical surveys

Jacobo Asorey
Korea Astronomy and Space Science Institute

We are currently living in the era of the wide field cosmological surveys, either spectroscopic such as Dark Energy Spectrograph Instrument or photometric such as the Dark Energy Survey or the Large Synoptic Survey Telescope. By analyzing the distribution of matter clustering, we can use the growth of structure, in combination with measurements of the expansion of the Universe, to understand dark energy or to test different models of gravity. But we also live in the era of multi-tracer or multi-messenger astrophysics. In particular, during the next decades radio surveys will map the matter distribution at higher redshifts. Like in optical surveys, there are radio imaging surveys such as continuum radio surveys such as the ongoing EMU or spectroscopic by measuring the hydrogen 21cm line. However, we can also use intensity mapping as a low resolution spectroscopic technique in which we use the intensity given by the emission from neutral hydrogen from patches of the sky, at different redshifts. By cross-correlating this maps with galaxy catalogues we can improve our constraints on cosmological parameters and to understand better how neutral hydrogen populates different types of galaxies and haloes. Creating realistic mock intensity mapping