우주론/암흑물질

[구 CD-01] Cosmic Dawn III: Simulating the Reionization of the Local Group

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Cosmic Dawn III (CoDa III) is the last of the series of simulations of the reionization of the Local Group, the galaxy cluster including the Milky Way and the M31. The simulation is based on the constrained initial condition, N-body and hydrodynamic simulation of structure formation, modelling of galaxy formation, calculation of radiation transfer, and calibration against the observed high-redshift galaxy luminosity function. We present various physical properties we observed and important lessons that could stimulate future observations.

[구 CD-02] The clustering of critical points in the evolving cosmic web

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Focusing on both small separations and baryonic acoustic oscillation scales, the cosmic evolution of the clustering properties of peak, void, wall, and filament-type critical points is measured using two-point correlation functions in ΛCDM dark matter simulations as a function of their relative rarity. A qualitative comparison to the corresponding theory for Gaussian random fields allows us to understand the following observed features: (i) the appearance of an exclusion zone at small separation, whose size depends both on rarity and signature (i.e. the number of negative eigenvalues) of the critical points involved; (ii) the amplification of the baryonic acoustic oscillation bump with rarity and its reversal for cross-correlations involving negatively biased critical points; (iii) the orientation-dependent small-separation divergence of the cross-correlations of peaks and filaments (respectively voids and walls) that reflects the relative loci of such points in the filament's (respectively wall's) eigenframe. The (cross-) correlations involving the most non-linear critical points (peaks, voids) display significant variation with redshift, while those involving less non-linear critical points seem mostly insensitive to redshift evolution, which should prove advantageous to model. The ratios of distances to the maxima of the peak-to-wall and peak-to-void over that of the peak-to-filament cross-correlation are ~2-√~2 and ~3-√~3, respectively, which could be interpreted as the cosmic crystal being on average close to a cubic lattice. The insensitivity to redshift evolution suggests that the absolute and relative clustering of critical points could become a topologically robust alternative to standard clustering techniques when analysing upcoming surveys such as Euclid or Large Synoptic Survey Telescope (LSST).

[구 CD-03] Testing LCDM with eBOSS / SDSS

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In this talk I will review recent progress that the SDSS-IV / eBOSS collaboration has made in constraining cosmology from the clustering of galaxies, quasars and the Lyman-alpha forest. The SDSS-IV / eBOSS collaboration has measured the baryon acoustic oscillation (BAO) and redshift space distortion (RSD) features in the correlation function in redshift bins from z~0.15 to z~2.33. These features constitute measurements of angular diameter distances, Hubble distances, and growth rate measurements. A number of consistency tests have been performed between the BAO and RSD datasets and additional cosmological datasets such as the Planck cosmic microwave background constraints, the Pantheon Type Ia supernova compilation, and the weak lensing results from the Dark Energy Survey. Taken together, these joint constraints all point to a broad consistency with the standard model of cosmology LCDM + GR, though they remain in tension with local measurements of the Hubble parameter.

[구 CD-04] Be it unresolved: Measuring time delays from unresolved light curves

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Gravitationally lensed Type Ia supernovae may be the next frontier in cosmic probes, able to deliver independent constraints on dark energy, spatial curvature, and the Hubble constant. Measurements of time delays between the multiple images become more incisive due to the standardized candle nature of the source, monitoring for months rather than years, and partial immunity to microlensing. While currently extremely rare, hundreds of such systems should be detected by upcoming time-domain surveys. Others will have the images spatially unresolved, with the observed lightcurve a superposition of time delayed image fluxes. We investigate whether unresolved images can be recognized as lensed sources given only lightcurve information and whether time delays can be extracted robustly.

We develop a method that we show can identify these systems for the case of lensed Type Ia supernovae with two images and time delays exceeding ten days. When tested on such an ensemble the method achieves a false positive rate of $\lesssim$5%, and measures the time delays with the completeness of $\gtrsim$93% and with a bias of $\lesssim$0.5% for time delay $\gtrsim$10 days. Since the method does not assume a template of any particular type of SN, the method has the potential to work on other types of lensed SNe systems and possibly on other transients.

[구 CD-05] Accurate application of Gaussian process regression for cosmology

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Gaussian process regression (GPR) is a powerful method used for model-independent analysis of cosmological observations. In GPR, it is important to decide an input mean function and hyperparameters that affect the reconstruction results. Depending on how the input mean function and hyperparameters are determined in the literature, I divide into four main applications for GPR and compare their results.

In particular, a zero mean function is commonly used as an input mean function, which may be inappropriate for reconstructing cosmological observations such as the distance modulus. Using mock data based on Pantheon compilation of type Ia supernovae, I will point out the problem of using a zero input and suggest a new way to deal with the input mean function.

[구 CD-06] Comparing Bayesian model selection with a frequentist approach using iterative method of smoothing residuals

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We have developed a frequentist approach for model selection which determines consistency of a cosmological model and the data using the distribution of likelihoods from the iterative smoothing method. Using this approach, we have shown how confidently we can distinguish different models without comparison with one another. In this current work, we compare our approach with conventional Bayesian approach based on estimation of Bayesian evidence using nested sampling for the purpose of model selection. We use simulated future Roman (formerly WFIRST)-like type Ia supernovae data in our analysis. We discuss limits of the Bayesian approach for model selection and display how our proposed frequentist approach, if implemented appropriately, can perform better in falsification of individual models.

특별세션-소형망원경네트워크

[구 STN-01] orean Small Telescope Network (소형망원경 네트워크, 소망넷)

Myungshin Im[1], Yonggi Kim[2,3], Wonseok Kang[4], Chung-Uk Lee[5], Heewon Lee[6], Soojong Pak[7], Hyunjin Shim[7], Hyun-Il Sung[5], Taewoo Kim[4], Seong-Kook J. Lee[1], Gu Lim[1], Gregory S.-H. Paek[1], Jinguk Seo[1], Joh-Na Yoon[3], Dohyeong Kim[8] and SomangNet team
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SomangNet is a project that started in 2020 with a network of ten 0.4 to 1.0 m telescopes owned by Korean institutes. By coordinating observations with multiple facilities around the world, we hope to maximize the usefulness of small telescopes which are still competitive for carrying out time-domain astronomy projects. In this talk, we will give an overview of the project, outlining SomangNet facilities, its organization, and current science projects. We hope to open SomangNet for common use in 2021B, and we will present our plan regarding the use of SomangNet.