[포 CD-03] Graph Database Solution for Higher Order Spatial Statistics in the Era of Big Data

Cristiano G. Sabiu[1], Juhan Kim[2]
[1]*Yonsei University, Department of Astronomy*
[2]*Korea Institute for Advanced Study, Center for Advanced Computation*

We present an algorithm for the fast computation of the general N-point spatial correlation functions of any discrete point set embedded within an Euclidean space of ℝn. Utilizing the concepts of kd-trees and graph databases, we describe how to count all possible N-tuples in binned configurations within a given length scale, e.g. all pairs of points or all triplets of points with side lengths < rmax. Through benchmarking we show the computational advantage of our new graph-based algorithm over more traditional methods. We show that all 3-point configurations up to and beyond the Baryon Acoustic Oscillation scale (~200 Mpc in physical units) can be performed on current Sloan Digital Sky Survey (SDSS) data in reasonable time. Finally we present the first measurements of the 4-point correlation function of ~0.5 million SDSS galaxies over the redshift range 0.43< z <0.7.

We present the publicly available code GRAMSCI (GRAph Made Statistics for Cosmological Information; bitbucket.org/csabiu/gramsci), under a GNU General Public License.

[포 CD-04] The Joint analysis of galaxy clustering and weak lensing from the Deep Lens Survey to constrain cosmology and baryonic feedback

Mijin Yoon[1] (윤미진), M. James Jee[1,2] (지명국), and J. Tony Tyson[2]
[1]*Yonsei University (연세대학교)* [2]*University of California, Davis*

Based on three types of 2-point statistics (galaxy clustering, galaxy-galaxy lensing, and cosmic shear power spectra) from the Deep Lens Survey (DLS), we constrain cosmology and baryonic feedback. The DLS is a deep survey, so-called a precursor to LSST, reaching down to ~27th magnitude in BVRz' over 20 deg2. To measure the three power spectra, we choose two lens galaxy populations centered at z ~0.27 and 0.54 and two source galaxy populations centered at z ~0.64 and 1.1, with more than 1 million galaxies.

We perform a number of consistency tests to confirm the reliability of the measurements. We calibrated photo-z estimation of the lens galaxies and validated the result with galaxy cross-correlation measurement. The B-mode signals, indicative of potential systematics, are found to be consistent with zero. The two cosmological results independently obtained from the cosmic shear and the galaxy clustering + galaxy-galaxy lensing measurements agree well with each other. Also, we verify that cosmological results between bright and faint sources are consistent.

While there exist some weak lensing surveys showing a tension with Planck, the DLS constraint on S8 agrees nicely with the Planck result. Using the HMcode approach derived from the OWLS simulation, we constrain the strength of baryonic feedback. The DLS results hint at the possibility that the actual AGN feedback may be stronger than the one implemented in the current state-of-the-art simulations.

[포 CD-05] Detection of Intrinsic Spin Alignments in Isolated Spiral Pairs

Hanwool Koo[1,2], Jounghun Lee[3]
[1]*Korea Astronomy and Space Science Institute,*
[2]*University of Science and Technology (Korea),*
[3]*Seoul National University*

Observational evidence for intrinsic galaxy alignments in isolated spiral pairs is presented. From the catalog of the galaxy groups identified by Tempel et al. in the flux-limited galaxy sample of the Sloan Digital Sky Survey Data Release 10, we select those groups consisting only of two spiral galaxies as isolated spiral pairs and investigate if and how strongly the spin axes of their two spiral members are aligned with each other. We detect a clear signal of intrinsic spin alignment in isolated spiral pairs, which leads to the rejection of the null hypothesis at the 99.9999% confidence level via the Rayleigh test. It is also found that those isolated pairs comprising two early-type spiral galaxies exhibit the strongest signal of intrinsic spin alignment and that the strength of the alignment signal depends on the angular separation distance as well as on the luminosity ratio of the member galaxies. Using the dark matter halos consisting of only two subhalos resolved in the EAGLE hydrodynamic simulations, we repeat the same analysis but fail to find any alignment tendency between the spin angular momentum vectors of the stellar components of the subhalos, which is in tension with the observational result. Several possible sources of this apparent inconsistency between the observational and the numerical results are discussed.

[포 CD-06] Cosmology in UOS: Case with

SDSS galaxy sample and cosmological simulations

Sungwook E. Hong[1], Inkyu Park[1], Hyunmo Gu[1], Jua Kim[1], Yungi Kwon[1], Hannah Ji[1]
[1]*University of Seoul*

We introduce a newly established cosmology research group at the University of Seoul. We also present our recent progress with SDSS Main Galaxy samples and various types of cosmological simulations as follows: (1) A hint for the periodicity of very large-scale structures is found in both SDSS observation and the Horizon Run 4 (HR4) simulation. (2) New galaxy clustering and void finding algorithms, which are thought to be sensitive to the topological shape of galaxy distribution, are developed and tested in both SDSS and HR4 data. (3) Properties such as radial distribution of galaxies or cosmological shock waves are studied in hydrodynamic simulations.

특별세션 KMTNet

[포 KMT-01] Spin and 3D shape model of Mars-crossing asteroid (2078) Nanking

Dong-Heun Kim[1,2], Jung-Yong Choi[3], Myung-Jin Kim[2], Hee-Jae Lee[1,2], Hong-Kyu Moon[2], Yong-Jun Choi[2,4], Yonggi Kim[1]
[1]*Department of Astronomy and Space Science, Chungbuk National University,* [2]*Korea Astronomy and Space Science Institute,* [3]*Ilsan Astrocamp,* [4]*University of Science and Technology.*

Photometric investigations of asteroids allow us to determine their rotation states and shape models (Apostolovska et al. 2014). Our main target, asteroid (2078) Nanking's perihelion distance (q) is 1.480 AU, which belongs to the Mars-crossing asteroid (1.3 < q < 1.66 AU). Mars-crossing asteroids are objects that cross the orbit of Mars and regarded as one of the primary sources of near-Earth asteroids due to the unstable nature of their orbits. We present the analysis of the spin parameters and 3D shape model of (2078) Nanking. We conducted Cousins_R-band time-series photometry of this asteroid from November 26, 2014 to January 17, 2015 at the Sobaeksan Optical Astronomy Observatory (SOAO) and for 25 nights from March to April 2016 using the Korea Microlensing Telescope Network (KMTNet) to reconstruct its physical model with our dense photometric datasets. Using the lightcurve inversion method (Kaasalainen & Torppa 2001; Kaasalainen et al. 2001), we determine the pole orientation and shape model of this object based on our lightcurves along with the archival data obtained from the literatures. We derived rotational period of 6.461 h, the preliminary ecliptic longitude (λ_p) and latitude (β_p) of its pole as $\lambda_p \sim 8^\circ$ and $\beta_p \sim -52^\circ$ which indicates a retrograde rotation of the body. From the apparent W UMa-shaped lightcurve and its location in the rotation frequency-amplitude plot of Sheppard and Jewitt (2004), we suspect the contact binary nature of the body (Choi 2016).

[포 KMT-02] Searching for Dwarf Galaxies in deep images of NGC 1291 obtained with KMTNet

Woowon Byun[1,2], Minjin Kim[1,3], Yun-Kyeong Sheen[1], Hong Soo Park[1], Luis C. Ho[4,5], Joon Hyeop Lee[1,2], Hyunjin Jeong[1], Sang Chul Kim[1,2], Byeong-Gon Park[1,2], Kwang-Il Seon[1,2], Jongwan Ko[1,2]
[1]*Korea Astronomy and Space Science Institute,* [2]*University of Science and Technology, Korea,* [3]*Kyungpook National University,* [4]*Kavli Institute for Astronomy and Astrophysics, China,* [5]*Department of Astronomy, School of Physicys, Peking University, China*

We present newly discovered dwarf galaxy candidates in deep wide-field images of NGC 1291 obtained with KMTNet. We initially identify 20 dwarf galaxy candidates through visual inspection. 13 out of 20 appears to be high priority candidates, according to their central surface brightness ($\mu_{0,R}$ ~ 22.5 to 26.5 mag arcsec^{-2}) and effective radii (350 pc to 1 kpc). Structural and photometric properties of dwarf candidates appear to be consistent with those of ordinary dwarf galaxies in nearby groups and clusters. Using imaging simulations, we demonstrate that our imaging data is complete up to 26 mag arcsec^{-2} with > 70% of the completeness rate. In order to find an optimal way to automate detecting dwarf galaxies in our dataset, we test detection methods by varying parameters in *SExtractor*. We find that the detection efficiency from the automated method is relatively low and the contamination due to the artifacts is non-negligible. Therefore, it can be only applicable for pre-selection. We plan to conduct the same analysis for deep images of other nearby galaxies obtained through KMTNet Nearby Galaxy Survey (KNGS).