investigate the topological structures of five different multiverses produced by cosmological n-body simulations with various cosmological initial conditions: (1) one standard universe, (2) two different dark energy states, and (3) two different dark matter densities.

For the Big Data calculations, we use a custom build of stand-alone Spark cluster at KIAS and Dataproc Compute Engine in Google Cloud Platform with the sample sizes ranging from 7 millions to 200 millions.

Among many graph statistics, we find that three simple graph measurements, denoted by (1) $n_\k$, (2) τ_Δ, and (3) $n_{S\ge5}$, can efficiently discern different topology in discrete point distributions. We denote this set of three graph diagnostics by kT5+.

These kT5+ statistics provide a quick look of various orders of n-points correlation functions in a computationally cheap way: (1) $n = 2$ by n_k, (2) $n = 3$ by τ_Δ, and (3) $n \ge 5$ by $n_{S\ge5}$.

[구 GC-18] Making the Invisible Visible: Dark Matter Mapping of the Merging Galaxy Cluster ZwCl 1447.2+2619 via Weak Lensing

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ZwCL 1447.2+2619 is a merging galaxy cluster at z=0.37 with clear substructures in X-ray emission and galaxy distribution. In addition, the system possesses distinct radio relics. In order to constrain the merger scenario, it is necessary to measure both the distribution and mass of the cluster dark matter. We perform a weak lensing analysis of ZwCL 1447.2+2619 using Subaru imaging data. After carefully addressing instrumental systematics, we detect significant lensing signals. In this talk, our methodology, weak lensing results, and possible merging scenarios will be presented.

[구 GC-19] A redshift survey of the nearby galaxy cluster Abell 2107: Global rotation of the cluster and its connection to large-scale structures in the universe

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We present the results from a spectroscopic survey of the nearby galaxy cluster Abell 2107 at z=0.04 that has been known as a rotating cluster. By combining 978 new redshifts from the MMT/Hectospec observations with the data in the literature, we construct a large sample of 1968 galaxies with measured redshifts at R<60', which results in high (80%) and spatially uniform completeness at $m_{r,Petro,0}$<19.1. We use this sample to study the global rotation of the cluster and its connection to the large-scale structures in the universe. We first apply the caustic method to the sample and identify 285 member galaxies in Abell 2107 at R<60'. We then measure the rotation amplitude and the position angle of rotation axis. The member galaxies show strong global rotation at R<20' (V/σ~0.60-0.70) with a significance of >3.8 σ, which is confirmed by two independent methods. The rotation becomes weaker in outer regions. We find at least four filamentary structures at R<30h^{-1}Mpc smoothly connected to the cluster galaxies, which can suggest that the global rotation of the cluster is induced by the inflow of galaxies from the surrounding large-scale structures in the universe.

[구 GC-20] Environmental Dependence of Galaxy Properties in the Framework of the Cosmic Web

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There is growing observational evidence from several galaxy surveys that the cosmic web plays an important role in shaping galaxy properties in addition to the effects of isotropic environment including local density. To study the distinctive effects of anisotropic and isotropic environments on galaxy properties, we simultaneously examine the galaxy properties as functions of anisotropic and isotropic environments using the SDSS data.