distances for more than one billion stars in our Galaxy. These distance measurements would provide the important test as to the origin of the double RC in the Milky Way bulge. In this talk, we will present our preliminary results from Gaia DR2.

[구 IM-05] Evolutionary Models for Helium Giant Stars as Type Ibn Supernova Progenitors.

Jihoon Kim and Sung-Chul Yoon
Seoul National University

Among Type I supernovae, which show no evidence for hydrogen lines in spectra, Type Ib/c supernovae lack of strong Si absorption lines and are involved with massive progenitors. While strong helium absorption lines are present in Type Ib supernovae, narrow helium emission lines also can appear in some Type Ib that are often called Type Ibn supernovae (SNe Ibn). We consider helium giant stars as a promising progenitor candidate for SN Ibn and suggest the evolutionary scenario through binary systems using MESA code.

In our models the range of primary mass is 11 - 20 solar mass, mass ratio is 0.5 - 0.9, and initial period is 1.5 / 1.7 / 2.0 / 2.5 / 3.0 day. In particular, we find that the evolution of the secondary star can overtake the primary through mass transfer from the secondary to the primary, which is so-called 'reverse case B' mass transfer. In such systems the secondary star may undergo a supernova explosion earlier than the primary star. In this case, the primary star evolves towards a single helium giant to become a SN Ibn progenitor. These cases are more frequent in relatively low initial primary mass.

[구 IM-06] Extra-tidal stars around globular clusters NGC 5024 and NGC 5053 and their chemical abundances

Sang-Hyun Chun, Jae-Joon Lee
Korea Astronomy and Space Science Institute

NGC 5024 and NGC 5053 are among the most metal-poor globular clusters in the Milky Way. Both globular clusters are considered to be accreted from dwarf galaxies (like Sagittarius dwarf galaxy or Magellanic clouds), and common stellar envelope and tidal tails between globular clusters are also detected. We present a search for extra-tidal cluster member candidates around these globular clusters from APOGEE survey data. Using 20 chemical elements (e.g., Fe, C, Mg, Al) and radial velocities, t-distributed stochastic neighbour embedding (t-SNE), which identifies an optimal mapping of a high-dimensional space into fewer dimensions, was explored, and we find that globular cluster stars are well separated from the field stars in 2-dimensional map from t-SNE. We also find that some stars selected in t-SNE map are placed outside of the tidal radius of the clusters. The proper motion of stars outside tidal radius is also comparable to that of globular clusters, which suggest that these stars are tidally decoupled from the globular clusters. We manually measure chemical abundances for the clusters and extra-tidal stars, and discuss the association of extra-tidal stars with the clusters.

우주론/암흑물질, 암흑에너지

[박 CD-01] Toward precise and accurate modeling of matter clustering in redshift space

Minji Oh[1,2]
[1]*Korea Astronomy and Space Science Institute, Daejeon 34055, Korea,* [2]*University of Science and Technology, Daejeon 34113, Korea*

This dissertation presents the results on two-dimensional Redshift space distortion (hereafter RSD) analyses of the large-scale structure of the universe using spectroscopic data and on improvement of modeling of the RSD effect.

RSD is an effect caused by galaxies' peculiar velocity on their clustering feature in observation along the line of sight and is thus intimately connected to the growth rate of the structure in the universe, from which we can test the origin

of cosmic acceleration and Einstein's theory of gravity at cosmic scales in the end. However, there are several challenges in modeling precise and accurate RSD effect, such as non-linearities and the existence of an exotic component,

e.g. massive neutrino. As part of endeavors for modeling more precise and accurate galaxy clustering in redshift space, this dissertation includes a series of works for this issue. (More detailed descriptions were omitted.)

[구 CD-02] Testing Gravity with Cosmic Shear Data from the Deep Lens Survey

Cristiano G. Sabiu[1], Mijin Yoon[1], and Myungkook

James Jee[1]
[1]*Astronomy Dept, Yonsei University*

The current 'standard model' of cosmology provides a minimal theoretical framework that can explain the gaussian, nearly scale-invariant density perturbations observed in the CMB to the late time clustering of galaxies. However accepting this framework, requires that we include within our cosmic inventory a vacuum energy that is ~122 orders of magnitude lower than Quantum Mechanical predictions, or alternatively a new scalar field (dark energy) that has negative pressure.

An alternative approach to adding extra components to the Universe would be to modify the equations of Gravity. Although GR is supported by many current observations there are still alternative models that can be considered. Recently there have been many works attempting to test for modified gravity using the large scale clustering of galaxies, ISW, cluster abundance, RSD, 21cm observations, and weak lensing.

In this work, we compare various modified gravity models using cosmic shear data from the Deep Lens Survey as well as data from CMB, SNe Ia, and BAO. We use the Bayesian Evidence to quantify the comparison robustly, which naturally penalizes complex models with weak data support. In this talk we present our methodology and preliminary results that show f(R) gravity is mildly disfavoured by the data.

[구 CD-03] Constraints on cosmology and baryonic feedback by the combined analysis of weak lensing and galaxy clustering with the Deep Lens Survey

Mijin Yoon[1], M. James Jee[1], Tony Tyson[2], and DLS Collaboration
[1]*Department of Astronomy, Yonsei University, Republic of Korea*
[2]*Department of Physics, UC Davis, United States of America*

We constrain cosmological parameters by combining three different power spectra measured from galaxy clustering, galaxy-galaxy lensing, and cosmic shear using the Deep Lens Survey (DLS). Two lens bins (centered at z~0.27 and 0.54) and two source bins (centered at z~0.64, and 1.1) containing more than one million galaxies are selected to measure the power spectra.

We re-calibrate the initial photo-z estimation of the lens bins by matching with SHELS and PRIMUS and confirm its fidelity by measuring a cross-correlation between the bins. We also check the reliability of the lensing signals through the null tests, lens-source flipping and cross shear measurement. Residual systematic errors from photometric redshift and shear calibration uncertainties are marginalized over in the nested sampling during our parameter constraint process.

For the flat LCDM model, we determine S_8=sigma_8(Omega_m/0.3)^0.5=0.832+-0.028, which is in great agreement with the Planck data. We also verify that the two independent constraints from the cosmic shear and the galaxy clustering +galaxy-galaxy lensing measurements are consistent with each other.

To address baryonic feedback effects on small scales, we marginalize over a baryonic feedback parameter, which we are able to constrain with the DLS data alone and more tightly when combined with Planck data. The constrained value hints at the possibility that the AGN feedback in the current OWLS simulations might not be strong enough.

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

Stephen Appleby
School of Physics, Korea Institute for Advanced Study, 85 Hoegiro, Dongdaemun-gu, Seoul 02455, Korea

The Minkowski Functionals of the matter density eld, as traced by galaxies, contain information

regarding the nature of dark energy and the fraction of dark matter in the Universe. In particular, the genus 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 show how we can extract the genus from galaxy catalogs, and how we can use its properties to constrain the equation of state of dark energy and the energy content of the Universe.

[구 CD-05] Cosmological Information from the Small-scale Redshift Space Distortions

Motonari Tonegawa[1], Changbom Park[1], Yi Zheng[1],