caused by their spins, irregular shapes and companions. Thus, in principle, the spin state and shape model of a single object or, a combined model of spins, shapes and mutual orbit of a multiple components can be constructed from the analysis of light curves obtained from the time-series photometry. Using ground- and space-based facilities, a number of time-series photometric observations of asteroids have been conducted to find the possible causes of their light variations. Nonetheless, only about 2% of the known asteroids have been confirmed for their rotation periods. Therefore, a follow-on systematic photometric survey of asteroids is essential.

We started an asteroid light curve survey for this purpose using Korea Microlensing Telescope Network (KMTNet) during 199 nights between the second half of 2019 and the first half of 2020. We monitored within a 2° x 14° region of the sky per each night with 25 min cadences. In order to observe as many asteroids as possible with a single exposure, we mostly focus on the ecliptic plane. In our survey, 25,925 asteroids were observed and about 8,000 of them were confirmed for their rotation periods. In addition, using KMTNet's 24-hour continuous monitoring, we collected many composite light curves of slow rotating asteroids that were rarely obtained with previous observations.

In this presentation, we will introduce the typical light curves of asteroids obtained from our survey and present a statistical analysis of spin states and shapes of the asteroids from this study.

[구 SS-10] Asteroid Taxonomic Classification in Photometry

Sangho Choi[1,2], Dong-Goo Roh[2], Hong-Kyu Moon[2], Myung-Jin Kim[2], and Young-Jong Sohn[1]
[1]Department of Astronomy, Yonsei University, Seoul 03722, Korea
[2]Korea Astronomy and Space Science Institute, 776 Daedeokdae-ro, Yuseong-gu, 34055 Daejeon, Korea

Multi-band photometry provides an advantage in being able to perform taxonomic classification analysis on a large number of asteroids in a much shorter period of time than spectroscopy. We observed main-belt asteroids using Korea Microlensing Telescope Network (KMTNet) in CTIO during the summer seasons in the southern hemisphere, mostly in December 2015, 2016 and 2017 with two visible photometric systems, SDSS (g, r, i, and z), and Johnson-Cousins (B, V, R, and I). Targets were selected for the asteroids which had already been classified based on Bus-Binzel taxonomy (Bus & Binzel, 2002) and DeMeo taxonomy (DeMeo et al. 2009).

Not only the targets but also numerous serendipitously observed asteroids were identified. In summary, 6817 and 5456 known objects, including 307 and 233 already classified asteroids were observed with SDSS and Johnson-Cousins systems, respectively. Using principal component analysis, the three major asteroid complexes and a class, S-, C-, and X-complexes and V class are found to be well separated in the principal component plane (spectral slope and 1 micron absorption depth) with both filter systems. We will present and discuss the results of our newly proposed three-dimensional color taxonomy for asteroids using the whole dataset (Roh et al., to be submitted).

우주론/암흑물질

[구 CD-01] Interpretation of the EDGES observation in light of Planck 2018 Legacy Data

Kyungjin Ahn[1], Paul R. Shapiro[2]
[1]Chosun University,
[2]University of Texas at Austin

The Experiment to Detect the Global EoR Signature (EDGES) has probed the status of the early Universe through the global 21cm observation. The claimed (brightness temperature) of ~ 500 mK absorption dip at z~17 against the continuum background cannot be explained in the standard LambdaCDM framework. In the meantime, the Planck 2018 Legacy Data, especially the E-mode polarization power spectrum, puts rather strong constraints on the high-redshift reionization process. We show how these two observational contraints can be accomodated in a series of reionization scenarios, with a special focus on the strongly self-regulated reionization by first stars.

[구 CD-02] ``There's no Place like Home: The Sejong Suite"

Graziano Rossi
Department of Physics and Astronomy, Sejong University, 209 Neungdong-ro, Gwangjin-gu Seoul, South Korea, 147-747

I will present the Sejong Suite, an extensive collection of state-of-the-art high-resolution cosmological hydrodynamical simulations spanning a variety of cosmological and astrophysical parameters, primarily developed for modeling the

Lyman-Alpha forest. Adopting a particle-based implementation, we follow the evolution of gas, dark matter (cold and warm), massive neutrinos, and dark radiation, and consider several combinations of box sizes and number of particles. Noticeably, for the first time, we simulate extended mixed scenarios describing the combined effects of warm dark matter, neutrinos, and dark radiation, modeled consistently by taking into account the neutrino mass splitting. Along the way, I will also highlight some new results focused on the matter and flux statistics.

[구 CD-03] Star formation beyond z=0 and its role in the multiverse

Boon Kiat Oh
Seoul National University

The cosmological constant is accountable for the accelerated expansion of our Universe.

Observational data have provided a tight constraint on the cosmic star formation history from z = 8 to the present. What happens to the star formation rate beyond z=0?

I will discuss the star formation rates, along with the properties of the intergalactic mediumfrom our suite of simulations into the future. Since Lambda becomes dominant in the future of our universe, I further simulate counter-factual universes to assign anthropic weights to each universe within the multiverse setting.

I will argue that using the asymptotic star formation efficiency as weights, we almost double previous estimates of observers living in universes similar to ours. The expected value of the energy density of Lambda is also closer to the observed value. I will also discuss potential future works to improve the applicability of the anthropic reasoning of the cosmological constant.

[구 CD-04] [발표취소]

[구 CD-05] Identification of Cosmic Voids as Massive Cluster Counterparts

Junsup Shim(심준섭)[1], Changbom Park(박창범)[1], Juhan Kim(김주한)[2], Ho Seong Hwang(황호성)[1,3]
[1]*School of Physics, Korea Institute for Advanced Study,*
[2]*Center for Advanced Computation, Korea Institute for Advanced Study,*
[3]*Korea Astronomy and Space Science Institute*

We present a new void definition that connects voids with clusters, the high-density counterpart. We use a pair of ΛCDM simulations whose initial density fields are sign inverted versions to each other, and study the relation between the effective void volume and the corresponding cluster mass. Massive cluster halos ($M \geq 10^{13} M_{\odot}/h$) are identified in one simulation at z=0 by linking dark matter particles. The corresponding void to each cluster is defined in the other simulation as the region occupied by the member particles of the cluster. We find a universal functional form of density profiles at z=0 and 1. We also find a power-law relation between the void effective radius and the corresponding cluster mass. Based on these findings, we identify cluster-counterpart voids directly from a density field without using the pair information by utilizing three parameters such as the smoothing scale, density threshold, and minimum core fraction. We identified voids corresponding to clusters more massive than $M \geq 3 \times 10^{14} M_{\odot}/h$ at approximately 70-74 \% level of completeness and reliability. Our results suggest that we can detect voids comparable to clusters of a particular mass-scale.

[구 CD-06] Model-independent test of gravity

Benjamin L'Huillier
Yonsei University

Using redshift-space distortion, I reconstruct the growth history as a smooth function using model independent methods. Assuming general relativity, I obtain the expansion history independently of the dark energy model, and test it to the supernovae data. The results are consistent with general relativity as gravity and the cosmological constant as dark energy, although interestingly negative dark energy densities are not ruled out by the data at z~0.7 to 1.

[구 CD-07] Model-independent Constraints on Type Ia Supernova Light-curve Hyperparameters and Reconstructions of the Expansion History of the Universe

Hanwool Koo[1,2], Arman Shafieloo[1,2], Ryan E. Keeley[1], Benjamin L'Huillier[3]
[1]*Korea Astronomy and Space Science Institute,*
[2]*University of Science and Technology,*
[3]*Yonsei University*

We reconstruct the expansion history of the universe using type Ia supernovae (SN Ia) in a manner independent of any cosmological model assumptions. To do so, we implement a nonparametric iterative smoothing method on the Joint Light-curve Analysis (JLA) data while