We started a systematic observational study of the 22 GHz water and 44 GHz class I methanol masers in 87 high-mass young stellar objects (HM-YSOs) as a KaVA large program (LP). The primary goal is to understand dynamical evolution of HM-YSOs and their circumstellar structures by measuring spatial distributions and 3-dimensional velocity fields of multiple maser species. In the first-year observations (2016-2017), we made snap-shot imaging surveys of 25 water and 19 methanol maser sources. In the second-year observations (2018-2019), we have carried out monitoring observations of 19 water and 3 methanol maser sources that were selected on the basis of the first-year survey results. By combining follow-up observations with VERA (distances), JVN/EAVN (6.7 GHz methanol masers), and ALMA cycles 3 and 6 (thermal lines/continuum), we will provide novel information on physical properties (density, temperature, size, mass), 3D dynamical structures of disk/jet/outflow/infalling envelope, and relationship between evolutionary of HM-YSOs. In this presentation, we will report the current status and future plans of our KaVA large program.

[구 KVN-06] KaVA and EAVN large program on two Supermassive Black Holes, Sgr A* and M87

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Exploring the vicinity of super-massive black holes (SMBHs) is one of the frontiers in astrophysics. KaVA AGN Science WG has launched its Large Program in 2014 focusing on two SMBHs, Sgr A* and M87. They are selected based on their large apparent size. Sgr A* is the excellent laboratory for studying gas accretion process onto SMBH and M87 is well known as the best case for investigating plasma outflow ultimately driven by SMBH. For Sgr A*, KaVA and EAVN provides superb UV-coverage on its emitting region and its scattering medium. In the case of M87, we have conducted high cadence dual-frequency (22and 43GHz)VLBI monitoring to clarify the global profile of the M87 jet velocity field and the spectral index map, which should reflect global structure of magnetic fields in the jet. From 2017, the AGN LP is recognized as multi-wavelength EHT project, conducting quasi-simultaneous coherent observations of M87 and Sgr A* with the Event Horizon Telescope (EHT) during its campaign observation periods. AGN WG is reviewing and revising its LP to convert it to EAVN LP. We will briefly report our scientific results and future plan which includes even broader international collaboration, namely East-Asia to Italy Nearly Global (EATING) VLBI to reach higher angular resolution.

우주론

[구 CD-01] Cosmology with Type Ia Supernova gravitational lensing

Jacobo Asorey
Korea Astronomy and Space Science Institute

In the last decades, the use of type Ia supernovae (SN) as standard candles has allowed us to understand the geometry of the Universe as they help to measure the expansion rate of the Universe, especially in combination with other cosmological probes such as the study of cosmic microwave background radiation anisotropies or the study of the imprint of baryonic acoustic oscillations on the galaxy clustering. Cosmological parameter constraints obtained with type Ia SN are mainly affected by intrinsic systematic errors. But there are other systematic effects related with the correlation of the observed brightness of Supernova and the large-scale structure of the Universe such as the effect of peculiar velocities and gravitational lensing. The former is relevant for SN at low redshifts while the latter starts being relevant for SN at higher redshifts. Gravitational lensing depends on how much matter is along the trajectory of each SN light beam. In order to account for this effect, we consider a statistical approach by defining the probability distribution (PDF) that a given supernova brightness is magnified by a given amount, for a particular redshift . We will show that different theoretical approaches to define the matter density along the light trajectory hugely affect the shape and width of the PDF. This may have catastrophic effects on cosmology fits using Supernova lensing as planned for surveys such as the Dark Energy Survey or future surveys such the Large Synoptic Survey Telescope.

[구 CD-02] Cosmological Information from the Small-scale Redshift Space Distortions

Motonari Tonegawa[1], Changbom Park[1], Yi Zheng[1], Juhan Kim[1], Hyunbae Park[2], and Sungwook Hong[2]

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We present our first attempt at understanding the dual impact of the large-scale density and velocity environment on the formation of very first astrophysical objects in the Universe. Following the recently developed quasi-linear perturbation theory on this effect, we introduce the publicly available initial condition generator of ours, BCCOMICS (Baryon Cold dark matter COsMological Inital Condition generator for Small scales), which provides so far the most self-consistent treatment of this physics beyond the usual linear perturbation theory. From a suite of uniform-grid simulations of N-body+hydro+BCCOMICS, we find that the formation of first astrophysical objects is strongly affected by both the density and velocity environment. Overdensity and streming-velocity (of baryon against cold dark matter) are found to give positive and negative impact on the formation of astrophysical objects, which we quantify in terms of various physical variables.

[구 CD-03] Current status of an interacting dark sector with cosmological observations

Jurgen Mifsud
Korea Astronomy and Space Science Institute

The cosmic dark sector, composed of dark energy and dark matter, might be coupled, and hence mediate a fifth-force which gives rise to distinctive cosmological signatures. I will consider an interacting dark sector, in which dark energy and dark matter are coupled via specific well-motivated coupling functions. After an overview of these coupled dark energy models, I will discuss the current model parameter constraints derived from the latest cosmological observations which probe the expansion history, and the growth of cosmic structures of our Universe. Moreover, I will demonstrate how different measurements of the Hubble constant, including the GW170817 measurement, influence the inferred constraints on the dark coupling. I will further discuss how one could put tighter constraints on such a dark sector coupling with the upcoming large-scale radio surveys.

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

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The genus of the matter density eld, as traced by galaxies, contains information regarding the nature of dark energy and the fraction of dark matter in the Universe. In particular, this topological measure 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 present measurements of the genus extracted from the SDSS DR7 LRGs in the local Universe, and also slices of the BOSS DR12 data at higher redshift.

I show how these combined measurements can be used to place cosmological parameter constraints on m, wde.

[구 CD-05] A Deep Convolutional Neural Network approach to Large Scale Structure

Cristiano G. Sabiu
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Recent work by Ravanbakhsh et al. (2017), Mathuriya et al. (2018) showed that convolutional neural networks (CNN) can be trained to predict cosmological parameters from the visual shape of the large scale structure, i.e. the filaments, clusters and voids of the cosmic density field. These preliminary works used the dark matter density field at redshift zero. We build upon these works by considering realistic mock galaxy catalogues that mimic true observations. We construct light-cones that span the redshift range appropriate for current and near future cosmological surveys such as LSST, EUCLID, WFIRST etc.

In summary, we propose a novel multi-image input CNN to track the evolution in the morphology of large scale structures over cosmic time to constrain cosmology and the expansion history of the Universe.

[구 CD-06] Matter Density Distribution Reconstruction of Local Universe with Deep Learning

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