

Intracluster stars are believed to be gravitationally bound to a galaxy cluster, however, not to individual cluster galaxies. Their presence is observed as diffuse light typically in the central region extended from the brightest cluster galaxy. The diffuse light, often referred to as intracluster light (ICL), is difficult to quantify in distant high-redshift galaxy clusters because of the significant surface brightness dimming although ICL observations in high-redshift clusters provide powerful constraints on the origin of intracluster stars. In this poster, we present ICL study of the distant galaxy cluster SPT2106-5844 at $z=1.132$ with Hubble Space Telescope IR imaging data. With careful control of systematics, we successfully quantify the total amount of the ICL, measure the color profile, and obtain its two-dimensional distribution. Our measurement of the high abundance of the intracluster stars in this young cluster favors the ICL formation scenario, wherein production of intracluster stars are predominantly associated with the BCG formation.

[포 GC-15] The evolution of merger fraction for galaxies in NEP-Wide field

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We present the results of the merger fraction evolution for galaxies in NEP-Wide field depending on star formation mode and redshift. We select the galaxies which have AKARI 9 μm detections as a sample for large number of galaxies. We use multi-wavelength data from GALEX to Herschel, and Subaru HSC i-band images for analysis. We classify the merger galaxies with using Gini and M20, which are non-parametric calculated by statmorph code. We obtain the total infrared luminosity from the SED modeling with using one band, AKARI 9 μm . We find that the merger fractions of galaxies in all different star formation mode increase as the redshift increases. However, with fixed mass range of $10.5 < \log(M_*) < 11.5$, the merger fractions of starbursts significantly increase as the redshift increases compared to those of main sequence and quiescent galaxies. We discuss the implications of these results in this poster.

[포 GC-16] Supermassive Black Hole Masses of ~500k QSOs from the Sloan Digital Sky Survey

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Measurements of supermassive black hole (SMBH) masses are crucial in studying the co-evolution of SMBHs and their host galaxies. Although reverberation mapping is the most accurate method known to date, this requires spectroscopic monitoring over long periods. Thus, the current sample barely reaches three digits. The virial method, on the other hand, uses emission-line and continuum properties from a single spectrum to estimate the SMBH mass; hence the name single-epoch method.

The Sloan Digital Sky Survey (SDSS) has observed spectra of almost all quasi-stellar objects (QSOs) discovered so far. Building on previous studies, using the single-epoch method, we estimate the SMBH masses of more than 500,000 QSOs from the SDSS DR14 Quasar Catalog. This increases the mass-estimated SMBH sample almost by a factor of two, and especially more for the low-mass regime, which was the main target of SDSS-IV (eBOSS).

[포 GC-17] The Formation of Compact Elliptical Galaxies: Nature or Nurture?

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We present an analysis of the stellar population of compact elliptical galaxies (cEs) in various environments. Following conventional selection criteria of cEs, we created a list of cE candidates in the redshift range of $z < 0.05$ using SDSS DR12 catalog. We finally selected cEs with low-luminosity ($M_g > 18.7 \text{ mag}$), small effective radius ($R_e < 600 \text{ pc}$), and high velocity dispersion ($> 60 \text{ kms}^{-1}$). We divide our cE sample into those inside and outside of the one virial radius of the bright ($M_r < -21 \text{ mag}$) nearby host galaxy which is then defined as cEs with (cEw) and without (cEw/o) host galaxy, respectively. We investigated the stellar population properties of cEs based on the H β , Mgb, Fe 5270, and Fe 5335 line strengths from the OSSY catalog. We found that cEw has a systematically higher metallicity than cEw/o. In the velocity dispersion-Mgb distribution, while cEw/o follows the relation of early-type galaxies, cEw are found to have a systematically higher metallicity than cEw/o at a given velocity dispersion. The different

feature in the metallicity between cEw and cEw/o can suggest that two different scenarios can be provided in the formation of cEs. cEw would be the remnant cores of the massive progenitor galaxies that their outer parts have been tidally stripped by massive neighbor galaxies (i.e., nurture origin). On the other hand, cEw/o are likely to be faint-end of early-type galaxies maintaining in-situ evolution (i.e., nurture origin).

[포 GC-18] Deep survey using deep learning: generative adversarial network

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There are a huge number of faint objects that have not been observed due to the lack of large and deep surveys. In this study, we demonstrate that a deep learning approach can produce a better quality deep image from a single pass imaging so that could be an alternative of conventional image stacking technique or the expensive large and deep surveys.

Using data from the Sloan Digital Sky Survey (SDSS) stripe 82 which provide repeatedly scanned imaging data, a training data set is constructed: g-, r-, and i-band images of single pass data as an input and r-band co-added image as a target. Out of 151 SDSS fields that have been repeatedly scanned 34 times, 120 fields were used for training and 31 fields for validation. The size of a frame selected for the training is 1k by 1k pixel scale. To avoid possible problems caused by the small number of training sets, frames are randomly selected within that field each iteration of training.

Every 5000 iterations of training, the performance were evaluated with RMSE, peak signal-to-noise ratio which is given on logarithmic scale, structural symmetry index (SSIM) and difference in SSIM. We continued the training until a GAN model with the best performance is found. We apply the best GAN-model to NGC0941 located in SDSS stripe 82. By comparing the radial surface brightness and photometry error of images, we found the possibility that this technique could generate a deep image with statistics close to the stacked image from a single-pass image.

천문우주관측기술

[포 AT-01] Control software for temperature sensors in astronomical devices using GMT SDK 1.6.0

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The temperature control of a scientific device is essential because extreme temperature conditions can cause hazard issues for the operation. We developed a software which can interact with the temperature sensor using the GMT SDK(Giant Magellan Telescope Software Development Kit) version 1.6.0. The temperature sensor interacts with the EtherCAT(Ethernet for Control Automation Technology) slave via the hardware adapter, sending and receiving data by a packet. The PDO(Process Data Object) and SDO(Service Data Object), which are the packet interacts with each EtherCAT slave, are defined on the TwinCAT program that enables the real-time control of the devices. The user can receive data from the device via grs(GMT Runtime System) tools and log service. Besides, we programmed the software to print an alert message on the log when the temperature condition changes to certain conditions.

[포 AT-02] Constraining the Evolution of Epoch of Reionization by Deep-Learning the 21-cm Differential Brightness Temperature

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We develop a novel technique that can constrain the evolutionary track of the epoch of reionization (EoR) by applying the convolutional neural network (CNN) to the 21-cm differential brightness temperature. We use 21cmFAST, a fast semi-numerical cosmological 21-cm signal simulator, to produce mock 21-cm map between $z=6-13$. We design a CNN architecture that predicts the volume-averaged neutral hydrogen fraction from the given 21-cm map. The estimated neutral fraction has a good agreement with its truth value even after smoothing the 21-cm map with somewhat realistic choices of beam size and the