an optimal number of Gaussian components in a quantitative manner. We classify the decomposed H I gas components of NGC 6822 into bulk-narrow, bulk-broad, and non_bulk with respect to their velocity and velocity dispersion. We correlate their gas surface densities with the surface star formation rates derived using both GALEX far-ultraviolet and WISE 22 micron data to examine the impact of gas turbulence caused by stellar feedback on the Kennicutt-Schmidt (K-S) law. The bulk-narrow component that resides within r25 is likely to follow the linear extension of the Kennicutt-Schmidt (K-S) law for molecular hydrogen (H2) at the low gas surface density regime where H I is not saturated.

## [구 GC-17] Galaxy Group Assembly Histories and the Missing Satellites Problem: A Case for the NGC 4437 Group

Yoo Jung Kim, Myung Gyoon Lee
*Seoul National University*

The overprediction of the number of satellite galaxies in the LCDM paradigm compared to that of the Milky Way (MW) and M31 (the "missing satellites" problem) has been a long-standing issue. Recently, a large host-to-host scatter of satellite populations has been recognized both from an observational perspective with a larger sample and from a theoretical perspective including baryons, and it is crucial to collect diverse and complete samples with a large survey coverage to investigate underlying factors contributing to the diversity. In this study, we discuss the diversity in terms of galaxy assembly history, using satellite populations of both observed systems and simulated systems from IllustrisTNG. In addition to previously studied satellite systems, we identify satellite candidates from 25deg2 of Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP) Wide layer around NGC 4437, a spiral galaxy of about one-fourth of the MW mass, paired with a ~2 magnitude fainter dwarf spiral galaxy NGC 4592. Using the surface brightness fluctuations (SBF) method, we confirm five dwarf galaxies as members of the NGC 4437 group, resulting in a total of seven members. The group consists of two distinct subgroups, the NGC 4437 subgroup and the NGC 4592 subgroup, which resembles the relationship between the MW and M31. The number of satellites is larger than that of other observed and simulated galaxy groups in the same host stellar mass range. However, the discrepancy decreases if compared with galaxy groups with similar magnitude gaps (V12 ~ 2), defined as the V-band magnitude difference between the two brightest galaxies in the group. Using simulated galaxy groups in IllustrisTNG, we find that groups with smaller V12 have richer satellite systems, host more massive dark matter halos, and have assembled more recently. These results show that the host-to-host scatter of satellite populations can be attributed to the diversity in galaxy assembly history and be probed by V12 to some degree and that NGC 4437 group is likely a recently assembled galaxy group with a large halo mass compared to galaxy groups of similar luminosity.

## [구 GC-18] Searching for MgII absorbers in and around galaxy clusters

Jong Chul Lee[1], Ho Seong Hwang[1,2], Hyunmi Song[3]
*[1]KASI, [2]SNU, [3]Yonsei*

To study environmental effects on the circumgalactic medium (CGM), we use the samples of redMaPPer galaxy clusters, background quasars and cluster galaxies from the SDSS. With 82,000 quasar spectra, we detect 197 MgII absorbers in and around the clusters. The detection rate per quasar is 2.70 times higher inside the clusters than outside the clusters, indicating that MgII absorbers are relatively abundant in clusters. However, when considering the galaxy number density, the absorber-to-galaxy ratio is rather low inside the clusters. If we assume that MgII absorbers are mainly contributed by the CGM of massive star-forming galaxies, a typical halo size of cluster galaxies is smaller than that of field galaxies by 30 per cent. This finding supports that galaxy haloes can be truncated by interaction with the host cluster.

## [구 GC-19] Catching a growing giant: Discover y of a galaxy cluster in formation

Seong-Kook Lee[1], Myungshin Im[2], Bomi Park[3], Minhee Hyun[4], Insu Paek[5] et al.
*[1]Seoul National University, [2]Seoul National University, [3]Seoul National University, [4]Seoul National University, [5]Seoul National University*

In LCDM universe, large, massive structures, like galaxy clusters, grow through the successive accreti on/mergers of smaller structures. Therefore, at hig h redshift, unlike local, it is expected that there woul d be plenty of galaxy clusters which are still growin g. Here, we report the discovery of a high-redshift (z~1) galaxy cluster which is in its active formation s tage. This cluster is well connected to the large sca le overdense environment and contains high fractio n of star-forming galaxies, providing a good examp le supporting our previously suggested 'Web-feedin

g model'.

### [구 GC-20] A Weak-lensing Study of the Double Radio Relic Galaxy Cluster Abell 1240

Hyejeon Cho (조혜전)[1], Myungkook James Jee (지명국)[1,2], Kyle Finner[1,3]
*[1]Department of Astronomy & Institute of Earth·Atmosphere·Astronomy, Yonsei University, Korea, [2]Department of Physics, University of California, Davis, USA, [3]Harvard-Smithsonian Center for Astrophysics, USA*

Abell 1240 is a merging galaxy cluster hosting prominent, symmetric double radio relics. To constrain its merging history, we provide the first weak-lensing analysis of the dark matter distribution of the Abell 1240 field with Subaru/Suprime-Cam observations after robustly addressing instrumental systematics. We also investigate the cluster galaxy distributions, combining our new MMT/Hectospec observations and the spectroscopic redshifts from the literature. Both weak-lensing mass reconstruction and galaxy distribution show that Abell 1240 consists of two subclusters stretched north to south between the double radio relics. We quantify the significance of the substructures and present their mass estimates. Finally, we discuss a merging stage of Abell 1240 with the current weak-lensing results and the radio relic priors.

### [구 GC-21] Multi-wavelength view of SPT-CL J2106-5844: A massive galaxy cluster merger at z~1.13

Kim HyeongHan[1], Luca Di Mascolo[2,3,4,5], Tony Mroczkowski[6], Yvette Perrott[7], Lawrence Rudnick[8], M. James Jee[1,9], Eugene Churazov[2,10], Jordan D. Collier[11,12], Jose M. Diego[13], Andrew M. Hopkins[14], Jinhyub Kim[1], Bärbel S. Koribalski[12,15], Joshua D. Marvil[16], Remco van der Burg[6], Jennifer L. West[17]
[1]Department of Astronomy, Yonsei University [2]Max-Planck-Institu für Astrophysik (MPA) [3]Astronomy Unit, Department of Physics, University of Trieste [4]INAF – Osservatorio Astronomico di Trieste [5]IFPU – Institute for Fundamental Physics of the Universe [6]European Southern Observatory (ESO) [7]School of Chemical and Physical Sciences [8]Minnesota Institute for Astrophysics, School of Physics and Astronomy, University of Minnesota [9]Department of Physics, University of California, Davis [10]Space Research Institute [11]The Inter-University Institute for Data Intensive Astronomy (IDIA), Department of Astronomy, University of Cape Town [12]School of Science, Western Sydney University [13]Institute de Física de Cantabria (CSIC-UC) [14]Australian Astronomical Optics, Macquarie University [15]Australia Telescope National Facility, CSIRO Astronomy and Space Science [16]National Radio Astronomy Observatory [17]Dunlap Institute for Astronomy and Astrophysics University of Toronto

SPT-CL J2106-5844 is the most massive galaxy cluster at z>1 discovered to date. It has been known to be an isolated system with a singular, well-defined halo. However, recent studies provide lines of evidence for its merging state. We strengthen the case with the multi-wavelength observations from ALMA, ACA, ASKAP, ATCA, and Chandra. With the sensitive, high resolution ALMA+ACA observations, we reconstruct the ICM pressure map from the thermal SZ effect. It reveals two main gas components that are associated with the mass clumps inferred from the weak-lensing analysis. Furthermore, the X-ray hardness map supports the bimodal gas distribution. With these multi-wavelength data, we probe the merger phase in SPT-CL J2106-5844.

## 항성 및 항성계

### [구 SA-01] Messier 3: An Extra-Galactic System with Two Globular Clusters

Jae-Woo Lee[1], Christopher Sneden[2]
*[1]Department of Physics and Astronomy, Sejong University, [2]Department of Astronomy, The University of Texas at Austin*

We present Ca-CN-CH-NH photometry for the globular cluster (GC) M3. Our new photometric system combined with robust and self-consistent theoretical fine model grids allows us to measure key elements in stellar populations, [Fe/H], [C/Fe], and [N/Fe], even in the extremely crowded fields. Our results show that M3 consists of two GCs with different chemical abundances, structural and kinematical properties. Furthermore, each GC has its own carbon-nitrogen anticorrelation with whose fractions of the CN-weak populations are consistent with those in the Magellanic Clouds. We suggest that M3 is a merger remnant of two GCs, most likely in a dwarf galaxy environment and accreted to our Milky Way Galaxy later in time.

### [구 SA-02] Absolute Dimension and Pulsational Characteristics of the Eclipsing Binary EW Boo with a δ Sct Pulsator

Hye-Young Kim[1], Kyeongsoo Hong[1], Chun-Hwey