Kyungpook National University, [6]School of Space REsearch, Kyung Hee University, [7]Dept. of Astronomy, School of Physics, Peking University, [8]Korea Institute for Advanced Study [9]Nature Astronomy, [10]Korea Astronomy and Space Science Institute, [11]Metaspace Inc.

Faint z ~ 5 quasars with M1450 ~ -23 mag are known to be the potentially important contributors to the ultraviolet ionizing background in the post-reionization era. However, their number density has not been well determined, making it difficult to assess their role in the early ionization of the intergalactic medium (IGM). In this work, we present the updated results of our z ~ 5 quasar survey using the Infrared Medium-deep Survey (IMS), a near-infrared imaging survey covering an area of 85 square degrees. From our spectroscopic observations with the Gemini Multi-Object Spectrograph (GMOS) on the Gemini-South 8 m Telescope, we discovered eight new quasars at z ~ 5 with $-26.1 \leq$ M1450 ≤ -23.3. Combining our IMS faint quasars with the brighter Sloan Digital Sky Survey (SDSS) quasars, we derive, for the first time, the z ~ 5 quasar luminosity function (QLF) without any fixed parameters down to the magnitude limit of M1450 = -23 mag. We find that the faint-end slope of the QLF is very flat (-1.2) with a characteristic luminosity of -25.7 mag. The number density of z ~ 5 quasars from the QLF gives lower ionizing emissivity and ionizing photon density than those in previous works. These results imply that quasars are responsible for only 10-20% of the photons required to completely ionize the IGM at z ~ 5, disfavoring the idea that quasars alone could have ionized the IGM at z ~ 5.

[구 GC-17] The fate of an infalling circumgalactic gas clump and the growth of the central massive black hole in a high-redshift quasar

Yongseok Jo and Ji-hoon Kim
Seoul National University

Since the discovery of SMBHs at z > 6, the growth spurt of a BH in a relatively short time—a few hundred Myr—has been a challenging topic for many observers and theorists. Super-Eddington accretion, major and minor merger have been compelling candidate machanisms to account for such growth.

We introduce a passive scalar field to trace the infalling of circumgalactic gas clump onto high-z quasar. With the scalar field, we investigate e.g. where the most of the gas clump eventually reside in the host galaxy and how much gas is accreted onto the central massive black hole. In addition, we have studied the impact of thermal feedback of stars on the growth of black hole and the infalling gas. We will also discuss the future application of passive scalar field in e.g. minor and major mergers of high-z quasar.

[구 GC-18] The Nature of Submillimeter Galaxies in the North Ecliptic Pole SCUBA-2 Survey

Dongseob Lee, Hyunjin Shim
Department of Earth Science Education, Kyungpook National University

Submillimeter galaxies (SMGs) have played an important role in the understanding of galaxy evolution and cosmic star formation history at high redshift because they are known as being located at $z \sim 2$ and harbor a vigorous star formation. Therefore studying properties of SMGs can lead us to understand evolution of massive and actively star forming galaxies and distribution of cosmic star formation density. Recently we detected 548 SMGs near North Ecliptic Pole with JCMT/SCUBA-2 from the JCMT large program covering about 2 deg^2 so far. To derive their physical parameters, we compiled a multi-wavelength photometry ranging from optical (0.3 μm) to submillimeter (850 μm) by cross-identifying counterparts at different wavelengths. In order to find counterparts, we used either VLA-1.4 GHz image and/or Spitzer/IRAC 3.6 μm, 4.5 μm image. The number of SMGs with relatively robust counterparts is 349. In this talk, we present photometric redshifts, stellar mass, star formation rates, total infrared luminosity, and AGN fraction of these 349 SMGs derived through SED fitting analysis.

[구 GC-19] SCUBA-2 Observation of the JWST/GTO Time Domain Survey Field

Minhee Hyun[1], Ian Smail[2], Myungshin Im[1], Roger A. Windhorst[3], Rolf A. Jansen[3], Christopher N. A. Wilmer[4], William D. Cotton[5], Giovanni Fazio[6], Richard Perley[5], James J. Condon[5], Mark Swinbank[2], Seth Cohen[3], Li-Hwai Lin[7], Fangxia An[8], Hyunjin Shim[9] and JWST/GTO TDS team
[1]Center for the Exploration of the Origin of the Universe (CEOU), Seoul National University, ROK, [2]Centre for Extragalactic Astronomy, Department of Physics, Durham University, UK, [3]School of Earth & Space Exploration, Arizona State University, USA, [4]Steward Observatory, University of Arizona, USA, [5]National Radio Astronomy Observatory, USA, [6]Center for Astrophysics, Harvard & Smithsonian, USA, [7]Academia Sinica

Institute of Astronomy and Astrophysics (ASIAA), Taiwan, [8]Inter-University Institute for Data Intensive Astronomy & University of the Western Cape (Department of Physics and Astronomy), South Africa, [9]Department of Earth Science Education, Kyungpook National University

The Time Domain Field is one of the future GTO program fields of JWST(JWST/GTO TDS), surveying about 14' diameter field at the North Eliptical Pole(NEP) with NIRCam/NIRISS. As a part of the multi-wavelength study of the field, we have obtained SCUBA-2 850μm mapping which reaches a depth of σ_{rms} = 0.9mJy/beam and detect 93 sources at S/N > 3.5 – which are expected to be highly star-forming (SFR>400$M_{\odot}$/yr) galaxies at $z \gtrsim 1.5$-4 and pinpoint the location at <0." 1 accuracy of 68 sub-mm sources by identifying VLA 3GHz radio counterparts. In this talk, we will introduce the SCUBA-2 JWST/GTO TDS project and the newly discovered sub-mm sources in this field.

[구 GC-20] Intensive Monitoring Survey of Nearby Galaxies (IMSNG) : Constraints on the Progenitor System of a Type Ia Supernova SN 2019ein from Its Early Light Curve

Gu Lim[1,2] (임구), Myungshin Im[1,2] (임명신), Dohyeong Kim[2,3] (김도형), Gregory S. H Paek[1,2] (백승학), Changsu Choi[1,2] (최창수), Sophia Kim[1,2] (김소피아), Sungyong Hwang[1,2] (황성용), and IMSNG team
[1]Center of the Exploration of the Origin of the Universe, Department of Physics & Astronomy, Seoul National University, Korea
[2]Astronomy Program, Department of Physics & Astronomy, Seoul National University, Korea
[3]Kavli Institute for Astronomy and Astrophysics, Peking University, Beijing 100871, China

The progenitor of Type Ia supernovae (SNe Ia) is mainly believed to be a carbon/oxygen white dwarf (WD) with non-degenerate (single degenerate) or another WD companion (double degenerate). However, there is little observational evidence of their progenitor system. Recent studies suggest that shock-breakout cooling emission after the explosion can constrain the size of the progenitor system. To do so, we obtained a optical/Near-IR light curve of SN 2019ein, a normal but slightly sub-luminous type Ia supernova, from the very early phase using our high-cadence observation of Intensive Monitoring Survey of Nearby Galaxies (IMSNG). Assuming the expanding fireball model, the simple power-law fitting of the early part of the light curve gives power indices of 1.91 (B) and 2.09 (R) implying radioactive decay of ^{56}Ni is the dominant energy source. By comparison with the expected light curve of the cooling emission, the early observation provides us an upper limit of the companion size of $R* \leq 1R_{\odot}$. This result suggests that we can exclude a large companion such as red giants, which is consistent with the previous study.

[구 GC-21] Intensive Monitoring Survey of Nearby Galaxies (IMSNG) : On the progenitor system of Type Ia SN 2018kp

Changsu Choi[1,2] (최창수), Myungshin Im[1,2] (임명신), Dohyeong Kim[2,3] (김도형), Gu Lim[1,2] (임구), Gregory S. H Paek[1,2] (백승학), Sophia Kim[1,2] (김소피아), Sungyong Hwang[1,2] (황성용), and IMSNG team
[1]Center of the Exploration of the Origin of the Universe, Department of Physics & Astronomy, Seoul National University, Korea
[2]Astronomy Program, Department of Physics & Astronomy, Seoul National University, Korea
[3]Kavli Institute for Astronomy and Astrophysics, Peking University, Beijing 100871, China

Intensive Monitoring Survey of Nearby Galaxies (IMSNG) has been managed over 6 years. It aimed to constrain the progenitor system and explosion mechanism of SNe by detection of very early signal from shock heated emission. We have conducted monitoring observation of nearby bright galaxies those were carefully selected using global network of 1-m class telescopes. More than 20 SNe have occured in our target fields. As One of result of the survey, we present light curve analysis of type Ia SN 2018kp, which was discovered in NGC 3367.

Based on photometric analysis, we calculated explosion parameters and set constraints of physical conditions of this supernova. We compared the results with theoretical model progenitor systems to find out which scenario is the most fitted to SN 2018kp case. Moreover, we estimate the distance to the galaxy and look into the relation between SNe and galactic physical parameters.

[구 GC-22] Gravitational-wave Electromagnetic Counterpart Korean Observatory (GECKO): Network of Telescopes and Follow-up Observation of GW190425

Gregory S.H. Paek, Myungshin Im, and SNU GECKO team[1]
CEOU, Astronomy Program, Department of Physics and Astronomy, Seoul National University, Republic of Korea

Recent observation of the neutron star merger event, GW170817, through both gravitational wave (GW) and electromagnetic wave (EM) observations