University

We will present a scenario of the presence of a second AGN in a nearby Seyfert galaxy, NGC 1068. Using VLT/MUSE IFU data, we investigated the complex kinematics of ionized gas in the central region of NGC 1068. Interestingly, at a distance of 180 pc to the northeast from the nucleus of NGC 1068, we detected a kinematical signature of the launching point of AGN gas outflows, which suggests that there would be a second AGN. We will also discuss another supporting evidence of the second AGN based on previous spectropolarimetric results.

[구 GC-11] Merging, Recoiling, or Slingshotting of Supermassive Black Holes in a Red AGN 1659+1834

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We report the Gemini Multi-Object Spectrograph (GMOS) Integral Field Unit (IFU) observation of a red active galactic nucleus (AGN), 2MASSJ165939.7+183436 (1659+1834). 1659+1834 is a prospective merging supermassive black hole (SMBH) candidate due to its merging features and double-peaked broad emission lines. The double-peaked broad emission lines are kinematically separated by 3000 km/s, with the SMBH of each component weighing at 10^8.9 and 10^7.1 solar mass. Our GMOS IFU observation reveals that the two components of the double-peaked broad emission line are spatially separated by 0.085" (~250pc). In different assumptions for the line fitting, however, a null (<0.05") or a larger spatial separation (~0.15") are also possible. For this GMOS IFU observational results of 1659+1834, various models can be viable solutions, such as the disk emitter and multiple SMBH models. We believe that these results show the need for future research of finding more multiple SMBH systems in red AGNs.

[구 GC-12] The faintest quasar luminosity function at z ~ 5 from Deep Learning and Bayesian Inference

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To estimate the contribution of quasars on keeping the IGM ionized, building a quasar luminosity function (LF) is necessary. Quasar LFs derived from multiple quasar surveys, however, are incompatible, especially for the faint regime, emphasizing the need for deep images. In this study, we construct quasar LF reaching $M_{1450} \sim -21.5$ AB magnitude at z ~ 5, which is 1.5 mag deeper than previously reported LFs, using deep images from the Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP). We trained an artificial neural network (ANN) by inserting the colors as inputs to classify the quasars at z ~ 5 from the late-type stars and low-redshift galaxies. The accuracy of ANN is > 99 %. We also adopted the Bayesian information criterion to elaborate on the quasar-like objects. As a result, we recovered 5/5 confirmed quasars and remarkably minimized the contamination rate of high-redshift galaxies by up to six times compared to the selection using color selection alone. The constructed quasar parametric LF shows a flatter faint-end slope $\alpha = -1.27^{+0.16}_{-0.15}$ similar to the recent LFs. The number of faint quasars ($M_{1450} < -23.5$) is too few to be the main contributor to IGM ionizing photons.

[구 GC-13] The Relative Role of Bars and Galaxy Environments in AGN Triggering of SDSS Spirals

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We quantify the relative role of galaxy environment and bar presence on AGN triggering in face-on spiral galaxies using a volume-limited sample with 0.02 < z < 0.055, Mr < 19.5, and σ > 70 km s-1 selected from Sloan Digital Sky Survey (SDSS) Data Release 7. To separate their possible entangled effects, we divide the sample into bar and non-bar samples, and each sample is further divided into three environment cases of isolated galaxies, interacting galaxies with a pair, and cluster galaxies. The isolated case is used as a control sample. For these six cases, we measure AGN fractions at a fixed central star formation rate and central velocity dispersion, σ. We demonstrate that the internal process of the bar-induced gas inflow is more efficient in AGN triggering than the external mechanism of the galaxy interactions in groups and cluster outskirts. The significant effects of bar instability and galaxy environments are found in galaxies with a relatively less massive bulge. We conclude that from the perspective of AGN-galaxy coevolution, a massive black hole is one of the key drivers of spiral galaxy evolution. If it is not met, a bar instability helps the evolution,

and in the absence of bars, galaxy interactions/ mergers become important. In other words, in the presence of a massive central engine, the role of the two gas inflow mechanisms is reduced or almost disappears. We also find that bars in massive galaxies are very decisive in increasing AGN fractions when the host galaxies are inside clusters.

[구 GC-14] Magnetic Field Strengths of Flaring Region in the Jet of CTA 102

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We present the magnetic field strengths of CTA 102 using multi-frequency data at 2.6-343.5 GHz in order to study the physical origins of radio flares. The observations at 22 and 43 GHz were conducted using the single-dish radio telescopes of the Korean VLBI Network (KVN) from December 2012 until May 2018 (MJD 56200-58400). We used multi-frequency data obtained from the Effelsberg 100-m, OVRO 40-m, Metsähovi 14-m, IRAM 30-m, SMA, ALMA, and VLBA telescopes. During the period of the observations, two major flares (R1 and R2) are seen clearly at 15 and 37 GHz during MJD 57500-57800 and MJD 58000-58300, respectively. The source shows typical variability with time-scales ranging from 20-161 days at 15 GHz. The variability Doppler factor is in the range of 11.51-31.23. The quasi-simultaneous radio data are used to investigate the synchrotron spectrum of the source, finding that the synchrotron radiation is self-absorbed. The turnover frequency and the peak flux density of the synchrotron self-absorption (SSA) spectra are in ranges of 38.06-167.86 GHz and 1.49-10.38 Jy, respectively. From the SSA spectra, magnetic field strengths are estimated to be < 10 mG. The equipartition magnetic field strengths are larger than the SSA magnetic field strengths by a factor of > 100. This indicates that the radio flares may be related to a particle energy-dominated emission region.

[구 GC-15] Tales of AGN tails: How AGN tails become radio relics in merging galaxy clusters?

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Radio relics, Mpc-size elongated diffuse radio emissions found at galaxy cluster outskirts, are known as the result of shock acceleration during the cluster merger. Theories have claimed that low Mach number shocks are too inefficient to create the observed properties of radio relics. Alternative scenarios such as fossil cosmic ray electrons (CRes) from AGNs are required to explain the observations. However, how exactly the fossil CRes from AGNs can supply the Mpc-size radio relic is still an open question. In this study, we present our recent uGMRT radio observation results of the merging galaxy cluster Abell 514. We found three remarkable AGN jet tails that may have undergone multiple reorientations and extend nearly 800 kpc. Using multi-frequency data, we have performed spectral analysis along the AGN tails and track how the tails lose or gain energy as they propagate in the intracluster medium. We will discuss whether these AGN jets can provide sufficient seed CRes to radio relics.

[구 GC-16] Kennicutt-Schmidt law with H I velocity profile decomposition in NGC 6822

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We present H I gas kinematics and star formation activities of NGC 6822, a dwarf galaxy located in the Local Volume at a distance of ~ 490 kpc. We perform profile decomposition of the line-of-sight velocity profiles of the high-resolution (42.4" × 12" spatial; 1.6 km/s spectral) H I data cube taken with the Australia Telescope Compact Array (ATCA). For this, we use a new tool, the so-called BAYGAUD (BAYesian GAUssian Decompositor) which is based on Bayesian Markov Chain Monte Carlo (MCMC) techniques, allowing us to decompose a line-of-sight velocity profile into