Minbae Kim[1], Yun-Yung Choi[2], Sungsoo S. Kim[1,2]
*[1]School of Space Research, Kyung Hee University, [2]Department of Astronomy and Space Science, Kyung Hee University*

We explore the role of bars in AGN-galaxy co-evolution using a volume-limited face-on late-type galaxy sample with $M_r < -19.5$ and $0.02 < z < 0.055$ selected from SDSS DR7. In this study, we investigate how $SFR_{\rm fib}$ as a proxy of gas contents at galactic center (over 1~1.5 kpc bulge scale) and central stellar velocity dispersion, $\sigma$, of host galaxies are connected to the bar presence and AGN activity. We find that galaxies are distributed in three distinct regions over the $SFR_{\rm fib}-\sigma$ space and the behaviors of their bar fraction ($f_{\rm Bar}$) are clearly different for each region. Galaxies at the AGN dominant region tend to be gas-deficient as $f_{\rm Bar}$ increases and bars are more frequently found in fully-quenched late-type galaxies at the quiescent region, suggesting that bars speed up of the consumption of gas by SF and lead a sudden decline in the central gas. Overall, the bar effects on the AGN activity are positive over the same space except for quiescent galaxies with $\sigma > 170$ km s$^{-1}$. Most significant bar effect on the AGN activity occurs in the less massive galaxies having sufficient gas, whereas the effect on galaxies at the AGN dominant region with higher the AGN fraction is relatively small. We suggest that the bar affect both central SF and AGN activities, but differently for central gas amount and BH (or bulge) mass of galaxies. We also investigate the AGN-bar connection with only pure AGNs and then confirm that they give marginally the same results.

## [구 GC-14] Constraining the shielded wind scenario in PG 2112+059

Cristian Saez[1], Niel Brandt[2], Franz Bauer[3], Fred Hamann[4], George Chartas[5], Sarah Gallagher[6]
*[1]Korea Astronomy and Space Science Institute, [2]The Pennsylvania State University, [3]Pontificia Universidad Catolica de Chile, [4]University of Florida, [5]College of Charleston, [6]University of Western Ontario.*

The physical scenario describing the origin of quasar winds remains largely unsettled due to our failure to account for X-ray weak BAL quasars. We approach this problem by studying the relation between the inner part of the outflow which is likely to be shielding the X-ray emission and thereby helping to drive the UV winds characterised by broad absorption lines (BALs). In particular, we aim to probe the wind-shield connection in the highly X-ray variable BAL quasar PG 2112+059, which has exhibited periods of X-ray weakness and X-ray normality in the past. A set of two 20 ks Chandra observations and two contemporaneous HST observations, separated by at least eight months, combined with a nearly simultaneous archival Chandra-HST observation from 2002, afford us a unique opportunity to study the connection between the shield (which is thought to be responsible for the X-ray absorption) and the ionisation state of the wind (observed as UV BAL features; e.g., C IV and O VI lines) over various timescales.

## [구 GC-15] The long-term centimeter variability of active galactic nuclei: A new relation between variability timescale and black hole mass

Jongho Park and Sascha Trippe
*Seoul National University*

We study the long-term radio variability of 43 radio bright AGNs by exploiting the data base of the University of Michigan Radio Astronomy Observatory (UMRAO) monitoring program. The UMRAO database provides high quality lightcurves spanning 25 - 32 years in time at three observing frequencies, 4.8, 8, and 14.5 GHz. We model the periodograms (temporal power spectra) of the observed lightcurves as simple power-law noise (red noise, spectral power $P(f) \propto f^{-\beta}$ using Monte Carlo simulations, taking into account windowing effects (red-noise leak, aliasing). The power spectra of 39 (out of 43) sources are in good agreement with the models, yielding a range in power spectral index ($\beta$) from $\approx 1$ to $\approx 3$. We find a strong anti-correlation between $\beta$ and the fractal dimension of the lightcurves, which provides an independent check of the quality of our modelling of power spectra. We fit a Gaussian function to each flare in a given lightcurve to obtain the flare duration. We discover a correlation between $\beta$ and the median duration of the flares. We use the derivative of a lightcurve to obtain a characteristic variability timescale which does not depend on the assumed functional form of the flares, incomplete fitting, and so on. We find that, once the effects of relativistic Doppler boosting on the observed timescales are corrected, the variability timescales of our sources are proportional to the black hole mass to the power of $\alpha = 1.70 \pm 0.49$ We see an indication for AGNs in different regimes of

accretion rate, flat spectrum radio quasars and BL Lac objects, having different scaling relations with $\alpha \approx 1$ and $\approx 2$, respectively. We find that modelling the periodograms of four of our sources requires the assumption of broken powerlaw spectra. From simulating lightcurves as superpositions of exponential flares we conclude that strong overlap of flares leads to featureless simple power-law periodograms of AGNs at radio wavelengths in most cases (The paper is about to be submitted to ApJ).

## [구 GC-16] Acceleration of Relativstic Jets on Sub-parsec Scales

Sang-Sung Lee[1,2], Andrei Lobanov[3], Thomas P. Krichbaum[3], J. Anton Zensus[3]
*[1]Korea Astronomy and Space Science Institute, [2]Korea University of Science and Technology, [3]Max-Planck Institute for Radio Astronomy*

Jets of compact radio sources are highly relativistic and Doppler boosted, making studies of their intrinsic properties difficult. Observed brightness temperatures can be used to study the intrinsic physical properties of the relativistic jets. The intrinsic properties of relativistic jets depend on inner jet models. We aimed to observationally test the inner jet models. The very long baseline interferometry (VLBI) cores of compact radio sources are optically thick at a given frequency. The distance of the core from the central engine is inversely proportional to the frequency. Under the equipartition condition between the magnetic field energy and particle energy densities, the absolute distance of the VLBI core can be predicted. We compiled the brightness temperatures of VLBI cores at various radio frequencies of 2, 8, 15, and 86~GHz. The brightness temperatures in the rest frame were investigated in the sub-parsec regions of the compact radio sources. From the vicinity of the central engine, the brightness temperatures increased slowly and then rose with steeper slope, indicating that the Lorentz factor increases along the jet. This implies that the jets are accelerated in the (sub-)parsec regions from the central engine.

## [구 GC-17] The drivers and energetics of ionized gas outflows in powerful Type 2 AGN in the local Universe

Marios Karouzos[1], Jong-Hak Woo[1], Hyun-Jin Bae[1,2]
*[1]Department of Physics and Astronomy, Seoul National University, [2]Department of Astronomy, Yonsei University*

There exist scaling relations that link the mass of supermassive black holes with both the velocity dispersion and the mass of the central stellar cusp of their host galaxies. This implies that galaxies co-evolve with their central black holes, potentially through the feedback from actively accreting supermassive black holes (AGN). We use integral field spectroscopy data from the 8.2m Gemini-North telescope to investigate ionized gas outflows in luminous local (z<0.1) Type 2 AGN. Our sample of 6 galaxies was selected based on their [OIII] dust-corrected luminosity (>$10^{42}$ erg/s) and signatures of outflows in the [OIII] line profile of their SDSS spectra. These are arguably the best candidates to explore AGN feedback in action since they are < 1% of a large local type 2 AGN SDSS sample selected based on their [OIII] kinematics. Expanding on previously reported results concerning the kinematic decomposition and size determination of these outflows, here we report their photoionization properties and energetics. We find strong evidence that connect the extreme kinematics of the ionized gas with AGN photoionization. The kinematic component related to the AGN-driven outflow is clearly separated from other kinematic components, such as gravitation- or stellar-driven motions, on the velocity and velocity dispersion diagram. Our spatially resolved kinematic analysis reveals that up to 90% of the mass and kinetic energy of the outflow is contained within the central kiloparcec of the galaxy. The total mass and kinetic energy of the outflow correlate well with the AGN bolometric luminosity, resulting in energy conversion efficiencies between 0.01% and 1%. Intriguingly, we detect ubiquitous signs of ongoing circumnuclear star formation. Their small size, the centrally contained mass and energy, and the universally detected circumnuclear star formation cast doubts on the potency of these AGN-driven outflows as agents of negative feedback.

## [구 GC-18] Discovery of a Faint Quasar at z ~ 6 and Implications for Cosmic Reionization

Yongjung Kim[1,2], Myungshin Im[1,2], Yiseul Jeon[1,2], Minjin Kim[3,4], Changsu Choi[1,2], Jueun Hong[1,2], Minhee Hyun[1,2], Hyunsung David Jun[1,5], Marios Karouzos[2], Dohyeong Kim[1,2], Duho Kim[1,6], Jae-Woo Kim[1,2], Ji Hoon Kim[7], Seong-Kook Lee[1,2], Soojong Pak[8], Won-Kee Park[3], Yoon Chan Taak[1,2], and Yongmin Yoon[1,2]
*1Center fore the Exploration of the Origin of the Universe (CEOU), 2Astronomy Program, FPRD,*