Session:	**[B2B-4] S4 : Galaxies, AGN and Cosmology**
Date:	August 19, 2014 (Tuesday)
Time:	14:00~15:30
Room:	Room D (Room 105~106)
Chair:	Atefeh Javadi (Institute for Research in Fundamental Science)

[B2B-4-1] **14:00~14:15**

Super-Massive Black Hole Mass Scaling Relations

Alister W. Graham (Swinburne University of Technology, Australia), Nicholas Scott, and James Schombert

Feedback from AGN is thought to be a driving force in regulating the growth of galaxy bulges. For more than a decade it has been thought that this resulted in a linear relation generating a near constant (black hole)-to-(bulge) mass ratio of around 0.2%. Indeed, almost all of our models are matched to this constraint. However, new research with a larger, and better understood, galaxy sample has revealed that this linear relation only applies to high-mass galaxies/bulges likely formed from the simple additive dry merging of galaxies and their black holes. A significantly different relation exists between black holes and lower-mass galaxy bulges when gaseous processes (star formation, AGN fueling and feedback) are involved. In this regime, black hole growth scales quadratically with bulge growth. Some of the many implications of this dramatic revision will be briefly discussed, including: (i) galaxy/black hole formation theories; (ii) alleged pseudo-bulge detections; (iii) black hole mass predictions in other galaxies; (iv) predictions for space-based gravitational wave detections; and (v) evolutionary studies over different cosmic epochs.

[B2B-4-2] **14:15~14:30**

Black Hole - Galaxy Scaling Relation and its Evolution

Jong-Hak Woo (Seoul National University, Korea)

The scaling relations between black hole mass and galaxy properties suggest a close connection between black hole growth and galaxy evolution, motivating a flood of theoretical and observational studies over the last decade. While studying the evolution of these relations over cosmic time provides valuable clues of the origin of the connection, a definitive resolution of this conundrum relies on understanding the slope and scatter of the local relations for AGNs. I will discuss the combined results from three-fold approach.
First, accounting for the effect of the rotational broadening and inclination effect on the measured stellar velocity dispersion, I will discuss the local M-sigma relation using our new spectroscopy from Subaru and Palomar, particularly for pseudo-bulge galaxies, for which the spatially-resolved stellar kinematics were not previously available. Second, using a sample of ~100 AGNs in the local Universe, I will discuss the local AGN M-sigma relation, which provides a robust baseline of the BH mass scaling relations (MBH-sigma, MBH-L, MBH-M), based on the spatially-resolved Keck spectroscopy and SDSS imaging.
Third, I will discuss the evolution of the scaling relations out to look-back times of 4-6 Gyrs and 8-10 Gyrs, using Keck spectra and HST images. The results indicate that 1) rotation effect can change the local M-sigma relation, particularly for disk-dominant galaxies. 2) Active galaxies follow the same scaling relations as inactive galaxies. 3) BH growth predates the final assembly of bulges, and the evolution is driven by disks being transformed into bulges. I will discuss the current limitations in studying the scaling relations using active galaxy samples.

[B2B-4-3] **14:30~14:45**

Density Profiles for Chaplygin Gas Accretion Upon Black Holes : Moderately Differentiated Minima in Wind Branch

Ritabrata Biswas (Bengal Engineering and Science University Shibpur, India)

In this work we study the density change along the accretion and wind branches when modified Chaplygin gas is taken to be the accreting fluid. We get a high wind density very near to black hole while a low wind density far from the black hole. In modified Chaplygin gas accretion case a local minima in accretion-density is got which can be detected as the CENBOL.

[B2B-4-4] **14:45~15:00**

On Small Nascent Galaxies in the Debris of Interacting Systems

C. Sengupta (Korea Astronomy and Space Science Institute, Korea), T. C. Scott, K. S. Dwarakanath, D. J. Saikia, and B. W. Sohn

Tidal interactions between gas rich galaxies can result in the displacement of large amounts of HI from the parent galaxy(s). Most of this stripped HI will eventually fall back into the potential of one or other of the interacting galaxies or be incorporated into the intra--group medium (IGM). But if the HI densities are sufficient and environmental conditions are favourable, self-gravitating bodies with masses typical of dwarf galaxies, called Tidal Dwarf Galaxies (TDG), may form within the tidally stripped gas. Observing these exotic objects, during their formation from gas/star debris provides a unique opportunity to investigate the processes governing formation and evolution of galaxies as well as the role of dark matter in their formation.
To study in--situ star and TDG formation in tidal gas debris, we are carrying out an HI survey of a sample of interacting systems using the Giant Metrewave Radio Telescope (GMRT). In addition to the HI data from the GMRT, we are using the Sloan Digital Sky Survey (SDSS), Spitzer and Galaxy Evolution Explorer (GALEX) public data and images to understand the star/gas correlations in these objects. We present here results from three tidally interacting systems, Arp 181, Arp 202 and Arp 305. Each of these systems reveal interesting information on TDG formation. In Arp 181, a TDG is forming about 70 Kpc away from the parent galaxies, inside a massive gas cloud that shows signs of infalling HI. On the other hand, in Arp 305, the TDG candidate is observed between the parent galaxies. Due to its size and inclination, it is one of few TDG candidates suitable for dark matter studies. The TDG candidates in Arp 202 and Arp 305 are amongst a small number of TDGs which show extremely blue colours. We are studying these objects individually to understand their properties and whether they form a subcategory of ultra-blue TDGs

[B2B-4-5] **15:00~15:15**

Molecular Gas and Radio Jet Interaction: A Case Study of the Seyfert 2 AGN M51

Satoki Matsushita (Academia Sinica Institute of Astronomy and Astrophysics , Taiwan), Dinh-V-Trung, Frederic Boone, Melanie Krips, Jeremy Lim, and Sebastien Muller

Recent high spatial resolution (~10 pc scale) molecular gas observations toward nearby active galactic nuclei (AGNs) revealed very disturbed features, such as jet-entrained or outflowing motions from AGNs or infalling motions toward AGNs, with little evidence of obscuring rotating disks or tori at this spatial scale. Seyfert 2 nucleus in the nearby galaxy M51 is one of them. We observed multiple CO transition lines and the HCN(1-0) line at ~1” (~34 pc) or higher resolution toward the Seyfert 2 nucleus of M51 using the IRAM Plateau de Bure Interferometer (PdBI) and the Submillimeter Array (SMA). All the images show very similar overall molecular gas distribution; there are two discrete clouds at the eastern and western sides of the nucleus, and the western cloud exhibits elongated distribution and velocity gradient along the radio jet. In addition, high HCN(1-0)/CO(1-0) brightness temperature ratio of about unity has been observed especially along the radio jet, similar to that observed at the shocked molecular gas in our Galaxy. This strongly indicates that the molecular gas along the jet is shocked, namely the radio jet and the molecular gas are interacting, and the jet is entraining both diffuse (CO) and dense (HCN) molecular gas outward from the circumnuclear region. This is the first clear imaging of the outflowing molecular gas entrained by the AGN jet, and showing the detailed physical status of outflowing molecular gas. Our results may also help to understand the nature of some of AGNs or ultra-/luminous infrared galaxies (U/LIRGs) that show outflowing molecular gas and/or high HCN/CO ratios at the nuclear regions.

[B2B-4-6] **15:15~15:30**

BS2fit: New Tool for Analyzing Spectra and Color-Magnitude Diagrams of Galaxies and Clusters

Zhongmu Li (Dali University, China) and Caiyan Mao

We present a new tool for studying the spectral energy distributions (SEDs) and color-magnitude diagrams (CMDs) of galaxies and star clusters, BINARY STAR TO FIT (BS2fit). The feature of the tool is having taken the effect of binaries, stellar rotation, star formation history into account. It can determine many parameters, e.g., distance, extinction, binary fraction, rotational star fraction, and star formation history. Because more factors are included, BS2fit can potentially give new insight into the properties of galaxies and clusters.