Contribution ID: **79** Type: **not specified**

Galactic Dynamics and Dark Matter Profile of NGC1380 with ALMA and VLT/MUSE

Wednesday 16 October 2019 12:45 (15 minutes)

Contributed talk

Abstract:
ALMA's high resolution and high sensitivity enable us to obtain kinematics of molecular gas in the center of early-type galaxies (~1kpc) complementarily to the stellar kinematics obtained with optical IFU instrument. The molecular gas kinematics is a powerful tracer of mass distribution of galaxies because the velocity dispersion is low(~10km/s) and the simple rotational model is applicable. To understand the interaction between dark matter and baryonic matter in the galaxy evolution history, it is fundamental to measure dark matter distribution in galaxies. However, it was difficult to derive the dark matter profile in the central region of early-type galaxies because of the lack of neutral hydrogen gas and the degeneracy between dynamical stellar M/L and dark matter distribution. To overcome this difficulty, we conducted a combined analysis of ALMA data and MUSE data of early-type fast rotator galaxy NGC1380. Our strategy is to measure BH mass and stellar mass well in the central region (~radius of 6", 500pc) with the cold gas kinematics. Then we derive dark matter profile with the stellar kinematics which is available in a wide field of view(~radius of 120", 10kpc) with the help of information of the central cold gas modeling. Dynamical measurement of stellar M/L and BH mass is conducted with ALMA high angular resolution data (0.24"×0.18"~ 21pc×16pc where BH sphere of influence of the resulted BH mass is 0.37"~ 33pc). Simple gas rotational disk model reproduce observed data cube well. The obtained BH mass of 3.38×10^8^{+0.30}*{-0.24} solar masses. With Jeans Anisotropic Models (JAM; Cappellari 2008) of stellar kinematics, we found that the substantial amount of dark matter halo is needed to maintain flat velocity profile at large radius. However, the mass model obtained with ALMA cold gas modeling cannot reproduce the central high-velocity dispersion peak in the stellar kinematics data (~10"900pc). We obtained dark matter profile by using information from the central gas rotational disk model as a prior knowledge with Bayesian inference. The Obtained inner slope of the dark matter was gamma=0.45^{+0.11}*{-0.10} which is lower than 1.0 NFW profile predict, which indicate that this galaxy experienced some process modifying dark matter shape to shallower profile. Our developed method will enable us to increase the number of measured central slope of dark matter profile in a wide range of galaxies to explore this mechanism.

Presenter: Dr TSUKUI, Takafumi

Session Classification: Galaxies