**Subject**：Galaxies and Active Galactic Nuclei

**Title**：ALMA observations of galaxies and active galactic nuclei near and far

**Lecturer**：Takuma Izumi (ALMA Project)

**Outline**：With the advent of the ALMA telescope, submillimeter astronomy has entered a golden age. Many of you are likely aware that numerous significant discoveries have been made based on high-resolution, high-sensitivity observations. This lecture will focus on the "co-evolution" of galaxies and supermassive black holes (SMBHs), highlighting key recent findings achieved with ALMA. First, I will summarize high-resolution observations related to mass accretion onto SMBHs, feedback from active galactic nuclei (AGN) in the local universe, and the star formation in galaxies. Particular attention will be given to the impact of improved resolution. In the latter half of the lecture, the perspective will shift to high redshift, providing an overview of observations of quasars (high-luminosity AGN) and their host galaxies using ALMA and the JWST satellite. I would like to discuss the prevalence of outflows and whether galaxy mergers can trigger galaxy evolution, and then exploring future research directions.

**Learning objectives**：

- Obtain overview-level understanding of black hole growth (accretion and feedback) studied by spatially resolved observations
- Overview our current understanding of the co-evolution of galaxies and supermassive black holes at the early universe
- Learn about the challenges of this research field, and discuss future prospects

**Textbooks and references**：None. Note that this lecture will mainly handle ALMA's submillimeter observations, but knowledge or skill of submillimeter observations will not be required (provided in the lecture).