UCAT Summer Student Program:

Understand the formation process of the youngest and yet most active star-forming galaxies

Supervisors:
Primary supervisor: **Prof. Sébastien Foucaud** (NTNU, Department of Earth Sciences)
Secondary supervisor: Prof. Yasuhiro Hashimoto (NTNU, Department of Earth Sciences)

Project description:
Composed by billions of stars, large amount of gas, dust and dark matter, galaxies are fascinating objects, subject of beautiful pictures but also a real challenge for astronomers that want to understand their history. Despite detailed optical and near infrared observations over the past 15 years, theoretical models still have difficulty explaining the formation of galaxies in details, and especially the early stages which happened during the first billion year of the evolution of our Universe.

One key observational ingredient for understanding the formation of galaxies in the early Universe is their directly observed gas content, which can be probed with CO molecule observations. Although very distant galaxies are young, host extreme star-formation activity and have probably a very high fraction of molecular gas, observing the gas content of such galaxies is extremely challenging, and no real detection of CO line has been achieved so far.

However, we have identified a population of very young and extremely star-forming galaxies in the intermediate Universe, hence far closer from us. These galaxies share many common characteristics with the young galaxies in the very distant Universe, and therefore present a great laboratory for studying early stages of star-formation.
We recently proposed to use a submillimeter interferometer, IRAM/PdBI, to observe a handful of such objects. However having a larger sample is essential to be able to deduce any real properties of this population.

The goal of this summer project is to select a sample of young and extremely star-forming galaxies from archival datasets (such as ECDFS, GOODS, COSMOS, SXDS/UKIDSS-UDS etc…).
Then we will operate a multi-wavelength (radio, X-ray, Infrared) study of this sample to narrow down the selection to the best candidates for follow-ups using submillimeter interferometers, such as ALMA, SMA and IRAM/PdBI for the next calls. Such observations will probe their CO molecular properties, and lead to crucial information on their gas mass fractions, determine how their star formation rate depends on gas density, and provide a new avenue to measure their kinematics and masses.

Preferred background of student candidates:
- Senior or Junior students with good English skills are both welcome.
- Background knowledge in astronomy is essential.
- Strong knowledge/experience in computers (linux system) is highly desirable, as this project will make extensive use of archives and databases.