Project Title: Why are some gas-rich galaxies not forming stars?

Level: MSc project (possibility to extend to PhD)

Supervisor: SARAO SARChI chair, Renée Kraan-Korteweg (kraan@ast.uct.ac.za), D.J. Pisano (djpisano@mail.wvu.edu)

Requirement: Honours in astronomy or closely-aligned field

Description:

Historically, elliptical galaxies were believed to have no active star formation or any cold gas or dust to fuel future star formation. We know now that many massive ellipticals contain both neutral atomic hydrogen and molecular hydrogen capable of fueling ongoing star formation. Nevertheless, any star formation in these galaxies appears to be occurring with low efficiency. E+A galaxies are elliptical galaxies, but have optical spectra that indicate the presence of short-lived A stars and the absence of emission lines suggesting the presence of young stars but no active star formation. It remains unclear why these galaxies have ceased forming stars, or even why these elliptical galaxies were forming stars in the first place. This project will seek answers to these questions.

For this project, the student will use multi-wavelength data from Sloan Digital Sky Survey and COSMOS, to generate a catalog of E+A galaxies in the field. The student can use this catalog to extract HI and radio continuum measurements from the MIGHTEE-HI, CHILES, and LADUMA surveys. In combination with existing multi-wavelength data, the student will be able to determine if there is any ongoing, low-level star formation, what the potential for future star formation in these galaxies are, and what the total masses of these galaxies tell us about how their star formation has been quenched.

Using the CHILES and LADUMA survey data, the student can also examine for the first time how the gas properties of E+A galaxies may have evolved over the past four billion years.

Detailed Requirements: Students should have some familiarity with programming in Python (or similar languages), the willingness to work with large databases, and the ability to learn how to use radio astronomy analysis packages (such as CASA).

Further Reading: Smercina et al., 2018, ApJ, 855, 51; Zwaan et al. 2013, MNRAS, 432, 492; Goto, 2007, MNRAS, 381, 187