Project Title: Tracing the evolution of Luminous Compact Blue Galaxies

Level: MSc project (possibility to extend to PhD)

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Requirement: Honours in astronomy or closely-aligned field

Description:

Luminous Compact Blue Galaxies (LCBGs) are intensely star-forming galaxies characterized by their blue colors, small sizes, and high luminosities. LCBGs are common at high redshifts, comprising over half of all galaxies at z~0.9 (Hunt et al. 2021), but are an order of magnitude rarer today (Werk et al. 2004). Furthermore, they contribute almost half of the total star formation at z~1 (Guzman et al. 1997) and almost none today. All of these properties make them one of the most rapidly evolving classes of galaxies in the universe. The morphologies of LCBGs are heterogeneous despite their compact cores with about half showing asymmetric, clumpy morphologies in a spiral disk and half being non-clumpy and lacking spiral morphologies (Garland et al. 2015). With this large mix of information, we do not know what LCBGs currently are nor into what they will evolve. This project seeks to answer these questions.

There are three common hypotheses for what LCBGs will evolve into. They could be the progenitors of dwarf elliptical galaxies or of the bulges of large spiral galaxies, or both. HI observations can shed light of this by providing a measurement of the total gas mass available for future star formation and the total galaxy mass. Archival multi-wavelength data can further constrain the current star formation rates and the stellar masses of LCBGs. For this project, the student will use an existing catalog of nearby LCBGs selected from the Sloan Digital Sky Survey, along with multi-wavelength data and HI data from archival surveys and MIGHTEE-HI to quantify the current properties of local LCBGs and constrain their current nature and future evolution.

If this work were to expand into a PhD thesis, the student will be able to expand this study to look at the evolution of gas properties over cosmic time using LADUMA and CHILES data and compare HI properties with optical properties measured with SALT spectroscopy.

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: Hunt et al., 2021, ApJ, 909, 49; Rabidoux et al., 2018, 852, 125; Randriamampandry et al., 2017, MNRAS, 470, 4382; Garland et al. 2015, ApJ, 807, 134