Master's thesis project in astronomy (Dept of Space, Earth and Environment)

Imaging the molecular gas in gravitationally lensed, high-redshift starburst galaxies

Background

The evolution of massive galaxies are characterised by several different evolutionary phases. The most massive galaxies we see today have very old stellar populations, which indicate that most of the stars were formed much earlier. It has also been realised that starburst galaxies (star formation rates 100-1000 times the star formation rate of the Milky Way) are much more common in the early universe, 2-3 billion years after the big bang, and that these likely play an important role for our understanding of massive galaxies. Using the Atacama Large Millimeter/submillimeter Array (ALMA), which is the worlds largest and most sensitive millimeter wavelength telescope, the molecular gas in high-redshift starburst galaxies can imaged. This is an important piece of the puzzle for our understanding of the star formation taking place in these young galaxies. When combining the power of ALMA with gravitational lensing, which acts as an additional telescope, the emission of a background galaxy is magnified by factors 2-20, making it possible study the gas at sub-kpc scale. Thus through this detailed insights can be gained in how the conditions for star-formation on a galaxy-wide scale compares to that of local galaxies.

Task description

The project will focus on the analysing ALMA data for two lensed, high-redshift starburst galaxies, and placing the results in the relevant scientific context. High angular resolution data of CO line emission is available, and the analysis includes calibrating and imaging the data. As the sources are gravitationally lensed, the lensing magnification needs to be derived. Tools are available for both aspects of the project. Important aspects of the analysis include estimating the structure and kinematics of the starburst galaxy. The results should be compared to other starburst galaxies and normal star-forming galaxies.

Required education and course requirements

The courses "Galaxy and Observational Cosmology" (RRY091) and "Radio Astronomical Techniques and Interferometry" (RRY031) are highly recommended for this Master's research project. Programming skills, e.g. Python, are helpful, but may also be developed as a part of this thesis.

Credits

30 or 60 credits

Starting time

The project can start at any time

Contact information to supervisor

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The project also involves Hasselblad Fellow Bitten Gullberg and PhD student Kiana Kade.