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Molecular gas and star formation in the CARLA J1103+3449 cluster at z~1.4

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Galaxy evolution from a star-forming active galaxy rich in gas, dust, and young blue stars to a passive, 'dead' galaxy, void of gas and filled with an old population of red stars depends mainly on the molecular gas reservoirs present inside a galaxy. Molecular gas plays an important role since it acts as a star formation fuel. Detecting and estimating the molecular gas content inside a galaxy indicates that this galaxy is probably still star-forming.
In this project, I worked with my supervisor and collaborators on the IRAM NOEMA observations of a spectroscopically confirmed CARLA J1103+3449 cluster at z ~ 1.44. We measure the molecular gas content of confirmed cluster members and compare it with observations in other clusters and in the field at similar redshifts (Markov et al. to be submitted). The work on this project includes data reduction, imaging and analysis of NOEMA observations using gildas software. We target a CO(2-1) emission line redshifted at ν =94.5GHz, inside the central region of the cluster. We detect an extended continuum emission centered on the RLAGN with two components with a SNR ~ 26σ and SNR ~ 6σ. These two components originate from a synchrotron emission of a supermassive black hole in the cluster center and are roughly tracing the two radio jets from the work of Best et al. (1999). We detect a CO(2-1) emission in the central cluster region, we extract the spectra and derive the velocity integrated flux. We estimate a substantial amount of molecular gas of $M_{gas} = 1.7{\times}10^{11} M$ extended around the central RLAGN. We kinematically resolve the two components with a SNR ~ 3σ and SNR ~ 4.5σ. Both components are blueshifted with respect to the RLAGN and are spatially separated from the RLAGN by ~ 15 kpc. We discuss several hypotheses to explain these molecular gas reservoirs. We argue that the bipolar radio emission favors the outflow/inflow hypothesis, i.e. the two components are either originating from cold gas that is lifted ~ tens of kpc away from the RLAGN by the two jets, or it condensed from an interaction of the AGN jets with intracluster medium (ICM) and it has not settled yet on the RLAGN.

For the RLAGN and other cluster members we use 3σ values of the rms noise to estimate upper limits of molecular gas masses. Furthermore, we use the stellar mass estimates from Amodeo et al. (in prep.), to compute galaxy parameters and compare them with parameters of similar galaxies in other clusters and the field galaxies from the PHIBSS survey in order to understand the stage of the evolution of our galaxies.

Field

InterStellar Medium

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