

The IRAM 30m Nearby Galaxy Dense Gas Survey EMPIRE

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The focus of the ~600h IRAM 30m EMPIRE Large Program is to map multiple spectroscopic tracers in the 3mm window (e.g. HCN, HNC, HCO⁺ and CO isotopologues), covering a range of critical densities, among and across 9 nearby spiral galaxies. The faint nature of these lines (e.g. HCN) has made systematic, resolved surveys of such molecular lines across normal disk galaxies a challenging endeavor prior to EMPIRE. The goal of this survey is to probe in particular the distribution of the dense, star-forming gas within a wide range of galactic environments, its star formation efficiency and the link to local ISM conditions. While analysis of a final set of projects is ongoing, the survey has so far produced 8 publications since 2016. In this talk I will focus on one of our key findings, which is a variable dense gas fraction and efficiency of the dense gas to form stars. In particular, denser gas appears to be less efficient at forming stars. I will discuss these findings and place these results in context with recent Milky Way studies. I will further provide an overview of another suite of results from EMPIRE, focusing largely on CO isotopologues (¹²CO, ¹³CO, C¹⁸O) and their variation across local disk galaxies.

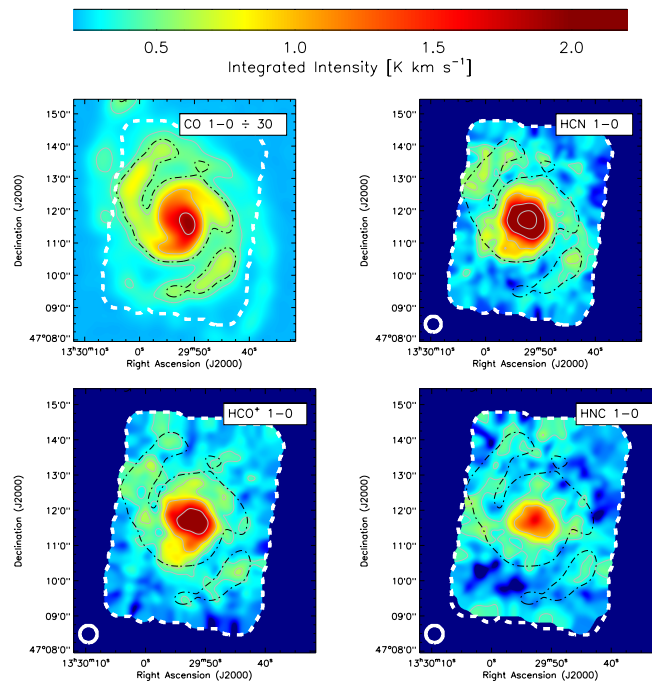


Figure: Exemplary set of integrated intensity maps of the high critical density lines of HCN, HCO⁺, HNC (and ¹²CO for comparison from the PAWS LP) for the spiral galaxy M51.