ALCHEMI: Results from the ALMA Comprehensive High-resolution Extragalactic Molecular Inventory of NGC253

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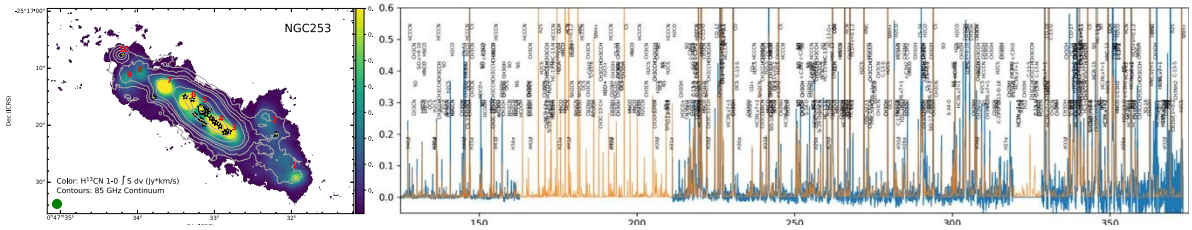
Spectral line surveys [e.g. 1,2,3] reveal significant differences in the chemical properties of the ISM in starburst galaxies, and that chemistry is an important diagnostic of evolutionary stage. ISM chemical cycling and enrichment by star formation can be assessed through observations of molecular isotopologues and the derivation of isotopic ratios. ISM energy exchange and mechanical feedback from the starburst process can be studied through other molecular species that trace shocked gas and dust. Ultimately, molecular tracers of ISM chemistry probe the fundamental regulation of the star formation process in galaxies.

To this end, we have conducted a multi-band spectral line survey within the nearby starburst galaxy NGC253. The ALMA Comprehensive High-resolution Extragalactic Molecular Inventory (ALCHEMI), an ALMA Cycle 5 Large Programme, encompasses the entirety of ALMA Bands 3, 4, 6, and 7 (85 to 366 GHz). A complimentary ALMA Cycle 6 program adds imaging at ALMA Band 5. ALCHEMI images the 50x20 arcsec (850x340 pc) central molecular zone (CMZ) of NGC253 using both the 12m Array and the Atacama Compact Array (ACA) at 1.6 arcsec (25 pc) spatial and 10 km/s spectral resolution (sample image and spectrum below).

In this presentation I will describe some of the first results derived from the ALCHEMI measurements. These results include an analysis of the molecular complexity within the NGC253 CMZ using the MADCUBA [4] line identification tool, characterization of the mechanical energy environment within the NGC253 GMCs, and measurements of the physical conditions on GMC size scales using Bayesian inference modeling constrained by the multiple transitions and species available from the ALCHEMI survey.



Sample image (left: $H^{13}CN$ 1-0) and spectrum (right) with line identification using MADCUBA.

References

[1] Martín, S. et.al., A&A, 527, A36 (2011)

[2] Aladro, R. et.al., A&A, 579, A101 (2015)

[3] Costagliola, F. et.al., A&A, 582, A91 (2015)

[4] Martín, S. et.al., A&A, 631, A159 (2019)