The chemistry in the starburst galaxy NGC 253 from the ALCHEMI survey

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Intense star formation, or starburst, characterizes the important phase of the galaxy evolution. Much is unknown about the properties of the interstellar medium (ISM) when the starburst is taking place, and when it is about to cease from the feedback. Astrochemistry is a useful tool to study these ISM properties.

By taking an advantage of the excellent capabilities of ALMA, we conducted a spectral line survey called ALCHEMI in the nearby starburst galaxy NGC 253 as a part of Cycle 5 ALMA large program. It covers most of ALMA Bands 3-7 that allowed the detection 1500 transitions.

Our results show that the central region of NGC 253 has at least three orders of magnitude higher cosmic-ray ionization rates than that in dense clouds in the Galactic disk[1,2,3]. We also found that the outskirts of the central molecular zone host intersections of galaxy orbits, and can be used as a laboratory of shock chemistry. We found that methanol, HNCO, HOCO+, and OCS are species that are enhanced in these regions[4,5,6]. From a statistical analysis on 150 integrated-intensity images using principal component analysis, we were able to identify the chemistry between young super star clusters and more developed ones.

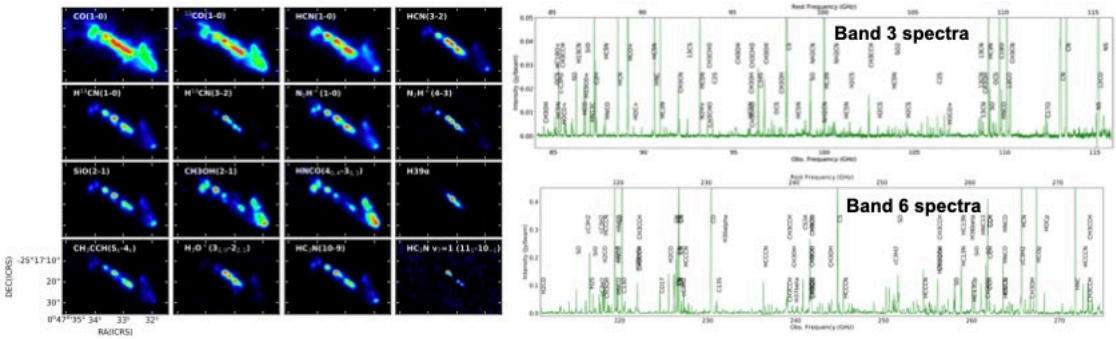

Figure 1: (Left) Selected velocity-integrated images and (right) spectra obtained from the ALCHEMI survey.

References

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[4] K.-Y. Huang et al. (2023) A&A, 675, 151
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