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A $\lambda = 1.3$ mm and 2 mm molecular line survey towards M82 [★]

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Abstract

Aims. We study the chemical complexity towards the central parts of the starburst galaxy M82, and investigate the role of certain molecules as tracers of the physical processes in the galaxy circumnuclear region.

Methods. We carried out a spectral line survey with the IRAM-30 m telescope towards the northeastern molecular lobe of M82. It covers the frequency range between 129.8GHz and 175.0GHz in the 2mm atmospheric window, and between 241.0GHz and 260.0 GHz in the 1.3mm atmospheric window.

Results. Sixty-nine spectral features corresponding to 18 different molecular species are identified. In addition, three hydrogen recombination lines are detected. The species NO, H₂S, H₂CS, NH₂CN, and CH₃CN are detected for the first time in this galaxy.

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Assuming local thermodynamic equilibrium, we determine the column densities of all the detected molecules. We also calculate upper limits to the column densities of fourteen other important, but undetected, molecules, such as SiO, HNC, or OCS. We compare the chemical composition of the two starburst galaxies M82 and NGC253. This comparison enables us to establish the chemical differences between the products of the strong photon-dominated regions driving the heating in M82, and the large-scale shocks that influence the properties of the molecular clouds in the nucleus of NGC253.

Conclusions. Overall, both sources have different chemical compositions. Some key molecules highlight the different physical processes dominating both central regions. Examples include CH₃CCH, c-C₃H₂, or CO⁺, the abundances of which are clearly higher in M82 than in NGC253, pointing at photodissociating regions. On the other hand, species such as CH₂NH, NS, SiO, and HOCO⁺ have abundances of up to one order of magnitude higher in NGC253 than in M82.

Key words: ISM: molecules / galaxies: nuclei / galaxies: abundances / radio lines: ISM / galaxies: starburst / galaxies: individual: M 82

* Appendix is available in electronic form at <http://www.aanda.org>

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