LABORATORY DETECTION AND ASTRONOMICAL SEARCH FOR AN UNCHARTED GLYCINE ISOMER

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In recent years, astrochemistry has shown that interstellar chemistry is able to generate several building blocks of key biomolecules. These investigations aim the detection of new interstellar systems, especially those that have a relevant prebiotic role, such as peptide-like molecules. Herein, we present the laboratory detection and astronomical search for acetohydroxamic acid ($CH_3CONHOH$), an uncharted glycine isomer. We provide frequencies of its ground state (up to 40 GHz), measured by broadband and narrowband rotational spectroscopies combined with a laser ablation device. The ^{14}N nuclear quadrupole hyperfine structure and the A-E splittings due to the internal rotation were resolved and interpreted. Hence, we determined a precise set of the rotational spectroscopic parameters for the two distinct Z- and E-conformers. [b] Our laboratory data were subsequently employed to search for the lowest-energy Z-conformer toward two prominent astronomical sources. Firstly, we used the spectral GOTHAM survey performed with the Green Bank Telescope to search for the molecule toward the cold molecular cloud TMC-1. We also employed a sensitive spectral survey of the Galactic Center molecular cloud G+0.693-0.027, based on IRAM 30 m and Yebes 40 m observations. We report the nondetection of acetohydroxamic acid toward both astronomical sources but, interestingly, the derived upper limit to its column density lies close to that obtained glycine. Its corresponding molecular abundance with respect to molecular hydrogen is found to be $\leq 1 \times 10^{-9}$ and 2×10^{-10} in TMC-1 and G+0.693-0.027, respectively, which further constrain the abundance of this glycine isomer in the ISM and provide additional insights into the chemistry of amino acid-related species in space.

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[b] M. Sanz-Novo, J. L. Alonso, V. M. Rivilla, B. A. McGuire et al. 2022, A&A, 666, A134.