

A molecular treasure trove in the Galactic Center: New discoveries toward the G+0.693-0.027 shocked molecular cloud

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In recent times, the number of newly detected molecules in the interstellar medium (ISM) has skyrocketed, to the point that over one third of the current interstellar molecular census originates from discoveries made in the past five years. Two astronomical sources stand above the rest: the dark molecular cloud TMC-1 [1] and the molecular cloud G+0.693-0.027. The latter, a shock-dominated region located in the Galactic center (GC), appears as an "astronomical mine" for the detection of species harboring the six key elements for life (C, H, O, N, S, P), along with other refractory species (i.e., Si-, Mg-, and Na-bearing compounds), resulting in more than 20 first detections.

In this talk, I will showcase some of the latest discoveries enabled by the superb sensitivity of a broadband, ultra-deep spectral survey carried out with the Yebes 40m and IRAM 30m telescopes toward G+0.693, and discuss their astrochemical implications. Among these findings are glycolamide, the first interstellar glycine isomer detected in space [2]; carbonic acid (HOCOOH), also known as "tansan", the first interstellar molecule containing three oxygen atoms and the third carboxylic acid detected in the ISM to date [3]; along with several sulfur-bearing species, such as thionylimide (HNSO), the first species detected in the ISM containing, simultaneously, N, S and O [4]; protonated carbonyl sulfide (HOCS⁺) [5]; and dimethyl sulfide (CH₃SCH₃, DMS) [6], the predominant volatile organic sulfur compound in our oceans, previously considered as a unique biomarker in the search for extraterrestrial life.

Although we are currently living a new golden age of astrochemistry, these discoveries likely represent only a small fraction of the molecular inventory yet to be identified, possibly just the tip of the iceberg. This underscores the need for a fully coordinated, multidisciplinary approach that integrates laboratory experiments, astronomical observations, and theoretical modeling to enable the detection of increasingly complex molecules. This exciting journey will be key to unveiling the actual levels of chemical complexity in the ISM and assessing how widespread the fundamental prebiotic ingredients needed for the development of life are throughout space.

References

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