

Isotopic Fractionation in Formamide: Tracing the Origin of a Key Prebiotic Molecule

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Formamide (NH₂CHO) is one of the most relevant prebiotic molecules detected in the interstellar medium, as it represents a potential precursor to biologically important compounds. Despite numerous detections towards star-forming regions, the formation routes of formamide remain debated, with both gas-phase and grain-surface reactions proposed to contribute to its synthesis.

Isotopic fractionation provides a powerful tool to constrain the chemical history of complex organic molecules. By comparing the abundance ratios of the rarer isotopologues of formamide with those of chemically related species, it is possible to identify common formation pathways and assess the degree of chemical inheritance from earlier evolutionary stages. In particular, isotopic signatures preserve information on the physical conditions and reaction environments in which the molecule was formed.

In this contribution, I will present recent observational constraints on the isotopic composition of formamide and discuss their implications for the origin and evolution of this key prebiotic species. The results provide new insights into the processes that regulate molecular complexity during star and planet formation and establish isotopic fractionation as a critical diagnostic of interstellar prebiotic chemistry.