Isotopic fractionation in interstellar clouds: Hydrogen, carbon, nitrogen, and oxygen

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The level of isotopic fractionation in molecules provides insights into their formation environments and how they formed. Radio observations toward star-forming regions have quantified the degree of isotopic fraction of abundant volatile elements (H, C, N, and O) in various molecules [e.g., 1, 2, 3]. Theoretical studies of isotopic fractionation are crucial to interpret the observations. The aim of this work is (i) to identify the major fractionation pathways of the abundant volatile elements, and (ii) to reveal (possible) correlations or anticorrelations of the isotope ratios among different elements.

In this poster, we present the results of our extended astrochemical models of molecular clouds, which includes isotopic fractionation of abundant volatile elements (H, C, N, and O). A set of isotopic exchange reactions, isotope selective photodissociation, and nuclear spin states of H_2 are considered. We find/confirm that hydrogen and carbon isotope fractionation are predominantly driven by isotope exchange reactions, while nitrogen and oxygen isotope fractionation are predominantly driven by isotope selective photodissociation. We show that different isotopes show different fractionation patterns.

References

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