

DETECTION AND FORMATION OF INTERSTELLAR $c\text{-C}_3\text{D}_2$

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Multiply deuterated molecules are unique observational probes for the earliest stages of star formation. Cyclopropenylidene, $c\text{-C}_3\text{H}_2$, is an ideal probe for deuterium chemistry. It is one of the most widespread molecules in our Galaxy and it has the possibility of double deuteration. Furthermore, since $c\text{-C}_3\text{H}_2$ is an early-type molecule, it is a particular useful tool to investigate early stages of a molecular cloud. This makes observations of its deuterated forms particularly important to test time-dependent chemical codes which include deuteration processes. The centimeter and millimeter wavelength spectra of doubly deuterated cyclopropenylidene have recently been measured in the laboratory^a, allowing for the first time a search for $c\text{-C}_3\text{D}_2$ in space. We report the detection of $c\text{-C}_3\text{D}_2$ in two starless cores, L1544 and TMC-1C. The deuteration of this small hydrocarbon ring is analysed with a comprehensive gas-grain model, the first including doubly deuterated species. The observed abundances of $c\text{-C}_3\text{D}_2$ can be explained solely by gas-phase processes, supporting the idea that $c\text{-C}_3\text{H}_2$ is a good indicator of gas-phase deuteration.

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