

TO KINK OR NOT: THE SEARCH FOR LONG CHAIN CUMULENONES USING MICROWAVE SPECTRAL TAXONOMY

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Although cumulene carbenes terminated with sulfur up to $\text{H}_2\text{C}_7\text{S}$ are known to possess C_{2v} geometries, the analogous oxygen species have only been characterized in the gas-phase up to $\text{H}_2\text{C}_4\text{O}$, and propadienone ($\text{H}_2\text{C}_3\text{O}$) and butatrienone ($\text{H}_2\text{C}_4\text{O}$) exhibit kinked heavy atom backbones. Using microwave spectral taxonomy, searches have been undertaken for pentatetenone ($\text{H}_2\text{C}_5\text{O}$) and its isomers. Surprisingly, no evidence has been found for the cumulene, but rotational lines of a bent-chain isomer, $\text{HC}(\text{O})\text{C}_4\text{H}$, analogous in structure to propynal, $\text{HC}(\text{O})\text{CCH}$, have been detected instead. In closely-related work, the sulfur analog $\text{HC}(\text{S})\text{C}_4\text{H}$ has also been identified for the first time. This talk will provide a summary of our search procedure and experimental findings, quantum chemical calculations of isomeric stability and dipole moments, and prospects for detecting these longer chains in astronomical sources where $c\text{-C}_3\text{H}_2\text{O}$ and $\text{HC}(\text{O})\text{CCH}$ are known.