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 H$_2$C$_7$S are known to possess C$_{2v}$ geometries, the analogous oxygen species have only been characterized in the gas-phase up to H$_2$C$_4$O, and propadienone (H$_2$C$_3$O) and butatrienone (H$_2$C$_4$O) exhibit kinked heavy atom backbones. Using microwave spectral taxonomy, searches have been undertaken for pentatetrenone (H$_2$C$_5$O) and its isomers. Surprisingly, no evidence has been found for the cumulenone, but rotational lines of a bent-chain isomer, HC(O)C$_4$H, analogous in structure to propynal, HC(O)CCH, have been detected instead. In closely-related work, the sulfur analog HC(S)C$_4$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-C$_3$H$_2$O and HC(O)CCH are known.