THE PURE ROTATIONAL SPECTRA OF ACETALDEHYDE AND GLYCOLALDEHYDE ISOTOPOLOGUES MEASURED IN NATURAL ABUNDANCE BY CHIRPED-PULSE FOURIER TRANSFORM MICROWAVE SPECTROSCOPY

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Complex organic molecules (COMs) such as glycolaldehyde ($HOCH_2CHO$) and acetaldehyde (CH_3CHO) have now been detected in numerous interstellar sources. Glycolaldehyde has been detected in two hot cores, Sgr B2(N) and G31.41+0.31. Acetaldehyde has been observed in various sources, including the translucent clouds CB 17 and CB 24, cold molecular clouds such as TMC-1 and L134N, and hot cores such as Sgr B2(N), NGC 6334F, and the Orion Compact Ridge. Such COMs are known to have rich and complex spectra that add to the line confusion problem faced in observations of molecule-rich sources. Laboratory studies of excited vibrational states and isotopologues for known COMs therefore provide important guidance for sorting out the interstellar line confusion problem. Detection of isotopologues and determination of their abundance relative to the main isotopic species would also provide important constraints on interstellar chemical models, as these isotopic ratios are dependent on the formation mechanism for each species. The isotopic ratios for $^{13}C/^{12}C$, $^{18}O/^{16}O$, and D/H are known in various interstellar environments for simple molecules, but remain relatively unexplored for more complex species such as glycolaldehyde and acetaldehyde. The rotational spectra of the main isotopologues for glycolaldehyde and acetaldehyde have been well-characterized through microwave, millimeter, and submillimeter laboratory spectroscopy. Here we present the laboratory characterization of the isotopologues of acetaldehyde and glycolaldehyde in natural abundance by chirped pulse Fourier transform microwave spectroscopy (CP-FTMW). This spectroscopic information lays the groundwork for additional higher-frequency studies that can be directly applied to the interpretation of millimeter and submillimeter observations.