

MICROWAVE SPECTRAL TAXONOMY AND ASTRONOMICAL SEARCHES FOR VIBRATIONALLY-EXCITED C₂S AND C₃S

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C₂S and C₃S are common interstellar species, and have relatively simple reaction chemistries. For these reasons, they frequently serve as probes of chemical evolution and physical conditions in rich astronomical sources. Because their rotational lines are often conspicuous there, detection of C₂S and C₃S in vibrationally-excited states might provide additional insight into formation pathways and excitation conditions. However, knowledge of the vibrational satellite transitions of both species is incomplete. Here, we report laboratory measurements of rotational spectra of vibrationally-excited C₂S and C₃S obtained from two microwave spectral taxonomy studies, in which CS₂ alone or in combination with a hydrocarbon precursor (acetylene or diacetylene), were produced using an electrical discharge. For C₃S, these studies, in combination with high-level quantum chemical calculations, greatly extend previous microwave measurements, while for C₂S, satellite transitions from several vibrational states have been observed for the first time. On the basis of precise laboratory rest frequencies, renewed searches for these transitions can be undertaken with confidence in publicly-available astronomical line surveys.