THE LABORATORY AND OBSERVATIONAL STUDY OF 2-BUTANONE AS A TEST FOR ORGANIC CHEMICAL COMPLEXITY IN VARIOUS INTERSTELLAR PHYSICAL ENVIRONMENTS

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We have undertaken a combined laboratory, observational, and modeling research program in an attempt to more fully understand the effects that physical environment has on the chemical composition of astronomical sources. To this end, deep millimeter and submillimeter spectral line surveys of multiple interstellar sources with varied physical conditions have been collected. These sources cover a range of physical environments, including hot cores, shocked regions, low-mass star forming regions, and stellar outflows. We have conducted broadband spectral line surveys at λ =1.3 mm of 10 sources at the Caltech Submillimeter Observatory (CSO). These are forerunner observations to our Herschel OT1 program to continue these line surveys at higher frequencies. Only a fraction of the lines observed in the CSO spectra can be assigned to known molecules. Laboratory spectra of many additional candidates for interstellar detection must therefore be collected before these spectral line surveys can be fully-analyzed. One such molecular target is 2-butanone [also known as methyl ethyl ketone (MEK), $CH_3COCH_2CH_3$], which contains similar functional groups to other known interstellar molecules and is therefore a likely product of interstellar organic chemistry. The microwave spectrum for MEK was collected with the chirped-pulse waveguide Fourier Transform Microwave (FTMW) spectrometer at New College Florida, and the millimeter and submillimeter spectrum was collected using the direct absorption flow cell spectrometer at Emory University. We will report here both on the laboratory characterization of MEK and the analysis of the observational line surveys in the context of the identification of new, complex organic molecules in the ISM.