A UNIQUE EXPERIMENTAL APPROACH FOR IDENTIFYING DESORBED INTERSTELLAR/COMETARY ICE SPECIES VIA SUBMILLIMETER SPECTROSCOPY

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A new experimental approach to studying interstellar and cometary ice analogs has been designed that uses millimeter/submillimeter (mm/submm) spectroscopy coupled with mass spectrometry to identify desorbed gas-phase species, and infrared (IR) spectroscopy to monitor the photochemistry within icy mantles photolyzed by ultra-violet (UV) light. Rotational spectroscopy provides several benefits for laboratory ice studies including the capability of distinguishing structural (e.g. methyl formate ($HCOOCH_3$) and glycolaldehyde ($HCOCH_2OH$)) and conformational (e.g. cis- and trans-methyl formate) isomers, determining the rotational temperature of desorbed species, and laboratory spectra that are directly comparable to mm/submm spectra from ground- and space-based telescopes. Here we will show how surface binding energy can be determined via mm/submm spectroscopic detection of thermally desorbed ices, and how to combine IR spectroscopy, mass spectrometry, and mm/submm spectroscopy to determine UV photoproducts of methanol ices.