

Submillimeter Spectra of Low Temperature Gases and Gas Mixtures

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We have measured submillimeter absorption spectra of weakly bound dimers using a new spectrometer and absorption cell apparatus. The spectrometer is a differential Michelson interferometer which is designed specifically to observe weak absorption features over the frequency region 2-30 (1/cm). The absorption cell is a pair of 6 meter light pipes which are immersed in a cryogenic bath. We have conducted preliminary experiments on mixtures of hydrogen and argon, and nitrogen and argon, at 89 K using gas pressures in the range 1-2 atmospheres. These experimental conditions involve gas temperatures and densities near to those found in the atmospheres of Saturn and Titan. The spectra of low temperature nitrogen, nitrogen-argon, and methane measured using an earlier instrument will also be presented over the frequency range 20-100 (1/cm). The goal of these experiments is to identify the spectral signatures of dimers that form in the atmospheres of the planets. Dimer features will likely appear in the far-infrared spectra of Saturn and Titan that will be obtained by the Composite Infrared Spectrometer (CIRS) onboard the Cassini spacecraft. These laboratory measurements may be applied to the detailed interpretation of new planetary spectra.