

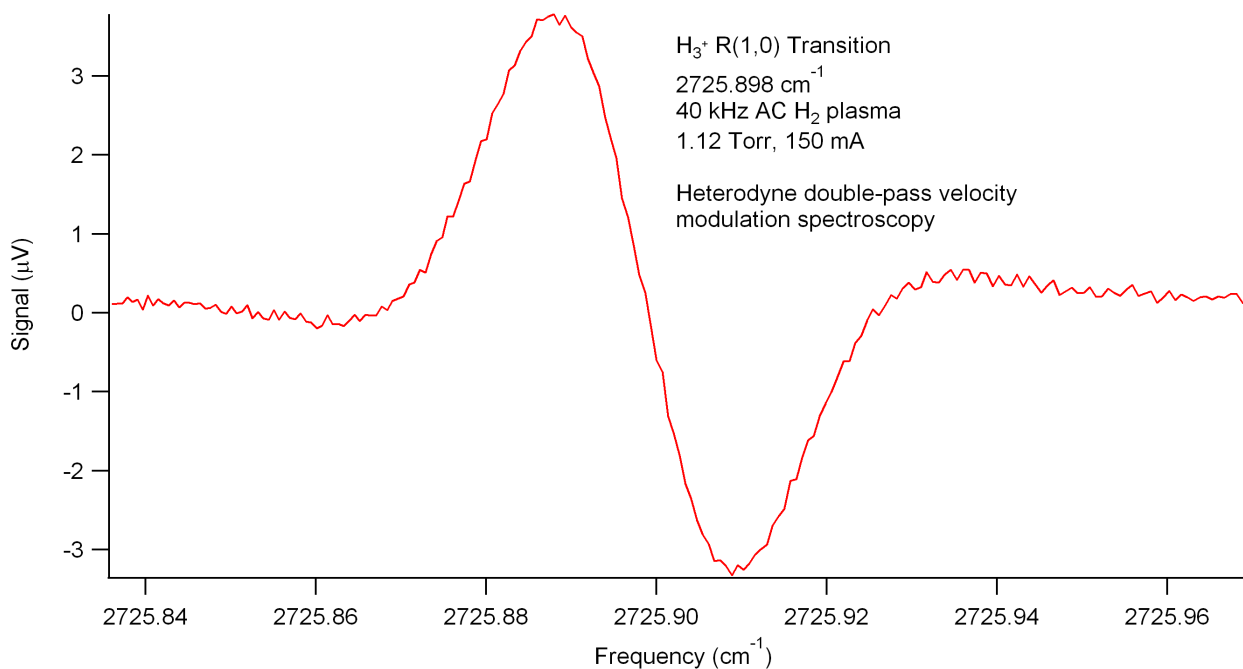
Indirect THz Spectroscopy of Molecular Ions

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THz/sub-mm telescopes such as Herschel, ALMA, and SOFIA give data in a spectral region that plays a critical role to understanding the chemical composition in the interstellar medium. Laboratory spectroscopy of astrochemically relevant molecules is essential to interpreting the wealth of data that will come from these instruments.

This work describes experimental progress towards building a mid-IR spectrometer that utilizes Noise Immune Cavity Enhanced Optical Heterodyne Velocity Modulation Spectroscopy (NICE-OHVMS), a technique created by the McCall group. This instrument will be able to record sub-Doppler rovibrational lines of molecular ions with sub-MHz precision due to Lamb dips and sub-MHz accuracy with a frequency comb. By utilizing combination differences and effective Hamiltonian fitting, we can infer the frequencies of rotational transitions. This is an indirect approach to solving the problem of the relative immaturity of THz light sources and detectors by application of well developed IR light sources and detectors. This represents a general instrument for indirect THz spectroscopy.

We will present NICE-OHVMS results of N_2^+ in the near-IR on a different instrument and discuss progress towards implementing this technique in the mid-IR using H_3^+ as a simple test molecule with the instrument we are constructing. Implementation of the NICE-OHVMS technique will allow us to observe sub-Doppler features and aid astronomical searches for molecular ions.



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