PROGRESS TOWARDS A HIGH-PRECISION INFRARED SPECTROSCOPIC SURVEY OF THE H_3^+ ION

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The trihydrogen cation, H_3^+, represents one of the most important and fundamental molecular systems. Having only two electrons and three nuclei, H_3^+ is the simplest polyatomic system and is a key testing ground for the development of new techniques for calculating potential energy surfaces and predicting molecular spectra. Corrections that go beyond the Born-Oppenheimer approximation, including adiabatic, non-adiabatic, relativistic, and quantum electrodynamic corrections are becoming more feasible to calculate[a,b,c,d]. As a result, experimental measurements performed on the H_3^+ ion serve as important benchmarks which are used to test the predictive power of new computational methods.

By measuring many infrared transitions with precision at the sub-MHz level it is possible to construct a list of the most highly precise experimental rovibrational energy levels for this molecule. Until recently, only a select handful of infrared transitions of this molecule have been measured with high precision ($\sim$ 1 MHz)[e]. Using the technique of Noise Immune Cavity Enhanced Optical Heterodyne Velocity Modulation Spectroscopy, we are aiming to produce the largest high-precision spectroscopic dataset for this molecule to date. Presented here are the current results from our survey along with a discussion of the combination differences analysis used to extract the experimentally determined rovibrational energy levels.

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