INDIRECT TERAHERTZ SPECTROSCOPY OF MOLECULAR IONS USING HIGHLY ACCURATE AND PRECISE MID-IR SPECTROSCOPY[a]

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With the advent of Herschel and SOFIA, laboratory methods capable of providing molecular rest frequencies in the terahertz and sub-millimeter regime are increasingly important. As of yet, it has been difficult to perform spectroscopy in this wavelength region due to the limited availability of radiation sources, optics, and detectors. Our goal is to provide accurate THz rest frequencies for molecular ions by combining previously recorded microwave transitions with combination differences obtained from high precision mid-IR spectroscopy. We are constructing a Sensitive Resolved Ion Beam Spectroscopy setup which will harness the benefits of kinematic compression in a molecular ion beam to enable very high resolution spectroscopy. This ion beam is interrogated by continuous-wave cavity ringdown spectroscopy using a home-made widely tunable difference frequency laser that utilizes two near-IR lasers and a periodically-poled lithium niobate crystal. Here, we report our efforts to optimize our ion beam spectrometer and to perform high-precision and high-accuracy frequency measurements using an optical frequency comb.

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