APPLICATION OF 11 GHz CHIRPED-PULSE BROADBAND FOURIER TRANSFORM MICROWAVE (FTMW) SPECTROSCOPY TO VIBRATIONALLY EXCITED STATE ROTATIONAL SPECTROSCOPY

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The application of our broadband 11 GHz chirped-pulse FTMW spectrometer to vibrationally excited state rotational spectroscopy is presented. The chirped pulse FTMW spectrometer is ideally suited for studying the MW spectra of vibrationally excited molecules. The key feature of our new spectrometer is that the entire 11 GHz rotational spectrum (7.5 - 18.5 GHz) is acquired on each valve shot. In about 10 seconds of signal averaging (100 valve shots), we are able to acquire a "snapshot" of the excited state spectrum, and see the general dynamics occurring in the system. Since rotational spectra of single excited vibrational states can cover several GHz, it often requires hours of scanning a traditional FTMW spectrometer to find the excited state rotational frequencies. The broadband spectrometer significantly reduces this search time. Our broadband FTMW spectrometer has demonstrated the ability to reproduce intensities accurately, a key to uncovering the dynamics of a system. Furthermore, since the entire spectrum is generated from every IR laser shot, laser drift does not skew intensities, as it would in the traditional FTMW spectrometer. The use of infrared-microwave double resonance and infrared-microwave-microwave triple resonance techniques to measure IVR dynamics and isomerization kinetics of vibrationally excited molecules will be described.