HIGH-RESOLUTION PULSED INFRARED LASER SPECTROSCOPY USING OPTOTHERMAL AND FOURIER-TRANSFORM MICROWAVE DETECTION

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Frequency-domain studies of the intramolecular dynamics of cold, isolated molecules offer several advantages for obtaining homogeneous kinetics information with full eigenstate resolution. Several high- resolution infrared spectroscopy techniques using cw lasers have been developed for this type of measurement. However, very high resolution infrared spectroscopy (experimental linewidth 10 MHz) is inconvenient for making survey scans of large regions of the vibrational spectrum because of the long scan times required. Furthermore, in many cases the intramolecular dynamics produce broad homogeneously broadened lineshapes that do not require exceptionally high spectral resolution. We present the results for two new approaches to measuring reasonably high-resolution infrared spectra (linewidth of 600 MHz) using a single-mode pulsed infrared laser. Infrared spectra are detected by either a liquid helium cooled bolometer detector or through changes in the rotational free induction decay signal of a pure rotational transition monitored by Fourier transform microwave (FTMW) spectroscopy. These approaches provide methods to obtain high quality survey spectra of large spectral ranges in short times. In the case of FTMW detection, rotationally-resolved spectra are obtained. Applications of these techniques to large molecules and molecular complexes will be presented.