DESIGN AND CHEMICAL APPLICATION OF CHIRPED-PULSE MILLIMETER-WAVE SPECTROSCOPY

G. B. PARK, A. H. STEEVES, K. KUYANOV-PROZUMENT, A. P. COLOMBO, and R. W. FIELD, *Department of Chemistry, Massachusetts Institute of Technology, Cambridge, MA 02139*; J. L. NEILL and B. H. PATE, *Department of Chemistry, University of Virginia, Charlottesville, VA 22904*.

Chirped-Pulse Millimeter-Wave (CPmmW) Spectroscopy is the first truly broadband Fourier-transform technique for high-resolution spectroscopy in the millimeter-wave region. The design is based on the pioneering Fourier-Transform Chirped-Pulse Microwave (FT-CPMW) spectrometer developed at the University of Virginia, which operates at frequencies up to 20 GHz. We have built an instrument that covers the 70-102 GHz frequency region and can acquire up to 12 GHz bandwidth of spectrum in a single shot. Preliminary tests indicate a significant advantage in spectral acquisition time over existing millimeter-wave spectrometers, and further improvement to the sensitivity is expected as broadband millimeter-wave power amplifiers become affordable. The ability to acquire broadband Fourier-transform millimeter-wave spectra enables rapid measurement of survey spectra at sufficiently high resolution to measure diagnostically important electronic properties and also allows the accurate determination of relative line strengths. As an example of the usefulness of this tool to physical chemists, the nascent vibrational distribution of products from the photolysis of acrylonitrile at 193 nm is investigated and preliminary results are discussed.