MM-WAVE SPECTROSCOPY FOR THE MASSES: COMBINING COMMERCIAL SOLID-STATE SOURCES WITH MOLECULAR BEAMS

CHRISTINA RAGAIN, LIAM M. DUFFY, *Department of Chemistry & Biochemistry, University of North Carolina Greensboro, Greensboro, NC 27402-6170*.

In recent years, new broadband solid-state devices for generating mm-waves have been developed by the telecommunications industry for network analysis. Their use in molecular spectroscopy offers several advantages over traditional techniques. These advantages include their ease of use, flexibility, relatively low cost ($ 15k), high power (1 mW), broadband tunability (e.g. 75-110 GHz), and high resolution (1 part in 10^{10}). In my lab at UNC Greensboro I have developed a pulsed molecular beam instrument to measure the direct absorption of mm-waves by molecules in the beam. For mm-wave source powers as high as 1 mW, the sensitivity of the instrument is limited by the NEP ($2\times 10^{-13} W Hz^{-1/2}$) of the InSb hot-electron bolometer rather than by the shot noise of the source, resulting in a sensitivity on the order of $10^{-10} Hz^{-1/2}$. The high sensitivity of the instrument rivals that of optothermal detection methods and should allow the technique to be used in a wide variety of molecular beam experiments. The instrument is capable of operating in both the frequency and time domain. In the frequency domain the source may be either stepped or swept as the molecules fly by. While in the time domain, coherent effects may be probed using double resonance techniques or by pulse modulating the source. Preliminary results on the UV photodissociation of HOCl will be presented. In these studies, the Λ-doublet states of the OH radical fragments will be probed by Doppler spectroscopy.