DETECTING BRANCHING RATIOS OF CHEMICAL REACTIONS AT ASTROPHYSICALLY RELEVANT TEMPERATURES USING CHIRPED PULSE MILLIMETER WAVE SPECTROSCOPY IN CONTINUOUS CRESU FLOWS

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The reactions of molecules in interstellar space occur over a wide range of temperatures, down to 10 K or colder. The study of gas-phase chemical reactions at these temperatures has been difficult until the development and implementation of the CRESU (French acronym for Reaction Kinetics in Uniform Supersonic Flow) technique in Rennes. Reaction kinetics at temperatures as low as 6 K has been monitored, but product branching ratios have not yet been measured at such low temperatures. The recent development of the CPUF (Chirped Pulse in Uniform supersonic Flow) technique has shown that chirped pulse spectroscopy can be combined with uniform supersonic flows, so that the branching ratios of chemical reactions can be examined. This has been extended to the continuous CRESU flows at Rennes, taking advantage of the deep averaging capabilities of chirped pulse Fourier transform spectrometers complementing the continuous flows. An E-band chirped pulse Fourier transform spectrometer has been incorporated into a current CRESU instrument to detect reaction products. The effects that the uniform flow has on molecular spectra have been characterized in this frequency range. Reactions of ethylene and cyanide radicals have been monitored using pulsed laser photolysis for product detection. The branching ratios of reactions will be discussed, as well as future directions of the instrument.