CPUF: Chirped-pulse Microwave Spectroscopy in Pulsed Uniform Supersonic Flows
Probing Reaction Dynamics with Rotational Spectroscopy

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We describe development and application of a new instrument combining two powerful techniques: chirped-pulse Fourier-transform microwave spectroscopy and pulsed uniform supersonic flows. The objective is to join the virtues of microwave spectroscopy: quantitative, near universal detection affording structural information, with Laval flows offering thermalized conditions at low temperature and high density, to study reaction dynamics of polyatomic molecules with unprecedented detail in product characterization. This combination, which we term "CPUF" (chirped-pulse/uniform flow), delivers broad-band rotational spectra with MHz resolution and allows monitoring, on the μs timescale, of the appearance of transient reaction products with quantitative determination of product branching, yielding isomer and in some cases vibrational level specificity. We have applied this technique to study multichannel product branching in the reaction of CN radicals with unsaturated hydrocarbons at low temperature as well as a number of photochemical systems. The approach will be described and recent examples of the capabilities of the technique will be presented. If time permits, other new directions in the probe of polyatomic reaction dynamics will be presented.