We present preliminary results describing the development of a new instrument that combines two powerful techniques: Chirped Pulse-Fourier Transform MicroWave (CP-FTMW) spectroscopy and pulsed uniform supersonic flows. It promises a nearly universal detection method that can deliver quantitative isomer, conformer, and vibrational level specific detection, characterization of unstable reaction products and intermediates and perform unique spectroscopic, kinetics and dynamics measurements.

We have constructed a new high-power Kα-band, 26–40 GHz, chirped pulse spectrometer with sub-MHz resolution, analogous to the revolutionary CP-FTMW spectroscopic technique developed in the Pate group at University of Virginia. In order to study smaller molecules, the E-band, 60–90 GHz, CP capability was added to our spectrometer. A novel strategy for generating uniform supersonic flow through a Laval nozzle is introduced. High throughput pulsed piezo-valve is used to produce cold (30 K) uniform flow with large volumes of 150 cm$^3$ and densities of $10^{14}$ molecules/cm$^3$ with modest pumping facilities. The uniform flow conditions for a variety of noble gases extend as far as 20 cm from the Laval nozzle and a single compound turbo-molecular pump maintains the operating pressure.

Two competing design considerations are critical to the performance of the system: a low temperature flow is needed to maximize the population difference between rotational levels, and high gas number densities are needed to ensure rapid cooling to achieve the uniform flow conditions. At the same time, collision times shorter than the chirp duration will give inaccurate intensities and reduced signal levels due to collisional dephasing of free induction decay. Details of the instrument and future directions and challenges will be discussed.