COAXIAL PULSE JET SUB-MILLIMETER WAVE FAST SCAN SPECTROMETER WITH A FREQUENCY AND PHASE STABILIZED BWO

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A coaxially configured pulsed jet sub-mm wave spectrometer with a digitally controlled fast scan frequency and phase stabilized Backward Wave Oscillator (BWO) has been constructed at TAMU. The spectrometer samples a segment of high resolution absorption spectra of jet-cooled species during a single jet pulse ($\sim$1 ms) by digitally scanning the BWO frequency with 10 μs (current minimum time) per step. The value of frequency step can be varied from 10 Hz to 100 kHz. To reduce a systematical error in frequency measurements, BWO can be scanned up and down during a given nozzle pulse. Newly developed software allows continuously coverage of the whole frequency range of the BWO using coadded frequency segments with signal averaging of a number ($\sim$1000) of pulses for each segment of recorded spectrum. Test measurements of jet-cooled spectra of monomers (CO, DBr) and molecular complexes (Ar-HBr) has shown that the accuracy of frequency measurements and resolution of this direct absorption spectrometer both are very similar (in a relative units) to those of pulse-nozzle Fourier transform MW spectrometers with a parallel beam configuration. The actual frequency range of the spectrometer 240 - 380 GHz (BWO OB-30) can be extended to 1 THz by simple replacement of BWO. A block-diagram of the spectrometer, its parameters and some jet-cooled spectra will be presented.