TECHNIQUES FOR HIGH-BANDWIDTH ($\geq$30 GHz) CHIRPED-PULSE MILLIMETER/SUBMILLIMETER-WAVE SPECTROSCOPY

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Due to the increased availability of active multiplier chains for converting microwave pulses into the millimeter/submillimeter with reasonably high power ($\geq$1 mW), chirped pulses with high phase stability and complete arbitrary waveform generator (AWG) frequency agility can be created and employed for high-sensitivity molecular spectroscopy, as demonstrated at the Symposium in the past few years.[a,b] The bandwidths of multiplier chains, however, can exceed the current limitations on digitizer bandwidth. Therefore, in order to obtain $\geq$30 GHz spectra in 1 ms or less, techniques are being developed in which a two-channel AWG creates both the chirped pulses for molecular irradiation and a local oscillator pulse for heterodyne detection. These approaches reduce the digitizer bandwidths to 500 MHz or less to collect a high-bandwidth spectrum. A single instrument design can be used to measure both absorption and emission spectra, only requiring that the AWG pulses are changed. Due to the phase stability of the pulse generation and detection, coherent time-domain signal averaging can be performed to enhance sensitivity as desired. Preliminary results from prototype instruments designed at UVa and NIST will be presented, with sensitivity, frequency accuracy, and measurement speed comparisons to current millimeter/submillimeter-wave spectrometers.

[a] G.B. Park, A.H. Steeves, K. Kuyanov-Prozument, A.P. Colombo, R.W. Field, J.L. Neill, and B.H. Pate, RH07, 64th International Symposium on Molecular Spectroscopy (2009).

[b] K.O. Douglass, D.F. Plusquellic, and E. Gerecht, WH09, 65th International Symposium on Molecular Spectroscopy (2010).