DIRECT FREQUENCY COMB SPECTROSCOPY FOR THE STUDY OF MOLECULAR DYNAMICS IN THE INFRARED FINGERPRINT REGION.[a]

ADAM J. FLEISHER, BRYCE BJORK, KEVIN C. COSSEL, JUN YE, *JILA, National Institute of Standards and Technology and University of Colorado, Department of Physics, University of Colorado, Boulder, Colorado 80309-0440, USA*; LORA NUGENT-GLANDORF, FLORIAN ADLER, TYLER NEELY, and SCOTT DIDDAMS, *National Institute of Standards and Technology, Boulder, Colorado 80305-3337, USA*.

The simultaneous identification of multiple chemical compounds requires spectroscopic techniques with inherently broad spectral bandwidth and high frequency resolution. This combination has been realized in the mid-infrared (MIR) molecular fingerprint region using direct frequency comb spectroscopy (DFCS) with an achieved spectral resolution on the order of 100 MHz over the entire comb bandwidth of several 100 cm^{-1}. When coupled to a high-finesse enhancement cavity or a multipass absorption cell, DFCS becomes an ultrasensitive tool for the detection of trace molecules in gas samples of biological, industrial, and atmospheric importance. Recently, the addition of a massively parallel detection scheme based on a MIR virtually imaged phased array (VIPA) disperser provides millisecond (ms) or better temporal resolution simultaneously over thousands of individual frequency channels making possible the study of transient chemical phenomena within the 2000-3500 cm^{-1} spectral window.

[a]This research is supported by AFOSR, DTRA, NSF, NRC, and NIST