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Cavity-Enhanced Direct Frequency Comb Velocity Modulation Spectroscopy LAURA SINCLAIR, KEVIN COSSEL, WILLIAM AMES, JUN YE, ERIC CORNELL, JILA, University of Colorado Boulder, and the National Institutes of Standards and Technology — We have developed a novel technique for broad bandwidth and high resolution survey spectroscopy of molecular ions. Cavity-enhanced direct frequency comb spectroscopy (CE-DFCS) provides broad bandwidth and high resolution by using individual comb lines as parallel detection channels. Here we combine CE-DFCS with velocity modulation spectroscopy to provide ion-specific detections with further enhanced sensitivity. A 2-dimensional lock-in camera is used for real-time demodulation across many simultaneous detection channels. This technique has broad applications for spectroscopy on molecular ions. The first application of this technique will map the electronic states of HfF^+ and ThF^+. Trapped molecular ions provide large effective electric fields and long coherence times for search of a permanent electron electric dipole moment (eEDM); however, the electronic state structure of HfF^+ and ThF^+ are not well known. Determination of the $^3\Delta_1$ potential, its coupling to various excited states, and the corresponding rovibrational levels is integral to the JILA eEDM measurement.

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