

Cavity-Enhanced Frequency Comb Spectroscopy

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With our recent development of novel frequency combs in the mid infrared and extreme ultraviolet, we have opened the door for sensitive and high-resolution spectroscopy in these spectral regions. Cavity-enhanced direct frequency comb spectroscopy provides simultaneous and precise measurements of many types of molecules, analyzing their spectral strengths and patterns, and thus forming global, signatory identifications of trace presence at an unprecedented level of specificity and confidence. With the integration of a powerful capability for time-resolved transient absorption at high spectral resolution, we demonstrate the utility of this technique for identifying transient chemical species and studying reaction kinetics. Combined with the technology of cold molecules, we can unravel complex spectra from large molecules and obtain new insights to molecular structure and dynamics. Finally, with an XUV comb produced inside an enhancement cavity we can directly manipulate molecules and probe the extreme nonlinear physics, opening future high-precision measurements in strong-field phenomena.