

CAVITY-ENHANCED ULTRAFAST TRANSIENT ABSORPTION SPECTROSCOPY

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We introduce cavity enhanced ultrafast transient absorption spectroscopy, which employs frequency combs and high-finesse optical cavities. Sub-100 fs pulses with a repetition rate of 90 MHz are generated by a home-built Ytterbium fiber laser. The amplified light has a power up to 10 W, which is used to pump an optical parametric oscillator, followed by second-harmonic generation (SHG) that converts the wavelength from near-IR to visible. A pump comb at 530 nm is separately generated by SHG. Both pump and probe combs are coupled into high-finesse cavities. Compared to the conventional transient absorption spectroscopy method, the detection sensitivity can be improved by a factor of $\left(\frac{\mathcal{F}}{\pi}\right)^2 \sim 10^5$, where \mathcal{F} is the finesse of cavity. This ultrasensitive technology enables the direct all-optical dynamics study in molecular beams. We will apply the cavity enhanced ultrafast transient absorption spectroscopy to investigate the dynamics of visible chromophores and then extend the wavelength to mid-IR to study vibrational dynamics of small hydrogen-bonded clusters.