Supplementary to

Dual-comb Photothermal Spectroscopy

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**Supplementary Note 1: Bandwidth of the Fabry-Pérot interferometer**



Fig. S1. Evaluation of the bandwidth of the Fabry-Pérot interferometer by measuring the photothermal response of C2H2 with a CW pump laser at 1531.6 nm.

The bandwidth of the Fabry-Pérot interferometer (FPI) is evaluated by a standard photothermal test. Instead of the dual-comb source, a CW DFB diode laser at 1531.6 nm is used as the pump for C2H2, whereas the probe laser is used the same as that described in the main text. With 2% C2H2/N2 mixture filled in the FPI, the photothermal response is measured by varying the modulation frequency of the pump laser. As shown in Fig. S1, the current FPI shows a relative flat-top with a variation within 3 dB. In this work, we select the band of 10 to 50 kHz, with a variation in 0.5 dB, for multi-heterodyne detection. The response curve in this range can be numerically described by a polynomial fit.

**Supplementary Note 2: Phase stabilization of the Fabry-Pérot interferometer**



Fig. S2. Phase stabilization of FPI. (a) Direct-current output ofthe FPI at the wavelength scanning mode and phase stabilization mode. (b) Evaluation of phase noise after locking the FPI at the quadrature point.

As shown in Fig. 2 of the main text, the FPI output is low-pass filtered and used as the error signal to maintain the FPI operation at the quadrature point. We can get the interference fringe and find the quadrature point by scanning the probe wavelength shown in Fig. S2(a). The probe laser is selected at 1572 nm, corresponding to the non-absorption wavelength and the quadrature point of the FPI. A slow feedback loop of a laser servo (Toptica FALC110) is used in this work for the FPI stabilization. The performance of the FPI stabilization in terms of phase fluctuation at quadrature point is shown in Fig. S2(b). Hence, the current FPI shows a phase noise (1σ) of ~1.6′ (0.027°).