VERSATILE AND SENSITIVE DUAL COMB FOURIER TRANSFORM SPECTROSCOPY

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Fourier transform spectroscopy based on time-domain interferences[a] between two slightly detuned frequency comb sources holds much promise for the real-time diagnostic of gaseous, liquid or solid-state samples. In one very recent example[b], cavity-enhanced absorption spectroscopy with two infrared frequency combs has demonstrated a dramatically enhanced sensitivity, compared to conventional Fourier spectroscopy, with intriguing implications for instantaneous trace gas analysis. It however remains challenging to match continuously the comb and cavity modes across a broad spectral bandwidth during the time of a measurement.

An obvious alternative for reaching a long interaction path is a conventional multipass cell. Additionally, differential detection schemes may be devised to increase the dynamic range of the interferometric measurements, thus providing enhanced signal to noise ratio. Experimental demonstrations will be given in the 1.5 μm region with a dual comb set-up based on two Er-doped fiber femtosecond lasers. The versatility and performances of these solutions will be compared to the cavity-enhanced dual comb technique and other state-of-the-art alternatives.

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[a] P. Jacquet, J. Mandon, B. Bernhardt, R. Holzwarth, G. Guelachvili, T. W. Hänsch, N. Picqué, Frequency Comb Fourier Transform Spectroscopy with kHz Optical Resolution, The Optical Society of America, Washington, DC 2009,paper FMB2 (2009).

[b] B. Bernhardt, A. Ozawa, P. Jacquet, M. Jacquey, Y. Kobayashi, T. Udem, R. Holzwarth, G. Guelachvili, T.W. Hänsch, N. Picqué, Cavity-enhanced dual-comb spectroscopy, Nature Photonics 4, 55-57 (2010)