A THZ PHOTOMIXING SYNTHESIZER BASED ON A FIBER FREQUENCY COMB FOR HIGH RESOLUTION ROTATIONAL SPECTROSCOPY

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To date the principal application for photomixing sources has been for high resolution spectroscopy of gases due to the large tuning range and spectral purity. New Developments of the Opto-Electronic THz Spectrometer have been performed in order to obtain a powerfull tool for High-Resolution Spectroscopy. The combination of two extended cavity laser diodes and fast charge carrier lifetime semiconductor materials has allowed a continuous-wave THz spectrometer to be constructed based on optical heterodyning. Unlike many THz sources, this instrument gives access to all frequencies in the range 0.3 to 3.5 THz with a resolution of 1 MHz. The main spectroscopic applications of this spectrometer were dedicated to line profile analysis of rotational transitions referenced in the spectroscopic databases.[a,b] One limitation of the THz spectrometer was accuracy with which the generated frequency is known. Recently, this obstacle has been circled with the construction of a photomixing spectrometer where the two pump lasers are phase locked to two modes of a repetition rate stabilized frequency doubled fiber laser frequency comb.[c] In order to achieve a tuning range in excess to 100 MHz a third cw laser was required in the new configuration of the THz spectrometer. To assess the performances of this instrument, the frequencies of the pure rotational transitions of OCS molecules have been measured beetween 0,8 to 1,2 THz. A rms inferior to 100 kHz, deduced from the frequencies measured, demonstrates that the THz photomixing synthesizer is now able to be competitive with microwave and submillimeter techniques.

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[b] C. Yang, J. Buldyreva, I. E. Gordon, F. Rohart, A. Cuisset, G. Mouret, R. Bocquet, F. Hindle,*J. Quant. Spectrosc. Radiat. Transfer*, 2008, **109:** 2857.

[c] G. Mouret, F. Hindle, A. Cuisset, C. Yang, R. Bocquet, M. Lours, D. Rovera, *Opt. Express*, 2009, **17:** 22031.