Bidirectional Mode-Locked Femtosecond Ti:Sapphire Ring Laser for Dual Comb Spectroscopy

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Bidirectional Kerr-lens mode-locked (BD-KLM) Ti:sapphire ring lasers were first developed as a source for rotation sensing via the Sagnac effect. Recently, the potential of this source for molecular spectroscopy has been highlighted, and proof–of–principle spectroscopic measurements have been conducted. BD-KLM laser generates two free-running trains of pulses at different repetition rates. The mutual coherence of the two counter-propagating beams enables interferometry applications, such as dual-comb spectroscopy (DCS).

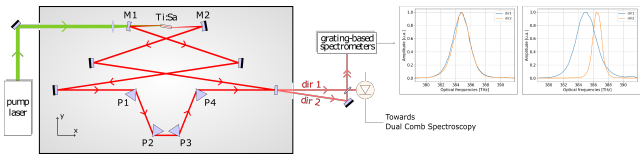

Figure 1: Schematic of the BD-KLM Ti:Sa cavity and output spectra of the dual KLM (direction 1 and 2) in particular cases where $\Delta f_{rep} = 0$ Hz (b) and $\Delta f_{rep} = 168$ Hz (c), measured using a grating-based spectrometer

In this presentation, we will characterize the laser system and present the essential aspects of this unique cavity. The source of asynchronicity will be discussed regarding the differential dual-emission energy, duration, and spectrum.

This laser source enables spectroscopic measurements on molecular gases with a GHz resolution level. These measurements demonstrate the high level of mutual coherence of the two counterpropagating beams generated by this laser source. Thanks to the spectral range versatility of Ti:sapphire (from 600 to 1100 nm) with high-peak powers, molecular-line resolved resolution could be achieved in the visible and UV range. Preliminary results in the UV range will also be presented.

References

[1] S Galtier, C Pivard, J Morville and P Rairoux, Opt. Express 30, 21148 (2022)