Laser frequency stabilization on a Cs microfabricated cell using dual-frequency sub-Doppler spectroscopy

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Miniaturized microwave atomic clocks based on coherent population trapping (CPT) have known a remarkable success, including their commercialization and are now widely-used in numerous applications [1]. In recent years, significant efforts were pushed towards the development of new-generation microcell-based optical clocks. In this domain, the photonic integration of a microcell-based optical clock using the 778 nm Rb two-photon transition was recently demonstrated with stability performances of $4 \times 10^{-12}\ \tau^{-1/2}$ until 1000 s [2] (with τ the integration time), later improved at $2.9 \times 10^{-12}\ \tau^{-1/2}$ until 100 s using a 35 cm^3 micro-optics breadboard [3]. In this study, we report the in-progress development and frequency metrology characterization of two table-top Cs microcell-stabilized lasers using a dual-frequency sub-Doppler spectroscopy technique [4,5]. The current laser beatnote Allan deviation is 1.5×10^{-12} at 1 s and found to be in good agreement with the systems' noise budget and absolute phase noise measurements. A relevant number of frequency shifts was also measured to estimate main contributions to the lasers' mid-term frequency stability budget. Latest results will be presented at the workshop.

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