Miniaturized Rb two-photon clock

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In this work, we present the in-progress development at FEMTO-ST of a Rb microcell two-photon absorption optical reference. The latter uses an external-cavity diode laser (ECDL) at 778 nm and an AOM for controlling the laser power. The laser beam is sent to a Rb MEMS cell[1] and reflected back using a dichroic mirror. TPA fluorescence photons at 420 nm are detected with a photomultiplier. The laser is stabilized onto the Rb^{87} F_g=2, F_e=4 transition.

Frequency measurements of the Rb TPA microcell reference against an ultra-stable cavity optical reference show a stability of $\sigma_y = 7 \times 10^{-13}$ at 1 s and $\sigma_y = 9 \times 10^{-14}$ at 100 s, in good agreement with the measured phase noise.

Main contributions to the reference short-term stability are currently the photon shot noise and the intermodulation effect from the laser FM noise.

Latest results and progress will be presented at the conference.

[1] R. Vicarini, V. Maurice, et al., "Demonstration of the mass-producible feature of a Cs vapor microcell technology for miniature atomic clocks", Sensors Actuators: Physical A 280, 99-106 (2018).