Improved clock frequency stability in a micro-atomic clock using pulsed interrogation and low-permeation glass cell

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We present an in-progress study about the development of a microcell atomic clock based on coherent population trapping (CPT). In a recent study, we demonstrated significant light-shift mitigation with the implementation of a symmetric auto-balanced Ramsey (SABR) interrogation sequence [1]. However, the clock stability for integration times higher than a few thousands of seconds remained limited by a contribution suspected to come from Ne permeation through the cell glass windows. In this study, we report novel results with this clock demonstrator. The latter uses now a Cs-Ne cell with low permeation alumino-silicate glass (ASG) to reduce the permeation process. In addition, SABR is now coupled with active temperature stabilization of the setup and microwave power servo. This yields to the demonstration of a clock fractional frequency stability of $2\ 10^{-12}$ at 10^5 s and 2×10^5 s. These stability results at 1 day are competitive with those of state-of-the-art microcell CPT clocks.

[1]: M. Abdel Hafiz et al., Appl. Phys. Lett. 120, 064101 (2022).