

Atomic spectroscopy setup to search for fundamental constant oscillations in a frequency range up to 125 MHz with a Hz resolution

Tuesday 9 August 2022 16:58 (3 minutes)

The presence of ultralight dark matter particles could lead to a fundamental constant oscillation according to the models [See refs. in 1]. This oscillation could be detected using atomic and molecular spectroscopy techniques [2, 3]. In this work, we present a Cs Doppler-free spectroscopy apparatus for searching for the fundamental constant oscillation in a range of 20 kHz-125 MHz, which corresponds to the particle mass range 8×10^{-11} to 3×10^{-7} eV. Using a graphics card to perform a power spectral density calculation in parallel to the data acquisition process allows having a continuous, 100% duty cycle measurement with an ultimate sensitivity and frequency resolution better than 1 Hz. This setup gives us three order of magnitude better constraints on the dark matter to the electron mass and the fine-structure constant coupling than in the earlier work [2]. [1] M. G. Kozlov, D. Budker, *Annalen Der Physik* 2019, 531, 1800254. [2] D. Antypas et al., *Phys. Rev. Lett.* 123, 2019 [3] R. Oswald et al., arXiv:2111.06883

Primary author: TRETIAK, Oleg

Co-authors: ZHANG, Xue (Johannes Gutenberg-Universität Mainz); Mr FIGUEROA LEIGH, Nataniel (Helmholtz Institut Mainz); ANTYPAS, Dionysios; BROGNA, Andrea; BANERJEE, Abishek; PEREZ, Gilad; BUDKER, Dmitry

Presenter: TRETIAK, Oleg

Session Classification: Poster Lightning Talks