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Searching for ultralight scalar dark matter with muonium and muonic atoms

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Ultralight scalar dark matter may induce apparent oscillations of the muon mass, which may be directly probed via temporal shifts in the spectra of muonium and muonic atoms. Existing datasets and ongoing spectroscopy measurements with muonium are capable of probing scalar-muon interactions that are up to 8 orders of magnitude feebler than astrophysical bounds. Ongoing free-fall experiments with muonium can probe forces associated with the exchange of virtual ultralight scalar bosons between muons and standard-model particles, offering up to 5 orders of magnitude improvement in sensitivity over complementary laboratory and astrophysical bounds.

Reference: Yevgeny V. Stadnik, arXiv:2206.10808.

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