Contribution ID: **34** Type: **Talk**

Searching for ultralight scalar dark matter with muonium and muonic atoms

Friday 7 July 2023 11:50 (35 minutes)

Ultralight scalar dark matter may induce apparent oscillations of the fundamental constants of nature and particle masses, including the muon mass. Oscillations in the muon mass 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.

References:

Yevgeny V. Stadnik, arXiv:2206.10808.
Y. V. Stadnik and V. V. Flambaum, PRL **114**, 161301 (2014); PRL **115**, 201301 (2015).

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Session Classification: Atoms and Exotic Atoms II