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Tests of physics beyond the standard model with the g factor of few-electron ions

Thursday 25 May 2023 16:45 (25 minutes)

emphasized textIn this contribution, we discuss the theory of the bound-electron g factor. This quantity can be measured nowadays to high precision in Penning-trap setups. The collaboration of theory and experiment enables impactful and detailed tests of quantum electrodynamics in a strong background electric field, and a competitive determination of fundamental constants [1] and nuclear properties [2]. Very recently, we have shown that such studies also allow to test certain extensions of the standard model of particle physics [3]: in study addressing the isotope shift of the g factor of H-like Ne ions, a competitive bound was set on the strength of a hypothetical fifth force by combining the experimental value of the isotope shift with the precision theory of nuclear recoil within QED.

[1] V. A. Yerokhin, E. Berseneva, Z. Harman *et al.*, Phys. Rev. Lett. **116**, 100801 (2016).
[2] A. Schneider, B. Sikora, S. Dickopf *et al.*, Nature **606**, 878 (2022).
[3] V. Debierre, C. H. Keitel, Z. Harman, Phys. Lett. B **807**, 135527 (2020); arXiv:2202.01668 (2022); V. Debierre, N. S. Oreshkina, I. A. Valuev, Z. Harman, C. H. Keitel, Phys. Rev. A **106**, 062801 (2022).
[4] T. Sailer, V. Debierre, Z. Harman *et al.*, Nature **606**, 479 (2022).

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