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Tests of physics beyond the Standard Model with the g factor of few-electron ions

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In this contribution, we discuss the precision theory of the bound-electron g factor. This quantity can be measured nowadays to high precision with the combination of Penning traps and electron beam ion traps. The collaboration of theory and experiment enables impactful and detailed tests of quantum electrodynamics in a strong background 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, and set bounds on the strength of a hypothetical fifth force [3,4]. We summarize our ongoing calculations of radiative corrections in the non-perturbative Coulomb potential, which are necessary for further improvements in this field.
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[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, Natalia S. Oreshkina, Igor A. Valuev, Z. Harman, C. H. Keitel, arXiv:2207.04868 (2022).
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Scientific topic

Symmetries

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