Contribution ID: **33** Type: **not specified**

Theory of the g factor of few-electron ions

Tuesday 11 June 2019 16:30 (25 minutes)

Quantum electrodynamic (QED) effects in strong Coulomb fields have been scrutinized recently in high-precision Penning trap g factor experiments. The uncertainty of the atomic mass of the electron has been largely decreased via measurements with the hydrogenlike $^{12}C^{5+}$ ion, and by using the theoretical value of the g factor. In order to further reduce uncertainties in the theoretical description, we calculate further higher-order corrections, such as two-loop Feynman diagrams in nonperturbative nuclear fields [1-3].

In future, an independent determination of the fine-structure constant α may also be possible by employing a specific weighted difference of the g factors of the hydrogen- and lithiumlike (or, alternatively, boronlike) ions of the same element. This weighted difference in chosen to cancel uncertainties due to nuclear effects. It is shown that this method can be used to extract a value for α from bound-electron g-factor experiments with an accuracy competitive with or better than the present literature value [4,5]. In a very recent experiment, the g factor of the boronlike $^{40}Ar^{13+}$ ion has been measured with an uncertainty on the 10^{-9} level, in agreement with the most recent theoretical predictions [6]. This represents a significant step towards the determination of α from the bound-electron g factor.

[1] B. Sikora, Z. Harman, N. S. Oreshkina, V. A. Yerokhin, H. Cakir, C. H. Keitel, arXiv:1804.05733 (2018).
[2] V. A. Yerokhin, Z. Harman, Phys. Rev. A **88** (2013) 042502.
[3] V. Debierre, B. Sikora, H. Cakir, N. S. Oreshkina, Z. Harman, C. H. Keitel, to be published.
[4] V. A. Yerokhin, E. Berseneva, Z. Harman, I. I. Tupitsyn, C. H. Keitel, Phys. Rev. Lett. **116** (2016) 100801.
[5] V. M. Shabaev, D. A. Glazov, N. S. Oreshkina, A. V. Volotka, G. Plunien, H.-J. Kluge, and W. Quint, Phys. Rev. Lett. **96** (2006) 253002.
[6] I. Arapoglou, A. Egl, M. Hocker, T. Sailer, B. Tu, A. Weigel, R. Wolf, H. Cakir, V. A. Yerokhin, N. S. Oreshkina, V. A. Agababaev, A. V. Volotka, D. V. Zinenko, D. A. Glazov, Z. Harman, C. H. Keitel, S. Sturm, and K. Blaum, Phys. Rev. Lett., in print (2019).

Primary author: HARMAN, Zoltan (Max Planck Institute for Nuclear Physics)

Presenter: HARMAN, Zoltan (Max Planck Institute for Nuclear Physics)

Session Classification: Session 6: Magnetic moment, g factor