



Contribution ID: 18

Type: **not specified**

Two-loop self-energy corrections to the g-factor of bound electrons

Wednesday 12 June 2019 14:00 (5 minutes)

The g-factor of bound electrons can be measured and calculated with high accuracy. Comparisons between the theoretical and experimental values of the g-factor allow precision tests of QED in the presence of strong electric background fields and the determination of fundamental constants.

We present the status of our ongoing calculations of the two-loop self-energy correction to the g-factor of the bound electron in hydrogenlike ions. This correction currently gives rise to the largest uncertainty of theoretical g-factor predictions. The interaction with the nuclear potential is taken into account non-perturbatively in our calculations, in order to achieve a high accuracy for the bound electron in heavy ions. We have obtained full results for the loop-after-loop diagrams, and partial results for the nested and overlapping loop diagrams. In the latter case, we treat the Coulomb interaction in intermediate states to zero and first order [1].

Our results will be highly relevant for planned g-factor measurements with high-Z ions in the near future as well as for an independent determination of the fine-structure constant from the bound-electron g-factor.

[1] B. Sikora, V. A. Yerokhin, N. S. Oreshkina et al., arXiv:1804.05733v1 [physics.atom-ph] (2018).

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Session Classification: Poster session