



Contribution ID: 8

Type: Oral

Total 10-th order QED electron anomalous magnetic moment calculation

Thursday 14 March 2024 15:10 (20 minutes)

Total 5-loop quantum electrodynamics calculation results for the electron anomalous magnetic moment will be presented. These results provide the first check of the previously known value obtained by T. Aoyama, M. Hayakawa, T. Kinoshita, M. Nio. A comparison will be provided. The results for the Feynman diagrams without lepton loops were presented by the author in 2018-2019. The remaining part of the diagrams will be presented here.

The difficulty is that known universal methods require enormous amount of computer resources to obtain the value. Author's method of reduction to finite integrals will be briefly explained as well as a specially developed Monte Carlo integration method.

The results are split into 95 gauge-invariant classes. Such a detailization is provided for the first time and is useful for independent checking and theoretical investigations.

Significance

1. After emerging a new experimental value in 2022 the tension between the theory and experiment for the electron $g-2$ became over 3.5 sigma (depending of the fine structure constant used). The 10-th order QED coefficient had not been double-checked yet; the coefficient is sensitive in experiments and will be more sensitive in the future.
2. The high-order calculation methods in quantum field theory are important themselves. Author's method does not use dimensional regularization or other limit-like regularizations and is based on a deep understanding of the structure of divergences in Feynman diagrams; this allows us to spare computer resources significantly.

References

<https://indico.cern.ch/event/1164804/contributions/5384597/>

<https://indico.cern.ch/event/855454/contributions/4606407/>

<https://arxiv.org/abs/2308.11560>

Experiment context, if any

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Session Classification: Track 3: Computations in Theoretical Physics: Techniques and Methods

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