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Quantum Electrodynamics and Quantum Cyclotron Energy Levels

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Relativistic and quantum electrodynamic corrections to the energy levels of quantum cyclotron states is are important for the determination of a number of fundamental constants, notably, for the g factor of the electron and positron, and atomic masses. We have recently analyzed the relativistic corrections in detail in [Phys. Rev.A vol. 106, 012816 (2022)] on the basis of higher-order Foldy-Wouthuysen transformations. Small modifications of literature values were found. The evaluation of quantum electrodynamic corrections requires the evaluation of bound-state Feynman diagrams with up to six magnetic vertices [Phys. Rev. D vol. 108, 036004 (2023)] and the use of fully relativistic Landau levels in the symmetric gauge, which were derived in [Phys. Rev. D vol. 108, 016016 (2023)]. Apparatus-dependent effects could limit the ultimate precision of the determination of the electron g factor [Phys. Rev. D vol. 107, 076014 (2023)], with the main apparatus-dependent effects impacting the so-called axial frequency. (As a supplement, a few other recent results such as those from arXiv:2403.07127, will be briefly summarized.) *This research was supported by NSF Grant PHY-2110294.

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