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Tenth-order lepton $g-2$: Contribution from diagrams containing a sixth-order light-by-light-scattering subdiagram internally

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Abstract

This paper reports the result of our evaluation of the tenth-order QED correction to the lepton $g-2$ from Feynman diagrams which have sixth-order light-by-light-scattering subdiagrams, none of whose vertices couple to the external magnetic field. The gauge-invariant set of these diagrams, called Set II(e), consists of 180 vertex diagrams. In the case of the electron $g-2$ (a_e), where the light-by-light subdiagram consists of the electron loop, the contribution to a_e is found to be $-1.344\ 9\ (10)\,(\alpha/\pi)^5$. The contribution of the muon loop to a_e is $-0.000\ 465\ (4)\,(\alpha/\pi)^5$. The contribution of the tau-lepton loop is about two orders of magnitudes smaller than that of the muon loop and hence negligible. The sum of all of these contributions to a_e is $-1.345\ (1)\,(\alpha/\pi)^5$. We have also evaluated the contribution of Set II(e) to the muon $g-2$ (a_μ). The contribution to a_μ from the electron loop is $3.265\ (12)\,(\alpha/\pi)^5$, while the contribution of the tau-lepton loop is $-0.038\ 06\ (13)\,(\alpha/\pi)^5$. The total contribution to a_μ, which is the sum of these two contributions and the mass-independent part of a_e, is $1.882\ (13)\,(\alpha/\pi)^5$.

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