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A tenth-order QED coontribution to the lepton g-2

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The anomalous magnetic moment of the electron a_e has played the central role in testing the validity of quantum electrodynamics (QED) as well as the standard model of the elementary-particle physics. In this talk we report further improvement of the test which is made possible by the newly evaluated tenth-order QED contribution to a_e. Altogether 12672 Feynman diagrams contribute to the tenth-order term. To handle them, we have developed the computer algorithm that generates FORTRAN programs automatically for individual diagrams. The resulting programs have been numerically evaluated on the supercomputer systems at RIKEN. Our preliminary result of the mass-independent tenth-order term, which is universal for all spices of leptons, is $A_1^{(10)} = 9.1 \pm 0.6$ in units of $(\alpha/pi)^5$. As a byproduct, the muon contribution to the tenth order a_e is obtained. It is far smaller than the uncertainty of the mass-independent term. We have also improved the eighth-order term by an intense numerical work. The uncertainty in the mass-independent term $A_1^{(8)} = -1.9109 \pm 0.0021$ in units of $(\alpha/\pi)^4$ has been reduced by about 2/3. The muon contribution to a_e at the eighth order, $A_2^{(8)}(m_e/m_\mu) = 0.0009222\ (66)$, is newly obtained. The improvement in the QED theory leads to about 10% improvement in the theoretical prediction of a_e and about 30% improvement in the fine-structure constant α derived from the measured value of a_e and the QED theory.