Four loop QED contributions to the electron $g$-2

Stefano Laporta$^a$

$^a$ Dipartimento di Fisica, Università di Padova, Istituto Nazionale Fisica Nucleare, Sezione di Padova, Via Marzolo 8, I-35131 Padova, Italy

The anomalous magnetic moment of the electron is one of the physical quantities measured with the highest precision. Such high precision demands a similar precision in the theoretical evaluations in order to obtain stringent tests of QED. In this talk I will summarize the situation of the theoretical calculations of the contributions to the electron $g$-2; then, I will describe in detail the results of the twenty-year long project of the evaluation of all the 891 mass-independent four-loop QED Feynman diagrams contributing to the electron $g$-2 [1],

with the 1100-digits result

$$a_e^{QED}(4\text{-loop}) = -1.91224576492645574152647167439830054060873390658725345\ldots \left(\frac{\alpha}{\pi}\right)^4$$

and high-precision analytical fits. The consequences of this result on the QED tests and the determination of the fine structure constant will be also discussed.