

Muon $g-2$ and EDM: Precision Tests of Fundamental Symmetries and New Physics

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The muon anomalous magnetic moment, $a_\mu = (g-2)_\mu/2$, is one of the most sensitive precision observables for testing the Standard Model and probing new physics. The successive Muon $g-2$ experiments at CERN, Brookhaven, and Fermilab were recognized with the 2026 Breakthrough Prize in Fundamental Physics, reflecting the long-standing impact of this experimental program on precision tests of fundamental interactions. The final result from the Fermilab Muon $g-2$ Experiment has reached a precision of 127 parts per billion, marking a major milestone for the storage-ring technique and providing the most precise measurement of the muon magnetic anomaly to date. At the same time, important questions remain concerning the Standard Model prediction, in particular the hadronic contributions, as well as the need for independent experimental cross-checks. Complementary to $g-2$, the muon electric dipole moment provides a highly sensitive probe of new sources of CP violation and charged-lepton-sector new physics. This talk will review the final Muon $g-2$ result and its physics implications, and discuss future prospects for EDM searches and next-generation $g-2$ concepts such as CANTON- μ as probes of fundamental symmetries and physics beyond the Standard Model.

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