Testing the Standard Model at the precision frontier: The anomalous magnetic moment of the muon

Dr. Andreas Hafner

Institut für Kernphysik, Universität Mainz

The anomalous magnetic moment of the muon $(g-2)_\mu$ is one of the most precisely measured quantities in particle physics (0.54~ppm).

There is a long-standing discrepancy of 3-4 standard deviations between the direct measurement of $(g-2)_\mu$ and its theoretical evaluation. This theoretical prediction is subdivided into three contributions: QED, weak and hadronic. The QED and weak parts can be determined in perturbative approaches with very high precision. Thus, the hadronic uncertainty dominates the total theoretical uncertainty. Within the hadronic uncertainty, the largest contribution stems from the vacuum polarization term, which can be evaluated with the measurement of the inclusive hadronic cross section in e^+e^- annihilation. The second largest contribution to the hadronic uncertainty stems from the so-called light-by-light amplitudes. They have to be evaluated via theoretical models. These models require transition form factor measurements as input.

The most recent $(g-2)_\mu$ experiment as well as existing and future measurements of the relevant hadronic cross sections and transition form factors are presented