APR10-2009-000834

Abstract for an Invited Paper
for the APR10 Meeting of
the American Physical Society

The Standard Model : Low Energy Measurements

DAVID KAWALL, University of Massachusetts

The Standard Model (SM) of particle physics, while supported by an extraordinary amount of experimental evidence, is incomplete. Understanding the physics that lies beyond the SM requires a new generation of experiments, operating at the frontiers of energy, intensity, sensitivity, and precision. At the frontiers of energy, the Large Hadron Collider will conduct direct searches for new particles. These same particles may also reveal themselves in radiative corrections to phenomena accessible at low energy. For instance, the g-factor of the muon deviates from 2 because of radiative corrections. New physics, with new particles, will contribute to g-2 and perturb its value from that expected from SM particles alone. A new experiment at Fermilab proposes a measurement of the muon g-2 to an unprecedented 140 ppb, sensitive to many new models of physics beyond the SM. Also at Fermilab, the new Mu2e experiment will search for muon to electron conversion, a process violating charged lepton flavor. The anticipated sensitivity for the conversion signal exceeds that predicted in some supersymmetric models by more than an order of magnitude, and exceeds that of its predecessors by almost 4 orders of magnitude. The symmetries of the SM can also be tested by searching for electric dipole moments (EDMs) of fundamental particles. EDMs violate time-reversal symmetry and CP, and are predicted in the SM, but at a level far below any planned experiment. However, many theories of physics beyond the SM predict new particles and new sources of CP violation. These lead to dramatically enhanced EDMs, within the reach of a new generation of experiments promising orders of magnitude improvement in sensitivity to EDMs in electrons, neutrons, protons, deuterons, and nuclei. These new low energy measurements will be described, with their prospects for ushering in a new era of physics beyond the Standard Model.