Precision Physics with Muons

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Precision physics with muons spans a long history and is currently an active field worldwide with new results at the Part-per-Million level. It allows for establishing basic parameters of the electroweak theory, exploring fundamental symmetries of low-energy QCD, and testing predictions for new physics beyond the Standard Model. I will discuss three experiments at the Paul Scherrer Institute in Switzerland and a future effort at Fermilab as examples of the diverse physics that can be explored with muons. The muon lifetime experiment MuLan has recently published a new result for the Fermi constant GF at unprecedented precision while the muon capture experiments MuCap and MuSun are determining important observables to test and better understand low-energy QCD. The recently approved new g-2 measurement of the muon anomalous magnetic moment at Fermilab will sensitively test new physics predictions at the low energy frontier, which are complementary to direct searches at high energies.