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Search for a muon Electric Dipole Moment Using the Frozen Spin Technique

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Despite the many successes of the Standard Model of Particle Physics, there are still several physical observations that it cannot explain, such as matter-antimatter asymmetry, non-zero neutrino masses, and the existence of dark matter. To address these limitations, extensions to the Standard Model are necessary, and a search for electric dipole moments of leptons is a valuable test. The measurement of the electric dipole moment of the muon is of particular interest, given recent experimental results indicating lepton-flavor universality violation and new results on the muon magnetic anomaly from Fermilab. A non-zero electric dipole moment of the muon would indicate Charge-Parity symmetry violation beyond the Standard Model. A dedicated experimental search for the muon electric dipole moment (EDM) has been proposed at Paul Scherrer Institute (PSI) using the frozen spin technique. In this technique, the anomalous spin precession of the muons in a storage ring is suppressed by applying an electric field in the radial direction. The muon EDM experiment will take place in two phases: the first phase will demonstrate the frozen spin technique using a precursor experiment with 28 MeV muons from the πE1 beamline at PSI, while the second phase will make use of 125 MeV muons from the μE1 beamline, which could search for muon EDM up to a sensitivity of 6×10^{-23} e.cm after a year of data taking. In this talk, we will describe the precursor experiment at PSI and provide an update on the current status of the experiment.

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