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Sensitive Search of The Muon EDM with the Frozen-spin Technique

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The permanent electric dipole moment (EDM) of an elementary particle is a charge-parity violating (CPV) observable. Consequently, precision searches for EDMs serve as a sensitive probe for new physics beyond the Standard Model (BSM). For the first time, the Paul Scherrer Institute (PSI) will conduct a dedicated search for the muon EDM. Utilizing the frozen-spin technique, the experiment will potentially increase the EDM sensitivity by more than three orders of magnitude compared to the current best limit, set by the BNL Muon g-2 collaboration. The muEDM experiment adopts a phased approach, with the final expected sensitivity reaching $d = 6 \times 10^{-23}\ e \cdot cm$, which is three orders of magnitude lower than the current limit. The first phase of the experiment involves injecting surface muons into a compact storage solenoid via a superconducting channel. Muons suitable for storage are then selected with an entrance detector and stored in the central region of the solenoid on a stable orbit. The implementation of the frozen-spin technique, which involves applying a radial electric field to the stored muons to cancel the g-2 precession, effectively freezes the muon spin direction relative to the direction of its motion. Thus, any observed precession would be attributable solely to a non-zero muon EDM. This presentation provides an overview of the experiment and reports the latest developments.

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