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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

Physikalisches Kolloquium

Jan. 31, 2023 at 4:15 p.m.
HS KPH

Dr. Philipp Schmidt-Wellenburg
PSI Switzerland

The search for a muon electric dipole moment using the frozen-spin technique

An electric dipole moment (EDM) of a fundamental particle would violate time and parity symmetry and by the virtue of the CPT theorem also the combined symmetry of charge conjugation and parity inversion. Searches for EDM are generally considered highly sensitive probes for new physics and might shed light on still unresolved questions in particle physics and cosmology like the origins of matter, dark matter, and dark energy.
At the Paul Scherrer Institute in Switzerland, we are setting up an experiment searching for a muon EDM with a sensitivity of 3E-21 ecm using, for the first time, the frozen-spin technique~\cite{Farley2004PRL} in a compact storage ring. This will lay the ground work for a second phase with a final precision of better than 6e-23 ecm.
This staged approach to search for a non-zero muon EDM probes previously uncharted territory and tests theories of BSM physics by: i) improving the current direct experimental limit of d < 1.5E-19 ecm (CL 90%) by roughly three orders of magnitude;
ii) being a complementary search for an EDM of a bare lepton;
iii) being a unique test of lepton-flavor symmetries;
and iv) in the case of a null result, will be a stringent limit on an otherwise very poorly constrained Wilson coefficient.

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