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Search for Electric Dipole Moments with Polarized Beams in Storage Rings.

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An electric dipole aligned along the spin axis of a fundamental particle, nucleus, or atomic system violates both parity conservation and time reversal invariance. The observation of such a phenomenon would, at present or proposed levels of experimental sensitivity, signal new physics beyond the Standard Model.

The usual method for identifying an electric dipole moment (EDM) in such searches is to observe the rotation of the spin axis or polarization under the influence of a strong electric field. The use of a storage ring opens the search to charged, polarized particles such as the proton, deuteron, 3He, etc. that would otherwise not be manageable in such a field.

The best procedure begins with the alignment of the beam polarization along the velocity of the beam followed by the observation of any slow rotation of that polarization into the vertical direction perpendicular to the ring. This imposes several feasiblity requiremens. As an example, the ring must utilize a special combination of higher order fields to ensure that the usually unstable polarization along the direction of the velocity remains for times up to 1000 s to allow any EDM effect to accumulate to a measurable level.

At present, dedicated studies are being performed at COSY to examine the use of higher-order (sextupole) fields in the storage ring to lengthen the coherence time of the stored, horizontal beam polarization.

The presentation will provide a general introduction to the EDM search by means of polarized beams in storage rings and will highlight the developments in the polarimeter system accomplished at the COSY ring at FZ-Juelich.

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