

# Search for Electric Dipole Moments and Axions/ALPS with Polarized Hadron Beams in Storage Rings

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The research addresses two fundamental questions in particle physics and cosmology: the fate of antimatter after the Big Bang and the nature of Dark Matter (DM). Its focus lies on the study of Electric Dipole Moments (EDMs) in particles such as protons and deuterons, explored through polarized particle beams stored in a dedicated ring.

Up to now, experimental efforts have been carried out at the COoler SYNchrotron (COSY) storage ring at Forschungszentrum Jülich in Germany, which ceased operations at the end of 2023. The next step foresees the design and construction of a Prototype Storage Ring (PSR), in both all-electric and hybrid (electric and magnetic) configurations, operating at beam energies of 30–45 MeV with a circumference of about 100 meters. The PSR will serve as a testbed to resolve key technical challenges and pave the way toward a full-scale EDM facility dedicated to precise proton EDM measurements.

In the subsequent phase, a high-precision EDM facility with 233 MeV beam energy and a circumference of approximately 500 meters will be developed. This installation is expected to push the current sensitivity limits of the neutron's static EDM to unprecedented levels, potentially enabling groundbreaking discoveries in our understanding of the fundamental symmetries of nature.

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