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The Search for Electric Dipole Moments of Charged Particles in Storage Rings

The dominance of matter over antimatter in the universe remains one of the key unresolved questions in modern physics. According to the Sakharov conditions, this asymmetry requires a violation of CP symmetry. While the Standard Model includes CP-violating effects, they are insufficient to account for the observed imbalance. A promising candidate for additional sources of CP violation is the permanent Electric Dipole Moment (EDM) of particles. The Standard Model predicts extremely small EDMs, while many theories beyond the Standard Model suggest values within experimental reach. To date, all measurements of EDMs have been consistent with zero, providing stringent upper limits on the EDM of various particles.

EDMs must align with a particles' spin, allowing their detection through changes in spin polarization in electric fields. Storage rings are ideal for measuring the EDMs of charged particles, such as the deuteron, for which no experimental limit currently exists. During this talk, I will present the results of the first direct measurement of the deuteron EDM at the Cooler Synchrotron COSY.

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