

Storage of polarized ultracold neutrons

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Experiments searching for a permanent electric dipole moment of the neutron (nEDM) aim at discovering new sources of CP violation beyond the Standard Model of particle physics and understanding the origin of the matter-antimatter asymmetry of the Universe.

In recent experiments, polarized ultracold neutrons are stored in material bottles, subject to a strong electric field and a weak stable and uniform magnetic field.

The longer the storage time of the polarized neutrons, the better the sensitivity of the measurement.

In order to keep the final polarization as high as possible, all depolarization mechanisms must be understood and minimized.

In the experiment that was taking nEDM data in 2015-2016 at the Paul Scherrer Institute (PSI), a final polarization of 0.75 was obtained, after a storage time of 180~s.

We will review the main depolarization mechanisms of stored ultracold neutrons: the depolarization at wall collisions and the depolarization due to residual magnetic field non-uniformity.

Dedicated measurements at PSI allowed to verify the theoretical predictions for the magnetic depolarization. In particular we used a spin-echo technique that we invented to separate the different depolarization sources.

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