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Design of a Simultaneous Spin Analyser for the nEDM experiment at PSI

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The Standard Model (SM) of Particle Physics predicts a neutron Electric Dipole Moment (nEDM) several orders of magnitude below the current best experimental limit $d_n < 2.9 \times 10^{-26}$ e.cm (90% CL \cite{Baker}). The nEDM breaks both Time Reversal and Parity symmetry. Many extensions of the SM predict nEDM values at the level of the current experimental sensitivity. Thus, the nEDM search is a probe for physics beyond the SM. The nEDM is measured via the Larmor frequency shift of ultracold neutrons (UCN) in parallel and anti-parallel magnetic and electric fields. This frequency shift is measured using the Ramsey's separated oscillating fields method. At the new UCN source at the Paul Scherrer Institute (Switzerland), the collaboration aims to improve the sensitivity to the nEDM to 5×10^{-27} e.cm at 95% CL in a first step.In a second step, we aim to improve the sensitivity by another order of magnitude in a new spectrometer.
We will present a new neutron spin analyser designed to detect the two neutron spin states at the same time after the Ramsey precession. Currently, the two UCN spin states are detected one after the other, limiting the statistic because of neutron losses. The aim of building a simultaneous spin analyser is to improve the neutron detection efficiency and the spin analysis power of the setup in order to increase the nEDM statistical precision during the second phase of the nEDM project. This work is supported by Agence Nationale pour la Recherche, grant ANR-09-BLAN-0046.

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