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Cs magnetometer based current source for permanent neutron electric dipole moment measurement

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(on behalf of the nEDM collaboration)

A non-zero permanent Electric Dipole Moment (EDM) in elementary A non-zero permanent Electric Dipole Moment (EDM) in elementary particles is a direct evidence for CP violation at subatomic level, which could be helpful for explaining the observed matter and anti-matter asymmetry of the Universe. In addition, the limit on any EDM of a fundamental particle or system provides a critical constraint for theoretical models. Due to this, EDM searches are being conducted on various scales from nuclei to neutron, electron and muon around the world. Among these, the neutron EDM (nEDM) and Hg EDM provide a stringent limit on θQCD, which rises the existence of an axion boson, a candidate of light dark matter. After 70 years'efforts, the limit of nEDM currently reaches the 10^{-26} e.cm [1] level measured at PSI. The goal of the new apparatus n2EDM, is in the baseline setup to reach the 10^{-27} level [2] that will test as example the theoretical prediction from left-right symmetric models [3].

To achieve this sensitivity, apart from increasing statistics, however, many technical challenges still exist which have to be overcome/optimized in order to achieve the 10-27 level. One of these challenges is the non-stability of the magnetic field over time. In order to solve this problem, a CsM based electric current source was developed at KU Leuven with $5*10^{-9}$ stability at 20 mA for 70 min, which could be used either to provide a feedback-stabilized current or for monitoring the evolution of the B-field and then performing an offline correction [4,5].

Here we present the latest performance of the CsM based electric current source and the possible schedule of its coupling with the n2EDM spectrometer at PSI. In addition, the upgrade of the magnetometry laboratory at Leuven and the planned endeavor of enhancing the sensitivity of the CsM based current source through adjusting its geometric configuration will be introduced.

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