Cesium magnetometers for the n2EDM experiment

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The sources of CP violation present in the Standard Model are not sufficient to explain the known baryon-antibaryon asymmetry in our Universe. Searches for a permanent electric dipole moment of the neutron (nEDM) serve as one of the most sensitive probes of new sources of CP violation which can then point towards the existence of beyond standard model physics. The n2EDM experiment, located at PSI, is currently being commissioned and tries to improve in the baseline setup by a factor of 10 on the previously measured most sensitive upper limit of the nEDM value up to date ($|d_n| < 1.8 \times 10^{-26}\, e \cdot cm$ [1]). These type of experiments require a very stable and homogeneous magnetic field in order to reduce the statistical and systematic uncertainties caused by spatial and temporal field fluctuations. Optically pumped atomic magnetometers, Cs and ^{199}Hg, play a very crucial role in the monitoring of the magnetic field stability and gradients. While the ^{199}Hg co-magnetometer system provides information on the average field in the neutron precession chambers, an array of 112 all-optical Cs magnetometers will be installed above and below the chambers, providing instantaneous information on the higher-order field gradients during data-taking [2]. The talk will contain more details about the magnetic field requirements of n2EDM and the operation and commissioning of these Cs magnetometers.

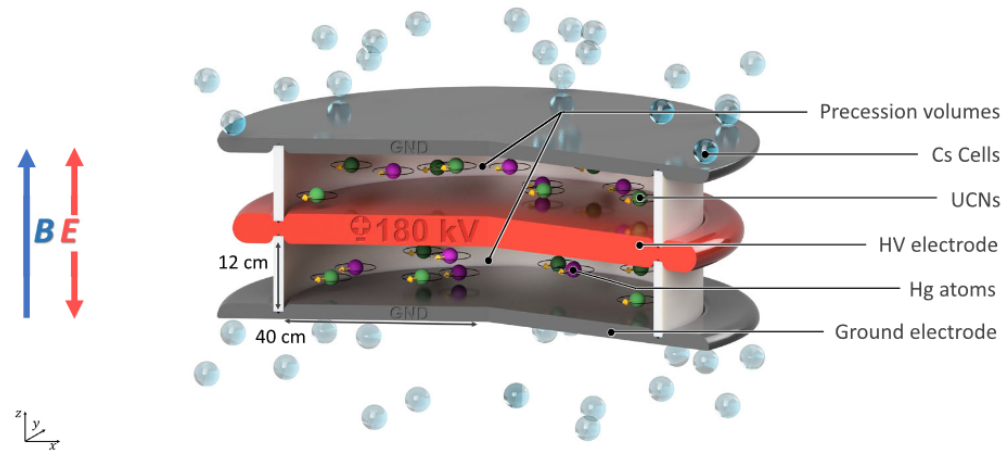

Figure 1. A basic representation of the neutron chambers (filled with both neutrons and ^{199}Hg) surrounded by an array of Cs cells [2].

[1] Abel, C. et al. Measurement of the Permanent Electric Dipole Moment of the Neutron. Phys. Rev. Lett. 124, 081803 (2020).
[2] Ayres, N. J. et al. The design of the n2EDM experiment: nEDM Collaboration. Eur. Phys. J. C 81, 512 (2021).