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A Potassium magnetometry based current source for the nEDM experiment at PSI

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A permanent electric dipole moment of the neutron (nEDM) would be a source of CP violation and could shed some light on beyond standard model physics (BSM). Such BSM models predict an nEDM in the range 10-27 –10-29 e cm while the standard model prediction is much lower (around 10-31 e cm). The search for an nEDM and the setting of new limits on its value is done with the Ramsey method of time separated oscillatory fields. This method requires a very well known magnetic field during the measurement cycles. This is typically done via magnetometers in the experimental volume which monitor the stability and the evolution of the magnetic field. The main field B0 is produced by a dedicated current source. Thus the stability of B0 is fundamentally limited by the stability of the current source.
In the spirit of continual improvement of the experiment, we plan to build a new ultra-stable current source for our experiment. The idea is to use a commercial very low noise current source and to stabilize its output via a feedback loop. This feedback loop will be installed outside of the nEDM experimental volume. A dedicated coil will be placed in series to the main coil (producing B0). There Potassium magnetometers will monitor drifts in current through drifts in the magnetic field. The feedback loop will correct for such drifts thus stabilizing the output current.

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