International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

First data from the measurement of the electric dipole moment of the neutron at PSI

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The observed baryon asymmetry in the universe cannot be explained by the standard model (SM) of particle physics and standard cosmology. An important issue therein is the small charge/parity reversal symmetry (CP) violation predicted by the SM. The existence of a finite permanent neutron electric dipole moment (nEDM) implies CP violation. Some extensions to the SM, e.g., minimal super symmetric ones, include additional sources of CP violation and also predict a rather large value for the nEDM [1]. While the value that is predicted by the SM is still out of experimental reach, some of the extension models have been already excluded by the present experimental upper limit of the nEDM ($2.9 \times 10^{-26}\, e$cm @90%CL) [2]. A limiting factor of these measurements was the low neutron count rate.

At PSI a new source for ultracold neutrons (UCN) was built to perform a next generation measurement of the nEDM. The source – based on solid deuterium at 5 K – went into operation in 2011. After tuning, we got first nEDM data in 2012. The data was taken with an upgraded version of the apparatus which provided the present best limit of the nEDM. While the performance of the UCN source is still being raised, the nEDM experiment has already reached a new record daily statistical sensitivity. The improvements originate mainly from a longer precession time and a better final polarization of the neutrons. Additional advances are being realized now and will further increase the sensitivity.

In parallel to the ongoing measurement, we are designing and constructing a new spectrometer, n2EDM, to take full advantage of the PSI UCN source and to further improve on systematic uncertainties. Major improvements will be due to the better adaptation to the UCN source, an enhanced magnetic shield, a differential measurement with a double UCN chamber and very advanced magnetometry. The new apparatus should be ready by 2015.

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