

A new facility for fundamental physics: the high-intensity ultracold neutron source at the Paul Scherrer Institute

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on behalf of the UCN Project Team

The first ultracold neutrons (UCN) have been produced at the Paul Scherrer Institute's (PSI) new UCN source in December 2010. The design goal is to exceed the currently available UCN densities by a factor 50 to 100 and to use these neutrons for fundamental physics experiments, most prominently the search for a neutron electric dipole moment (nEDM) or the precise determination of the lifetime of the free neutron.

The PSI UCN source is based on neutron production via spallation of 590 MeV protons on lead, followed by neutron thermalization in heavy water and subsequent cooling in a solid deuterium crystal to cold and finally ultracold neutron energies below about 300 nano-eV.

Central to UCN production at PSI are: Using the full 1.3 MegaWatt proton beam for optimal neutron production; Growing and maintaining of a suitable (ortho-) deuterium crystal for the superthermal UCN production at a temperature of 5 K in immediate vicinity of the spallation target; Low-loss storage and efficient guiding of the UCN from production to 3 experimental areas over several meters through the radiation shield.

The authorities' approval for full facility operation is now expected for June 2011. The full installation is being prepared for UCN production and performance optimization. The setup of the nEDM apparatus was finished and the experiment is awaiting data taking with UCN.

An overview of the completed UCN source and the first measurements of ultracold neutrons at this new facility will be presented.

Primary author: Dr LAUSS, Bernhard (Paul Scherrer Institute)

Presenter: Dr LAUSS, Bernhard (Paul Scherrer Institute)

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