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A UCN storage experiment with superconducting magnets to measure the neutron lifetime

abstract: Precise knowledge of the lifetime τ of the free neutron can contribute to a more thorough understanding of weak interaction and cosmology. Results from recent measurements storing ultra-cold neutrons (UCN) show a discrepancy of over 6 sigma, therefore it is mandatory to apply a complementary method for the determination of τ . We intend to store UCN not in material traps as before, but through interaction with the magnetic moment of the neutron: Stacked superconducting solenoids create a low-field region of around 700 l, surrounded by magnetic or gravitational potentials always greater than 110 neV. In addition, the decay protons will be measured in real-time to realize independence from the possibly varying number of stored neutrons, a major source of errors for past experiments. To ascertain a precise result, one has to minimize or correct for all systematic effects. Marginally trapped neutrons with energies higher than 110 neV play a major role, so a UCN absorber shall remove them from the trap before the storage period. An experiment to test the suitable absorbers down to helium temperature (AbEx) is conducted at the Institute Laue-Langevin at the moment. The poster will present the main ideas of PENeLOPE and also visualize first results from AbEx.

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