

The Neutron Lifetime Experiment at LANL

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We report a new experiment to measure the beta decay rate of the free neutron. The apparatus is based on the asymmetric magneto-gravitational trap for ultracold neutrons (UCNs) proposed by Walstrom et al. [NIMA 599 (2008) pp. 82-92]. A permanent-magnet Halbach array creates the levitating field for “low-field-seeking” UCNs, while external holding field coils eliminate field zeros inside the trap. A significant modification to the original concept is an in-situ UCN detector comprising a vanadium-51 sheet, which is lowered into the trap after defined storage periods to quickly absorb remaining UCNs, and a coincidence detector for the beta and gamma emitted in the decay of ^235U . This year we completed a prototype trap and performed initial studies with UCN from the LANL UCN source. Preliminary results from a few days of beam time indicate a long storage time consistent with the PDG value for the neutron lifetime. A number of upgrades are planned that will allow us to fully evaluate the prototype apparatus and develop a next-generation experiment with sub-1 second precision.

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