

Development of a systematic studies apparatus at North Carolina State University for the nEDM collaboration

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A test apparatus is being developed for use at the ultracold neutron (UCN) source located at the 1 MW NCSU PULSTAR reactor. The goal is to study several critical aspects of the Spallation Neutron Source (SNS) neutron electric dipole moment (nEDM) experiment without the electric field. Detailed studies of the interactions between the ^3He and the UCNs, measurements of the correlation functions determining the geometric phase systematic effect, optimization of the parameters for critical dressing, and the pseudomagnetic field caused by neutron scattering from polarized ^3He will be made. Because of the extremely long turn around times, these would be almost impossible with the SNS apparatus. In this setup, polarized UCNs and ^3He will be repeatedly loaded into a single full-sized measurement cell made from acrylic and coated with deuterated TPB and polystyrene on the inner walls. The coating will act as both the UCN reflector and the wavelength shifter for the scintillation light emitted from charged particles ionizing the superfluid ^4He that is also in the cell. This light is will be detected using two photomultiplier tubes in coincidence and the signal from spin-dependent capture of UCNs on ^3He can be used to measure the Larmor precession frequency difference between the two species in the presence of an external magnetic field. Presently, the apparatus is in the final design stages. An overview of the status of the UCN source, the design of the apparatus, and the physics goals to be addressed will be presented.

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