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Search for time-reversal violation with the neutron electric dipole moment at the Spallation Neutron

Source

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The existence of a permanent electric dipole moment (EDM) for a fundamental particle, such as the neutron, would provide a new source of time-reversal violation in our physical laws. Time-reversal violation is equivalent to charge-parity (CP) violation via the CPT theorem. Several orders of magnitude larger CP violation beyond that currently observed and predicted in the standard model of particle physics is required to explain the matter over anti-matter dominance of our Universe. The nEDM at SNS experiment will provide a sensitivity around two orders of magnitude better than the current world limit. Our experiment will utilize the FNPB cold neutron beam facility to produce ultracold neutrons inside our measurement cells to be stored and studied for around a thousand seconds. Various unique properties of 0.4 K superfluid helium and hyper polarized ^3He atoms in our cryogenic apparatus will be exploited to study the precession of the neutron spins in the presence of a large electric field to unprecedented accuracies. The motivation, description, and updates of our “flagship” nuclear physics experiment will be given in this talk.