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Measurement of Neutron Reflectivity from a Silicon Crystal: Preparation for an nMDM Measurement

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Physicists from Argonne National Laboratories, Valparaiso University, the University of Hawaii, and the National Institute for Standards and Technology have designed an experiment to use the known neutron magnetic dipole moment (nMDM) to measure Schwinger scattering in silicon (Si), a process whereby the orientation of the magnetic dipole polarization is altered by interactions with the atomic electric fields in a Si crystal. This measurement is intended to be a precursor to a search for a neutron electric dipole moment (nEDM) employing a similar spin rotation via a different interaction. Both measurements depend on neutron Bragg reflections down a slotted Si crystal. For a successful measurement, the neutron beam has to reflect approximately 150 times, without a large loss of beam intensity. This requires a high reflectivity, on the order of 99% reflective. In order to make an accurate measurement of the Schwinger scattering, both the incident neutron beam and the crystal's reflectivity need to be well understood. In summer 2010, we characterized the newly commissioned 'nMDM Experiment' neutron beamline at the NIST Center for Neutron Research, and measured the reflectivity of the slotted Si single crystal intended for the experiment. These measurements laid the groundwork for the coming nMDM Schwinger scattering measurement.

Information about the Author:

Benjamin Barber is a physics and mathematics double major, minoring in mechanical engineering. He has previously worked on VU physics projects with the STAR collaboration. After completing his degree, Benjamin hopes to pursue a graduate degree in accelerator physics. He became interested in this project after a presentation on the current status of the project as part of the VU Physics and Astronomy Department weekly colloquium series.

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