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Compatibility of Photomultiplier Tube Operation with SQUIDs for a Neutron EDM Experiment

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An experiment at the Spallation Neutron Source at Oak Ridge National Laboratory with the goal of reducing the experimental limit on the electric dipole moment (EDM) of the neutron will measure the precession frequencies of neutrons when a strong electric field is applied parallel and antiparallel to a weak magnetic field. A difference in these frequencies would indicate a nonzero neutron EDM. To correct for drifts of the magnetic field in the measurement volume, polarized Helium-3 will be used as a comagnetometer. In one of the two methods built into the apparatus, superconducting quantum interference devices (SQUIDs) will be used to read out Helium-3 magnetization. Photomultiplier tubes (PMTs) will be used concurrently to measure scintillation light from neutron capture by Helium-3. However, the simultaneous noise-sensitive magnetic field measurement by the SQUIDs makes conventional PMT operation problematic due to the alternating current involved in generating the high voltages needed. Tests were done at Los Alamos National Laboratory to study the compatibility of simultaneous SQUID and PMT operation, using a custom battery-powered high-voltage power supply developed by H.O. Meyer and P.T. Smith to operate the PMT. The results of these tests will be presented.

Information about the Author:

Matthew Libersky is a sophomore physics and electrical engineering major who became interested in the experiment from discussion with a VU professor due to its relevance in testing theories of physics beyond the Standard Model and the useful practical skills involved in the work. He will continue work on a related project this summer. He plans to pursue graduate study in physics and hopes to work as a research scientist in experimental physics.

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