

PMMA Mechanical Test for the Medium Scale High Voltage Apparatus (MSHV)

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This experiment at Oak Ridge National Laboratory (ORNL) aims to search for the electric dipole moment of the neutron (nEDM) at the 10^{-28} level. One of the variables proportional to the sensitivity of the measurement is the strength of the electric field. The electrodes that generate the field will be made of polymethyl methacrylate (PMMA) and coated with a conductive material. This unique condition is further complicated by the fact that the system will be cooled to a temperature of 0.4 K. These conditions have not been attempted in the past and provide new challenges. In order to test solutions to these challenges, the MSHV was constructed. This apparatus allows potential coatings to be tested at 0.4 K to ensure that the electrodes for the final design will function as required. Due to stresses from thermal contraction occurring during cool down, components to transition from the PMMA electrodes to the existing support structure had to be selected to minimize the stress on each material. A mechanical test of this structure was performed at Los Alamos National Laboratory (LANL) to ensure that there are no failures of either structure or electrode. The results of this mechanical test, as well as the design and materials selected, will be discussed.

Information about the Author:

Adam Clark is a junior physics and mathematics double major. The project was the research from his summer internship through the Department of Physics and Astronomy with the nEDM collaboration working at Los Alamos National Laboratory. He plans to attend graduate school to pursue a Ph.D. in nuclear physics.

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