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The Depolarization Probability of Ultracold Neutrons in Collision with Material Guide Tubes in a Varying Ambient Magnetic Field
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Ultracold neutrons (UCN) are defined as having an energy of ∼100 neV. Polarized β-decay experiments using UCN require consideration of material depolarization for maximizing statistics as well as for understanding and controlling systematic effects. The Los Alamos National Lab UCN team performed an experiment in which UCN were polarized using a 6T longitudinal field. The resulting high-field-seeking spin state neutrons were then introduced into a material test guide. UCN which depolarize become trapped between the high-field region and a shutter, while high-field seeking UCN return through the magnet and are upscattered on a plastic foil. After loading the system with UCN and monitoring the incoming flux, the depolarization probability per bounce can be determined by opening the shutter and counting the population of trapped depolarized neutrons. A determination from this dataset of depolarization per bounce as a function of the ambient magnetic field in guide tubes made of unpolished, mechanically polished, and electropolished Cu, diamond-like carbon coated Cu, and stainless steel will be presented.

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