Workshop on Muon Physics at the Intensity and Precision Frontiers (MIP 2024)



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Exploring Exotic Spin-Dependent Interactions in Muons and Electrons Across Microscopic and Macroscopic Ranges

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Experiments have explored exotic spin-dependent interactions across distances from micrometers to astronomical scales, corresponding to energy scales below roughly 10 eV. Most research in the macroscopic domain has focused on protons, neutrons, and electrons, leaving interactions involving other fermions, like muons, largely unexplored. Muons are particularly intriguing due to their connection to several unsolved problems in physics. We've used the anomalous magnetic moment and electric dipole moment (EDM) of muons and electrons to investigate these exotic interactions. The muon magnetic moment may point to the existence of pseudo-scalar interactions. We've established constraints on scalar-pseudo-scalar interactions for muons within our range of interest. For electron pseudo-scalar interactions, we've set new limits from nanometers to around 1 millimeter. Given that all current experiments have failed to detect new forces, it's plausible that these forces might interact exclusively with muons. We suggest employing muon spin rotation techniques in the continued search for these elusive interactions.

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