3He Relaxation Study at Low Temperature for the Neutron Electric Dipole Moment Experiment

QIANG YE, Duke University/TUNL — The search for the existence of a nonzero neutron electric dipole moment (EDM) is a direct search of time reversal symmetry violation and has the potential to reveal new sources of CP violation beyond the Standard Model and may have a significant impact on our understanding of baryogenesis. A new experiment has been proposed to provide a new way to measure the neutron EDM with unprecedented sensitivity. The experiment requires that the 3He polarization to have little or negligible loss during each measurement period. Therefore, understanding the relaxation mechanism of polarized 3He and maintaining its polarization at the unique nEDM experimental conditions is essential. We have studied the longitudinal relaxation time of 3He vapor for the first time from a deuterated tetraphenyl butadiene (d-TPB) coated acrylic cell in a diluted mixture of 3He-4He at a temperature of 1.9K and first set of results will be reported. A d-TPB coated acrylic cells will be used in the neutron EDM experiment. It is important to extend our current work down to ~500mK and to a 3He concentration closer to that of the nEDM experiment. Such measurements are being planned with the use of a dilution refrigerator and a SQUID setup for the monitoring of the 3He polarization.

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Dipangkar Dutta
Duke University/TUNL

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