Abstract for an Invited Paper
for the DNP11 Meeting of
The American Physical Society

New Results from the emiT Experiment: A Search for Time Reversal Invariance Violation in Neuron Decay[1]

PIETER MUMM, National Institute of Standards and Technology

The existence of charge-parity (CP) symmetry violation is necessary to explain the preponderance of matter over antimatter in the universe. Thus far, the observed CP violation can be entirely accounted for by a phase in the Cabbibo-Kobayashi- Maskawa matrix, however this phase is insufficient to account for the known baryon asymmetry in the context of Big Bang cosmology and there is good reason to search for CP and the related time-reversal violation in other systems. The emiT experiment tests time reversal symmetry in the β-decay of polarized free neutrons by searching for the T-odd, P-even triple correlation $D\vec{\sigma}_n \cdot \mathbf{p_e} \times \mathbf{p}_\nu$, where $\vec{\sigma}$ and $\mathbf{p}$ are the neutron spin and decay product momenta, respectively. The detection of this correlation above the small calculable effect from final state interactions would be a direct indication of time reversal symmetry violation. The D coefficient is the most sensitive probe of the phase, ϕ_{AV}, between the axial-vector (A) and vector (V) currents and is sensitive to scalar and tensor interactions that could arise due to beyond-Standard-Model physics. A 14-month run in 2002-2003 produced a sample of over 300 million proton- electron coincidence events. A blind analysis and extensive study of systematic effects has recently been completed with the result $D = (-0.96 \pm 1.89(stat) \pm 1.01(sys)) \times 10^{-4}$, representing the most sensitive test of time- reversal invariance in beta decay. Within the Standard Model, the result can be interpreted as a measure of the phase $\phi_{AV} = (180.013 \pm 0.028)^{\circ}$.

[1]This work was supported by the National Institute of Standards and Technology, the US DOE Office of Nuclear Physics, and the NSF Division of Physics.