Parity Nonconservation in Fixed Target Møller Scattering

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We will report on the first physics run of the E158[1] experiment at the Stanford Linear Accelerator Center (SLAC). The experiment measures the parity-violating left-right asymmetry in the scattering of longitudinally polarized 50 (GeV/c^2) electrons from quasi-static atomic electrons in a liquid hydrogen target. The asymmetry is due to the interference between the weak neutral current amplitude and the electromagnetic amplitude and thus measures the product of the vector and axial-vector neutral current coupling of the electron to the Z boson.

The predicted standard model asymmetry is 0.18 parts per million (ppm). The goal is to measure the asymmetry with statistical and systematic errors of 7% and 3% respectively, from which one can extract a measurement of the electroweak mixing angle with an accuracy $\delta(\sin^2\theta_W) \sim \pm 0.0008$. This would constitute the most precise measurement of $\sin^2\theta_W$ at low Q^2 and establish its running with respect to Q^2 at the 8σ level, as shown in Fig. 1. Such a measurement uniquely probes new contact interactions at a scale of 15 TeV in a manner complementary to high energy collider searchers for physics beyond the standard model.

E158 is carrying out its first run between March and May 2002, where it is anticipated that enough statistics will be accumulated to demonstrate for the first time that parity is not conserved in the Møller scattering reaction. The performance of the experimental apparatus and preliminary results from this first physics run will be presented.

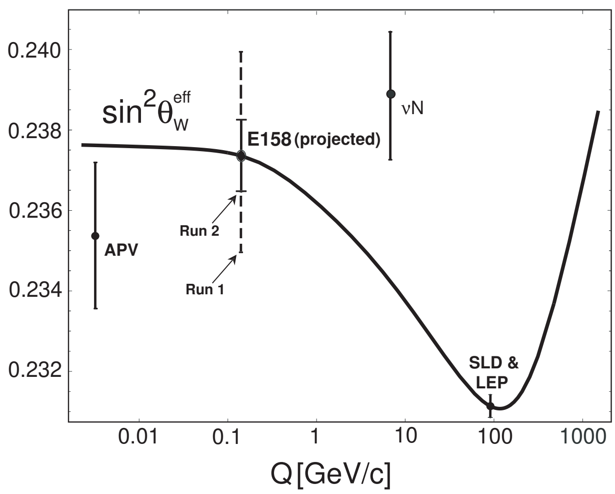

Figure 1: The dependence of the $\sin^2\theta_W$ as a function of Q is shown,[2] along with published measurements and the expected errors from the two runs of the E158 experiment.

References

[1] SLAC Experiment E158, http://www.slac.stanford.edu/exp/e158/

[2] A. Czarnecki and W.J. Marciano, Int.J.Mod.Phys.**A15** (2000) 2365.