

The MOLLER Experiment:
“An Ultra-precise Measurement of the Weak Charge of the
Electron using Møller Scattering”

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Abstract

Parity Violating Electron Scattering (PVES) is an extremely successful precision frontier tool that have been used for testing the Standard Model (SM) and understanding nucleon structure. Several generations of highly successful PVES programs at SLAC, MIT-Bates, MAMI-Mainz, and Jefferson Lab have contributed to understanding of nucleon structure and testing the SM. But missing phenomena like matter antimatter asymmetry, neutrino flavor oscillations, and dark matter and energy suggest that the SM is only a low energy effective theory. The MOLLER experiment at Jefferson Lab will measure the weak charge of the electron, $Q_W^e = 1 - 4\sin^2\theta_W$, with a precision of 2.3% by measuring the parity violating asymmetry in electron-electron (Møller) scattering and will be sensitive to subtle but measurable deviations from precisely calculable predictions from SM. The MOLLER experiment will provide the best contact interaction search for leptons at low OR high energy makes it a probe of physics beyond the Standard Model with sensitivities to mass scales of new PV physics up to 7.5 TeV.

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