

The MOLLER Experiment: Probing Electroweak Dynamics via Parity-Violating Electron Scattering

Friday, 13 February 2026 09:15 (15 minutes)

The MOLLER experiment aims to constrain fundamental parameters in the Standard Model by measuring the parity-violating asymmetry A_{PV} induced by the interference between electromagnetic and weak neutral current amplitudes. MOLLER will utilize polarized Møller scattering at Jefferson Lab to measure a highly precise 0.8 part per billion (ppb) uncertainty on the predicted 33 ppb A_{PV} . This precision will yield a 2.4% determination of the electron's weak charge and ultimately determine the weak mixing angle to 0.1% fractional uncertainty. As the most precise measurement of the weak mixing angle at low momentum transfer, the results will provide a unique probe into new, parity-violating physics at both MeV and multi-TeV scales. MOLLER has been designed to reach its precision through meticulous planning and the innovative design of its experimental apparatus—including the highest-power liquid hydrogen target to date, a toroidal spectrometer, and several detector systems capable of operating in tracking and integrating modes. This talk will outline the physics objectives, experimental design, and current status of construction efforts.

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