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Parity violating electron scattering at JLab: the MOLLER experiment

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Parity violating electron scattering (PVES) provides a tool which has been used at laboratories around the world to investigate aspects of nuclear and nucleon structure and to probe for physics beyond the Standard Model. Jefferson Lab has several proposed PVES experiments in the 12 GeV era, one of which is the MOLLER experiment. MOLLER proposes measuring the parity violating asymmetry in electron-electron scattering at a beam energy of 11 GeV, to determine the weak charge of the electron ($Q_w^e = 1 - 4 \sin^2 \theta_W$ at tree level) to a relative precision of 2.3%. From this measurement, the weak mixing angle at low 4-momentum transfer can be extracted and compared to the precise Standard Model predictions. Deviations would indicate new physics interactions were contributing to the PVES asymmetry; interpreting possible new physics as a contact interaction, MOLLER would have a sensitivity of $\Lambda/g \simeq 7.5$ TeV.

¹For the MOLLER Collaboration.