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A Precision Measurement of Deuteron Charge Radius (DRad)

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The muonic-deuterium spectroscopic measurements obtained a significantly smaller (5.6 σ) deuterium charge radius as compared to the CODATA 2014 value. It is also 2.6 σ away from the combined value of the proton charge radius from the muonic-hydrogen measurements and the isotope shift value from ordinary hydrogen and deuterium measurements, indicating an effect from the neutron charge distribution. Such a puzzling discovery awaits further precision investigations with different experimental techniques, and thus the DRad experiment (Jefferson Lab PR12-17-009) was proposed to measure the $e-d$ elastic scattering cross-sections with low momentum transfers ($Q^2 = 2\times10^{-4} - 5\times10^{-2}$ $(\mathrm{GeV/c})^2$), and precisely extract the deuterium charge radius. The designed setup of this experiment is largely based on that of the PRad experiment (Jefferson Lab E12-11-106), but with a low energy Si-based cylindrical recoil detector in the windowless target cell to reject the inelastic background. The design also includes an additional Gas Electron Multiplier (GEM), which improves the tracking capability and hence reduces the beam-line background and related systematic uncertainties. The measured $e-d$ cross-sections will be normalized to the well-known M
*o*ller process, which can be measured simultaneously with a similar kinematic range and detector acceptance. In this talk, we will present the DRad experimental setup and its projections.

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