A Precision Measurement of Deuteron Charge Radius (DRad) [1]

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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 ($Q^2 = 2 \times 10^{-4} - 5 \times 10^{-2}$ $(\mathrm{GeV/c})^2$), 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 quasi-elastic 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 Møller 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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