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Deuterium Charge Radius Experiment (DRad) at Jefferson Lab¹

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High precision muonic deuterium spectroscopic measurements found a significantly smaller (7σ) deuterium charge radius compared to the CODATA recommended value, creating the “deuterium charge radius puzzle”. In order to investigate this, the DRad experiment (Jefferson Lab PR12-17-009) was proposed to measure the $e-d$ elastic scattering cross section in a very low momentum transfer squared region ($Q^2 = 2 \times 10^{-4} - 5 \times 10^{-2} \text{ (GeV/c)}^2$), with a sub-percent proposed precision. The designed setup of the experiment will be largely based on that of the PRad experiment (Jefferson Lab E12-11-106), with an addition of a low energy Si-based cylindrical recoil detector within the windowless gas flow target cell for the rejection of the quasi-elastic background, and a second layer Gas Electron Multiplier (GEM) detector to improve the tracking capability for a better beam-line background rejection and reductions of other systematic uncertainties. The absolute $e-d$ elastic scattering cross section will be normalized to that of the well-known Møller scattering process, which will be measured simultaneously within similar kinematics and detector acceptances. In this talk, we will present the design of the experimental setup and preliminary projected results.

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