PRad-II Experiment: A High Precision Measurement of the Proton Charge Radius

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The PRad experiment at Jefferson Lab (JLab) measured the proton root-mean-square (RMS) charge radius with high accuracy at low four-momentum transfer square (Q^2). Despite the fact that the calorimetric technique used by PRad provided a set of systematic uncertainties different from all other modern electron scattering experiments, the PRad result agrees with the smaller radius extracted from the muonic hydrogen spectroscopy measurements, within its experimental uncertainties, but is in direct conflict with the scattering experiments. To further exploit the calorimetric technique and achieve the highest allowed precision, a new and upgraded experiment, PRad-II, was proposed and fully approved with the highest scientific rating at JLab in 2021. PRad-II will reduce the overall experimental uncertainties by a factor of 3.8 compared to PRad, resulting in a projected total uncertainty of 0.43%. This high-precision measurement of the proton charge radius will provide a critical input to address the yet unsettled controversy in subatomic physics. In addition, PRad-II will be the first lepton scattering experiment to reach the low Q^2 range of 10^{-5} GeV^2, allowing a more accurate and robust extraction of the proton charge radius. Its precise experimental data also allow a direct investigation into the data tension between PRad and Mainz A1 experiments within $0.02 < Q^2 < 0.06$ GeV^2. This talk will give an overview of the future PRad-II experiment.