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Higher-order Corrections in the Proton Radius Extraction KARL MEDINA, Argonne National Laboratory — Elastic electron-proton scattering is the primary technique used to extract proton electric and magnetic form factors. These form factors describe the electric charge and magnetization distributions inside the proton and at low energies allow for the extraction of the root-mean-square charge radius of the proton. Such extractions of the charge radius disagree with the value obtained using an alternate method involving muonic hydrogen. Corrections beyond the single-photon exchange model of the scattering are important in determining the form factors. The effect of the Coulomb interaction between the electron and proton has been estimated in the 2nd Born approximation, corresponding to the effect of a second soft photon exchange, but higher order effects are assumed to be negligible. We investigated the potential impact of higher order terms using a semi-classical calculation of the effect, which may become more important at extremely low energies. We find a correction that is small but not negligible, and which has a very different angular dependence from the previously-evaluated corrections. This examination suggests that the higher-order correction has the potential to impact the extraction of the proton's radius, pointing to the need for a more complete evaluation of the corrections.

Karl Medina
Argonne National Laboratory

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