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Global Analysis of the Protons Elastic Form Factors in the Space-like Region

Sunday, 19 February 2023 10:00 (15 minutes)

The response of the proton to elastic scattering events has long been known to be described via two functions of the squared momentum transfer Q^2: the Sachs electric and magnetic form factors $G_E\left(Q^2\right)$ and $G_M\left(Q^2\right)$, respectively. To understand this elastic structure of the proton there are two main observables which constrain the form factors: cross section data from elastic electron-proton scattering events, and polarization transfer measurements, which generate 'polarization ratio' data. After taking into account tree-level radiative corrections, separate fits of the form factors to these data lead to fits which disagree significantly with one another. Higher vertex corrections, especially two-photon-exchange corrections, have been assumed to play a larger role than previously thought in order to explain this discrepancy. We present our global reanalysis which takes special care to treat normalization uncertainties in a most statistically rigorous manner, with additional work done to understand how to extend certain statistical methods only defined for linear models, to non-linear models. We find only minor differences to fits when normalization uncertainty is correctly accounted for. We also present a simultaneous global fit to the two-photon-exchange corrected cross section data and polarization ratio data.

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