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Results from the OLYMPUS Experiment on the Contribution of Hard Two-Photon Exchange to Elastic Electron-Proton Scattering

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Measurements of the ratio of the elastic form factors of the proton ($\mu_p G_E/G_M$) exhibit a strong discrepancy. Experiments using unpolarized beams and Rosenbluth separation to determine the form factors consistently have found values of the ratio approximately consistent with unity over a wide range of Q^2, while polarization transfer experiments suggest that the ratio decreases as a function of Q^2. The most widely-accepted hypothesis to explain this discrepancy is that hard two-photon exchange (TPE) significantly contributes to the elastic ep cross section. Hard TPE has been neglected in previous analyses of electron-proton scattering scattering experiments, in part due to the fact that there exists no model independent way to calculate the contribution. The effect may be measured experimentally, however, via precise determination of the ratio of the electron-proton and positron-proton elastic cross sections. The OLYMPUS experiment collected more than 3 fb^{-1} of exclusive \ep and \pp elastic scattering data at DESY in 2012, and has determined the elastic \ratio ratio to unprecedented precision up to $Q^2 \approx 2.2$ (GeV/c)^2, $\epsilon \approx 0.4$. This presentation will discuss the OLYMPUS experiment and analysis, and present the recently published results from OLYMPUS in the context of the results from the other two TPE experiments.

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