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Two-photon physics

Electromagnetic interactions provide one of the cleanest probes of the proton's internal structure. A particularly rich class of processes involves two photons, such as Compton scattering $\gamma^{(*)}p \to \gamma^{(*)}p$, where either photon may be real or virtual. By varying the photon energy and virtuality, different pictures of the proton emerge.
At low virtuality, the proton responds coherently to the external electromagnetic field. Its structure is described by polarizabilities, which measure how easily internal charge and magnetization distributions are distorted. With virtual photons, generalized polarizabilities map the resulting deformations in position space.
At high virtuality, the response becomes incoherent, and the photon interacts with individual partons. This regime gives access to Generalized Parton Distributions (GPDs), which encode how momentum, spin, and position are shared among partons. Integrals of GPDs connect directly to the proton's energy–momentum tensor, providing insight into the origin of its mass, spin and internal mechanical properties.

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