APR09-2009-000657

Abstract for an Invited Paper
for the APR09 Meeting of
the American Physical Society

The Elastic Electromagnetic Form Factors of the Proton

EDWARD BRASH, Christopher Newport University and Jefferson Laboratory

In many senses, the internal structure of the nucleon is the defining problem of QCD, the fundamental theory of the strong interaction. The internal structure of the nucleon defines its mass, spin, and its interactions. The nucleon is the fundamental building block of the nucleus, and indeed it is the residual nucleon-nucleon interaction that governs all nuclear structure, in much the same way that residual interactions between atoms governs molecular structure. As such, a full and detailed quantitative understanding of the internal structure of the nucleon is a necessary precursor to extending our understanding of nuclear physics. A fundamental test of the QCD in the confinement region is the electromagnetic structure of the nucleon. In particular, measurements of the elastic electric and magnetic form factors of the proton, G_{Ep} and G_{Mp}, respectively, at large momentum transfer, Q^2, shed new light on its internal nonperturbative structure. The ratio, $R_p = \mu_p G_{Ep}/G_{Mp}$, where μ_p is the proton magnetic moment, has been measured extensively over the last decade at the Jefferson Laboratory, using the polarization transfer method, where one measures R_p directly by measuring the ratio of transverse to longitudinal polarizations of the recoiling proton in elastic electron-proton scattering. These data have revealed that the ratio decreases approximately linearly with increasing Q^2 above a $Q^2 \sim 1$ GeV^2. The polarization transfer results are of unprecedented high precision and accuracy, due in large part to the small systematic uncertainties associated with the experimental technique. Most recently, the Gep-III Experiment was completed in June of 2008 in Hall C at Jefferson Laboratory. It extends the Q^2-range from 5.6 to 8.54 GeV^2. In this presentation, I will review the status of the proton elastic electromagnetic form factor data, including the latest results from the Gep-III experiment, and discuss a number of theoretical approaches to describing nucleon form factors.