NUCLEON FORM FACTORS

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Abstract

Nucleon electromagnetic form factors are of fundamental importance for an understanding of their internal structure. These form factors, which in the Breit frame can be simply related to the spatial distribution of the nucleon charge and magnetization distributions, are measured through elastic electron-proton (in the case of the neutron through electron-deuteron or -^3He) scattering.

Spin-dependent electron scattering has been shown to offer the potential to enhance our understanding of nucleon structure through its access to interference terms between large and small components in the reaction amplitude. Electron-scattering experiments off polarized targets have been carried out at a number of intermediate- and high-energy facilities. Spin observables from polarized deuterium have provided important information on the elusive neutron electric form factor G_E^n. Polarized $^3\vec{He}$ provides an alternative access to measure G_E^n and G_M^n.

The breakthrough experimental progress will be demonstrated by presenting recent results from the Continuous Electron Beam Accelerator and Hall-A (and Hall-C) Facilities of JLab and from the MAMI facility at the University of Mainz. An outlook will be given of the results to be expected within the next five years.

The results will be compared to conventional meson-baryon physics calculations and to predictions of quark dimensional-scaling and perturbative quantum chromodynamics. They are expected to provide a crucial test of nuclear chromodynamics ideas and insights into the transition from the meson-baryon to quark-gluon descriptions. Ab initio predictions of the nucleon form factors have to wait for the fruition of Lattice QCD calculations.

Improvements in both accelerator and detector technology have made accurate measurements of the parity-violating asymmetry in elastic electron-proton scattering feasible, providing a method to measure the matrix elements of the neutral current. The active experimental program at various facilities worldwide will be presented, which will provide us in the next few years with accurate data on the s-quark contribution to the proton form factors at momentum transfer values up to 1 (GeV/c)^2.