

Weak Neutral-Current Form-Factors of the Nucleon

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A robust international program of parity-violating electron scattering utilizes the weak neutral-current interaction as a probe of the structure of the nucleon. As anticipated in the 2002 NSAC Long Range Plan, recently released results from this program have placed tight constraints on possible contributions of strange sea quarks to the electric and magnetic form factors of the nucleon. At forward angles and very low Q^2 , the high precision on the neutral weak form-factors now approaches limits on theoretical uncertainties in nucleon charge symmetry, while measurements at larger angles will be sensitive to uncertainties in the “anapole moment” radiative correction. The existing program promises results from backward-angle measurements at $Q^2 \sim 0.2\text{-}0.6 \text{ GeV}^2$ in 2007 and a new, high-precision, forward-angle measurement at $Q^2 \sim 0.6 \text{ GeV}^2$ in early 2009. Beyond that, future measurements might seek to extend constraints on strange form-factors to higher Q^2 or to more precisely map the neutral-weak form-factor at very low Q^2 for a further test of both charge symmetry and the role of strange quarks. Such increased precision at low Q^2 would serve to further reduce a leading source of interpretation uncertainty in the measurement of the proton weak charge.