

MEASUREMENTS OF THE DEUTERON ELECTRIC AND MAGNETIC FORM FACTORS AT THE JEFFERSON LABORATORY

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Abstract

The results from an experiment [1] to measure the electric, $A(Q^2)$, and magnetic, $B(Q^2)$, form factors of the deuteron at large momentum transfers at the Jefferson Laboratory (JLAB) will be reported. The experiment performed elastic electron scattering from deuterium in coincidence; it has improved the quality of the existing data [2,3] in the range of overlap and has significantly extended the Q^2 range of the previous $A(Q^2)$ SLAC data [2]. The range in the squared four-momentum transfer, Q^2 , is 0.7 to 6.0 (GeV/c)² for the $A(Q^2)$ measurements and 0.7 to 1.4 (GeV/c)² for the $B(Q^2)$ measurements.

The measurements used the Continuous Electron Beam Accelerator and Hall-A Facilities of JLAB. Incident electron beams of energy 0.5 to 4.4 GeV and current 10 to 120 μ A were scattered off a high power (500W) cryogenic deuterium/hydrogen target. Scattered electrons and recoiling deuterons were detected in coincidence using the two 4 GeV/c High Resolution Spectrometers (HRS) in Hall-A. Both HRSs used two planes of scintillators for triggering and timing and a drift chamber system for particle tracking. The electron HRS was also equipped with a gas Cherenkov counter and a lead-glass calorimeter for electron identification. Elastic electron-proton scattering in coincidence was used to calibrate the entire double-arm system.

The results will be compared to conventional meson-nucleon physics calculations based on the impulse approximation with the inclusion of meson-exchange-currents, and to predictions of dimensional scaling quark models and perturbative quantum chromodynamics. They are expected to provide a crucial test of nuclear chromodynamics ideas and insights into the transition from the meson-nucleon to quark-gluon descriptions of the two-body nuclear structure.

1. G. G. Petratos et al., *Measurement of the electric and magnetic form factors of the deuteron at large momentum transfers*, CEBAF Proposal 91-26, 1991.
2. R. G. Arnold et al., Phys. Rev. Lett. **35**, 776 (1975), and references therein.
3. P. E. Bosted, A. T. Katramatou et al., Phys. Rev. **C42**, 38 (1990), and references therein.

[†] REPRESENTING THE JEFFERSON LAB HALL-A COLLABORATION: Blaise Pascal, Cal. State LA, Duke, Florida International, Florida State, Georgia, Grenoble, INFN, JLAB, Kent State, Kentucky, Maryland, MIT, New Hampshire, Norfolk State, North Carolina Central, Old Dominion, Orsay, Princeton, Regina, Rutgers, Saclay, Stony Brook, Syracuse, Temple, Tohoku, Virginia, William and Mary, Yamagata, Yerevan.