NEW INSIGHTS INTO NUCLEAR STRUCTURE FROM ELECTRON SCATTERING AT JEFFERSON LAB

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The intense, cw beams of polarized electrons with energies of up to 6 GeV from the Continuous Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab have provided a unique tool for the study of atomic nuclei and their constituents. One hundred and seventy three experiments were carried out using the original accelerator configuration between 1995, when operations began, and 2012, when the facility ceased operation to start the 12 GeV Upgrade now nearing completion. These experiments advanced a broad range of nuclear physics research aimed at addressing key questions in the field, such as: how nucleons are constructed from the quarks and gluons of QCD; how the strong force arises from the underlying QCD quark-quark interaction; and where the conventional description of nuclei based on nucleons interacting via the nuclear force breaks down. Another major line of research emerged aimed at testing the Standard Model through very high precision experiments at low energies.

An equally exciting, but less broadly appreciated focus of CEBAF research has been on nuclear structure. This research includes an array of experiments taking advantage of the precision, spatial resolution, and interpretability of experiments performed using electromagnetic probes to address long-standing issues in nuclear physics. Results will be presented in a number of areas, including: identifying the limits of applicability of the conventional description of nuclei based on nucleons interacting via the nuclear force; quantitative investigations of short-range correlations among the nucleons in nuclei; the precision determination of the neutron radius of a heavy nucleus; and the study of the N-N force and the structure of deeply bound nucleons through the electro-production of hypernuclei. Prospects for extending this research using the beams from the newly operational 12 GeV Upgrade of CEBAF will also be discussed.