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Measurements of the Longitudinal to Transverse Cross Section Ratio and Separated Structure Functions on Nucleons and Nuclei

CYNTHIA KEPPEL, Hampton U. / Jefferson Lab

The ratio R of longitudinal (L) to transverse (T) electron scattering off the nucleon is a fundamental quantity that should be measured with the best possible accuracy. Recent data from experiments in Hall C at Jefferson Lab have measured precision inclusive elastic, quasi-elastic, resonance, and deep inelastic cross sections from nucleons and nuclei over the four-momentum transfer range $0.05 < Q^2 < 5.50$ GeV^2. This new data has been used to accurately perform over 200 Rosenbluth- type L/T separations. These separations have allowed for the longitudinal component of the electron-nucleon(us) cross section to be extracted, for the first time in many cases, and for the inelastic structure functions F_1, F_2, and F_L to be obtained. One surprising observation is that R is large at the larger W, low Q values, where it is typically assumed to go to zero. Other physics issues addressed by the new data include: the nuclear dependence of the longitudinal structure function; quark-hadron duality; structure function moment extractions; a search for nuclear pions; improved measurements of F_2; and modeling the vector contribution to neutrino cross sections.