Spin structure functions of the proton and the neutron at low to moderate Q^2

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April 14, 2013

Abstract

The physics program at Jefferson Lab has collected a large amount of data on the spin structure functions of the nucleon by using polarized electron beam directed on polarized NH_3, ND_3 and ^3He targets. In these experiments, the virtual photon asymmetry A_1 and the spin structure function g_1 were measured with an unprecedented precision in a large kinematic range of 0.01 GeV^2 $< Q^2 <$ 6.0 GeV^2 and 1.08 GeV $< W <$ 3.0 GeV. The data helps us to better understand the spin structure of the nucleon, especially in the transition region between hadronic and quark-gluon degrees of freedom. Therefore, it will be possible to put limits on the quark-hadron duality, test the pQCD predictions for the quark polarization at large x, perform more precise calculations of higher-twist matrix elements in the framework of the Operator Product Expansion and get a glimpse of A1 in high x. In addition, parameterizations of the world data on the asymmetries and the spin structure functions are studied to create and refine the models on these quantities that can be used in various applications. Finally, the neutron spin structure functions are extracted from the combined proton and deuteron data using a new unfolding technique. This is the first representation of the neutron data in the resonance region.