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Structure of the free neutron[1]

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Information on the structure of the neutron is indispensible for a full understanding of the static properties, resonance excitations and quark distributions of the nucleon. From elastic form factors over resonance transition amplitudes to deep inelastic structure functions (both unpolarized and polarized), studying both partners of the proton-neutron isospin doublet is necessary to address such fundamental questions as the valence quark structure of the nucleon (in particular the ratio of d/u quark probabilities at large x), higher twist effects and the phenomenon of quark-hadron duality. Measurements on the neutron are hampered by the fact that neutron targets of sufficient densities exist only bound inside nuclei, with the deuteron, the triton and (polarized) ^{3}He being the most often used "ersatz targets." The need to account for binding effects complicates the extraction of free neutron data from these experiments. Progress requires either a way to avoid model uncertainties (e.g., by focusing on kinematics where the PWIA spectator model works reasonably well for the struck nucleus) or a better understanding of these nuclear effects. In either case, one has to also deal with complications like final state interactions and other contributions. On the other hand, detailed studies of the reaction mechanism can yield important new information on the structure of few-body nuclei and the interplay of nuclear and quark degrees of freedom. In my talk, I will present some recent experimental results on neutron structure functions and some new approaches towards a better understanding of nuclear binding effects. I will concentrate on the large and varied program pursued at Jefferson Lab in this area, both from the present 6 GeV program and for the era after the 12 GeV upgrade.

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