The Proton and its Modification in the Nuclear Medium

Understanding the structure of the proton in terms of its constituents (quarks, antiquarks, and gluons) is of fundamental importance in nuclear and particle physics; ultimately such an understanding is necessary to describe the strong force. The electromagnetic structure of the proton can be studied through the exchange of a virtual photon, in elastic electron-nucleon scattering experiments. Indeed, polarization-transfer experiments from the proton have revealed distinct differences in the spatial distribution of charge and magnetization currents in the proton.

Whether or not this structure is significantly different for protons bound in the nuclear medium of an atomic nucleus is still an open question. In an attempt to study these possible medium modifications we have measured the proton recoil polarization in quasi-elastic electron scattering from ^{4}He at both the Mainz Microtron and Jefferson Lab. These experiments and various interpretations of the observed strong medium effects will be discussed.