

# Physics Seminar

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*Quark Structure of the Neutron at Large Bjorken- $x$*

## **Abstract:**

Understanding how the fundamental force between the constituent quarks and gluons, described by Quantum Chromodynamics, leads to the structure of the protons and neutrons comprising the nucleus of ordinary matter is one of the overarching questions in modern nuclear physics. One of the key experimental tools for nucleon structure studies has been measurements of inclusive structure functions via charged lepton scattering. While precision data exists for the proton, a lack of comparable precision data on the free neutron has hampered determinations of the valence quark structure of the nucleon. The BONuS12 experiment was designed to measure the neutron  $F_2$  structure function at large Bjorken- $x$  by tagging a spectator proton during the inclusive scattering of electrons from a deuterium target to ensure that the scattering took place from a *nearly* free neutron. The experiment will leverage the recently upgraded CEBAF accelerator and the new CLAS12 spectrometer in Jefferson Lab Experimental Hall B. This will extend the measurements performed during in the first BONuS experiment in the 6 GeV era to both larger Bjorken- $x$  and larger  $Q^2$ , allowing for a precision determination of the d to u quark ratio in the valence region, with the results offering insight into the dynamics of spin-flavor symmetry breaking in the nucleon. This designated *high impact* experiment is scheduled to begin data taking in February 2020 utilizing a significantly improved detector for the slow recoiling protons, which was constructed at Hampton University. This talk will present the results from the first experiment, the design and construction of the new proton recoil detector, and the expected physics impact of the new data within the context of new complementary data.

**Friday, January 10, 2020**

**9:00am**

**CEBAF Center L102**