Old Dominion University
Department of Physics
Colloquium

Tuesday, November 28, 2023

"Pulling the nuclear thread: efforts to unravel three puzzles that still confound nuclear physics"

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Abstract:
The majority of the mass of visible universe comes in the form of protons and neutrons in atomic nuclei. Protons and neutrons themselves are composite particles that ``emerge" from a fundamental theory called quantum chromodynamics (QCD), that describes the behavior of sub-atomic quarks and gluons. And while the predictions of QCD have been thoroughly confirmed at high energies, and low energies, the theory becomes less tractable. There are a rich array of array of emergent phenomena in nuclear physics for which we lack a satisfying explanation. In my research, I am interested in several such phenomena and I hope that by investigating them in new ways, we might learn something deep about how quarks and gluons build protons, neutrons, and the nuclei which make up the world around us. In this colloquium, I will discuss three loose threads that I am currently pulling. First, the EMC Effect describes the dramatic and unexpected difference in quark momentum in bound protons and neutrons relative to their unbound counterparts. Second, the helium-3 nucleus presents some challenges for our understanding how protons and neutrons form short-range correlations. Finally, our efforts to pin down the distribution of charge and magnetism within the proton using electron scattering will have to confront a complication called "two-photon exchange." I will present efforts by my group and my collaborators to address these questions with goal of gaining insight into the structure of protons, neutrons, and nuclei.

Presentation: OCNPS 200 @ 3:00 pm
Refreshments: OCNPS Atrium @ 2:30 pm

All interested persons are cordially invited to attend.