



Old Dominion University

Department of Physics

Colloquium

Thursday, March 24, 2022

"Probing the Fundamental Structure of Matter"

Dr. Felix Ringer
YITP – Stony Brook University

Abstract:

Protons and neutrons are the main building blocks of visible matter in our universe. They are made up of elementary quarks and gluons, which are described by the theory of quantum chromodynamics (QCD). In order to understand the complex inner workings of protons as well as heavy nuclei, and to search for processes beyond the Standard Model of particle physics, various measurements have been carried out at high-energy nuclear collider experiments. The detectors of these experiments do not observe free quarks and gluons but instead high-energy hadrons and jets. They are evidence of processes between quarks and gluons on distance scales far smaller than the size of an individual proton. Even though QCD was developed several decades ago, reliable predictions and direct comparisons with experimental data have remained challenging since QCD is strongly coupled at low energies. In this talk, I will discuss recent theoretical progress in first-principles calculations in QCD in the high-energy and low-energy regime. While a description of low-energy aspects at collider experiments is generally considered to be intractable with classical computing resources, progress in quantum computing may eventually allow for first-principles simulations. I will present first proof-of-concept studies using existing quantum devices and outline future directions. These results are directly relevant for the physics program at Jefferson Lab, the Large Hadron Collider at CERN and they provide new research directions for the Electron-Ion Collider, the premier future project of the U.S. Nuclear Physics program.

See zoom information below.

Dr. Felix Ringer

March 24, 2022

3:00 PM

"Probing the Fundamental Structure of Matter"

Join Zoom Meeting

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All interested persons are cordially invited to attend