

“ Toward Quantum Imaging of Nuclei ”

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Engineering 100

Abstract

The atomic nucleus emerges from interacting quantum particles called quarks and gluons, but how this happens remains unknown. This might be elucidated with quantum-level "images" of their position, orbital motion, spin alignment, and entanglement. I will describe recent and upcoming experiments at Jefferson Laboratory that use a high-intensity, high-energy electron beam to probe a wide range of nuclear targets, from polarized lithium to lead. I will also explain how these studies pave the way for future research at the Electron-Ion Collider (EIC), which will usher in a new era by providing a novel tool: particle jets. To advance EIC jet physics, we are developing next-generation, highly granular calorimeter systems, which can be enhanced with state-of-the-art AI/ML methodologies. I will summarize recent prototype testing conducted at various facilities and discuss plans for further testing and construction in the near future.

Biography

I am an Assistant Professor of Physics at the University of California, Riverside, since 2020. I earned my PhD from the University of Cambridge in 2017, following bachelor's and master's degrees in physics from Universidad Técnica Federico Santa María in Chile, and was a postdoctoral researcher at UC Berkeley. My work spans experimental nuclear and particle physics at CERN and Jefferson Laboratory, astroparticle physics projects such as the proposed CONDOR gamma-ray observatory in Chile, and applied science using muon tomography and nuclear physics for agriculture. My awards include the 2024 DOE Early Career Award, the 2025 Guido Altarelli Award, the 2025 UC Riverside Chancellor's Award, and the 2017 ATLAS Thesis Award.