Hunter Duggin

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Research Interests

Theoretical nuclear and particle physics; physics beyond the standard model; low energy effective field theories; hadron spectroscopy; non-Abelian field theories; Quantum Chromodynamics; Lattice computation methods; Lattice QCD; predicting rare nuclear processes.

Education

Grad. Student — **University of North Carolina**, Physics — Aug 2024 – Present

- GPA: 4.0/4.0
- **Coursework:** Classical Dynamics (Goldstien), Quantum Mechanics (Sakurai), Mathematical Methods (Arfken et. al.), Electrodynamics (Jackson), Statistical Mechanics (Landau & Lifshitz), Group Theory (Georgei).

BS — **North Carolina State University**, Physics (Mathematics Minor) — Aug 2020 – May 2024

- GPA: 3.6/4.0
- **Coursework:** Quantum Field Theory I/II (Peskin & Schroder), Nuclear Physics (Krane) , Quantum Mechanics I/II (Sakurai, Griffiths & Peebles), Classical Mechanics I/II (Goldstien et. al. & Taylor), Electrodynamics I/II (Jackson & Griffiths), Computational Physics, General Relativity (Carrol).

Experience

UNC, Research Assistant — Chapel Hill, NC — Jan 2025 – Present

- Investigating the structure of the unitary Fermi gas through the calculation of gravitational form factors (GFFs) on the lattice. Tuning the system towards unitarity creates a conformal theory, so this technique can be used to extract scale invariant physics.
- under the direction of Dr. Amy Nicholson, Assistant Professor at UNC.
- future endeavors include lattice QCD calculations.

JLab, SULI Student — Newport News, VA — May 2024 – Aug 2024

- Worked on the designing of an experimental laboratory used to create high performance polarized He-3 targets in Jefferson lab's experimental equipment lab.
- Under the direction of Dr. Arun Tadepalli, staff scientist at JLab.
- Additional responsibilities included experimental equipment calibration, RadCon II (contamination) training, Cleaning / repairing contaminated Helmholtz coils, Back end electronics, etc.

NC State, Research Assistant — Raleigh, NC — May 2024 – Aug 2024

- Worked on interpolating the 't Hooft model between instant form dynamics and light front dynamics in the Coulomb gauge.
- Under the mentorship of Dr. Chueng Ji, Professor at North Carolina State university and Bailing Ma, Postdoc at ANL.

Conferences

SPIN 2023 (Poster) — Durham, NC
Interpolating the 't Hooft Model Between IFD and LFD in the Coulomb Gauge ***Hunter Duggin***,Chueng Ji, Bailing Ma — Sept 2023
Conference Indico Page

APS / JPS Division of Nuclear Physics Joint Meeting 2023 (Oral) — Waikoloa, HI
Interpolating the 't Hooft Model Between IFD and LFD in the Coulomb Gauge — Dec 2023
Hunter Duggin,Chueng Ji, Bailing Ma
Conference Indico Page

National Conference on Undergraduate Research (Poster) — Long Beach, CA
Interpolating the 't Hooft Model Between IFD and LFD in the Coulomb Gauge — April 2024
Hunter Duggin,Chueng Ji, Bailing Ma
Conference Page

McCormick Symposium (Poster) — Raleigh, NC
Interpolating the 't Hooft Model Between IFD and LFD in the Coulomb Gauge — April 2024
Hunter Duggin,Chueng Ji, Bailing Ma
Conference Page

JLab SULI Session (Poster) — Newport News, VA
Polarized He-3 Target Set-up — Aug 2024
Hunter Duggin,Arun Tadepalli, Paul Kigaya, Hannah Murphy, Evan Utne
Conference Page

Proceedings

Interpolating the 't Hooft model between Instant and Light-Front dynamics in the Coulomb Gauge — July 2024
Hunter Duggin,Chueng Ji, Bailing Ma
10.22323/1.456.0051

Software Skills

Programming Languages: Python, Mathematica, Excel, LabVIEW, C, C++

Technologies: Final Cut Pro X, Logic Pro X, Apple Motion, Davinci Resolve, FL Studio, Adobe Premiere, Adobe Photoshop, Adobe illustrator, Affinity photo, Affinity Designer.

Other Relavent Skills

Mathematical: Solving ODEs, Solving PDEs, Monte-Carlo simulations, numerical integration & differentiation, linear algebra, group theory, etc.

Non-Mathematical: Problem solving, leadership, organization, time management, teaching, classroom management, communication, critical thinking.

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Pet Projects

Personal Website, Freelance Videography Business

Teaching

Spring 2023: PY 415: "Electromagnetism II"	Undergraduate Learning Assistant, NCSU
Fall 2024: PHYS 119: "Electromagnetism and Quanta"	Graduate Teaching Assistant, UNC
Spring 2025: PHYS 119: "Electromagnetism and Quanta"	Graduate Teaching Assistant, UNC
Summer II 2025: PHYS 119: "Electromagnetism and Quanta"	Graduate Teaching Assistant, UNC
Fall 2025: PHYS 119: "Electromagnetism and Quanta"	Graduate Teaching Assistant, UNC
Spring 2026 (i): PHYS 119: "Electromagnetism and Quanta"	Graduate Teaching Assistant, UNC
Spring 2026 (ii): PHYS 741: "Statistical Mechanics"	Graduate Learning Assistant, UNC

Outreach

Participation:

Big Physics at Small Scales, Public Lecture — September 9th, 2025

- Gave a public lecture on effective field theories and related topicsat Lanza's Cafe in Carrboro, NC. The slides can be found on my website.

Science is Awesome Day, Middle School Field Trip — December 16th, 2025

- Captain of the egg drop event during a middle school field trip hosted annually at UNC. Helped students understand the basics of air resistance, impulse, and pressure distribution when building an egg drop contraption.

Roles:

Physics From the Ground Up, Head — May 2025 - Present

- Graduate Student talks affiliated with UNC's APS chapter that involve 20-30 minute mini lectures on physics related topics. Takes place at Lanza's Cafe in Carrboro, NC.
- Responsible for recruiting speakers, deciding dates, coordinating with cafe staff, and managing team members.

Triangle Astronomy on Tap, Team Member — Aug 2024 - Present

- Speakers from universities in and around the triangle area give public lectures to the public on fun and interesting topics
- Responsible for the photography, videography, merchandise design, and social media marketing.

NC State Department of Physics, Abstract Videographer — May 2022 - May 2024

- Helped produce and film a number of videos for the CDSA REU summer program at NC State.
- Further produced videos for graduate students during the school semester.
- Under the direction of Dr. Katie Mack, Hawking chair at the Perimeter Institute.