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.

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

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.

See department service section for leadership roles in outreach.

Department Service

Physics Graduate Student Association, Co-President / outreach committee Member — May 2025 - Present

- The Physics Graduate Student Association (PGSA) at UNC is a liaison between the graduate student body and the departmental faculty. We are responsible for addressing issues related to coursework, interpersonal dynamics, scientific communication, etc...
- The co-presidents are responsible for hosting bi-annual "Town Hall" meetings where the graduate students are provided with an opportunity to discuss any shortcomings of the department. They also learn about what each of the committees in the PGSA are responsible for, and provide financial aid. They are the primary contact between the department chair and the graduate student body.
- The outreach committee is responsible for putting on events related to physics and astronomy outreach.

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.