## CONTACT INFORMATION

Phone: 704 650 0321
Email: cb7337@gmail.com

## PROFESSIONAL INTERESTS

RESEARCH: Combustion, Aerodynamics, Mechanical Engineering, Optical Trapping, Aerospace Engineering, Astronomy
SERVICE: STEM outreach to students K-12

## EDUCATION

Vanderbilt University, Nashville, TN
Doctorate of Philosophy in Mechanical Engineering
GPA: 3.66
Expected Graduation Date: May 2026

Appalachian State University, Boone, NC
Bachelor of Science in Physics
Concentration in Engineering Physics
Minors in Astronomy and Mathematics
Summa Cum Laude
GPA: 3.98
May 2021

## RESEARCH EXPERIENCE AND AUTHORED RESEARCH PRESENTATIONS

Vanderbilt University, Nashville, TN — Fall 2021- Present
Mechanical Engineering Department
Laser Diagnostics of Combustion Laboratory
Graduate Research Assistant

- Worked on a project to determine the best inline heater to heat N2 to 700 K in order to create DME cool flames using a dual tubular burner.
- Modified the experimental and computational set up to allow for the production and simulation of dual hydrogen enriched ammonia/air tubular flames, including adding a stainless steel fuel line and implementing an ammonia kinetic mechanism.
- Over saw two undergraduate students assisting with the graduate research taking place in the lab, trained them in basic optics training, chemical safety training, and laser safety training.
- Established a data and information management plan for the laboratory in order to streamline productivity and improve ability to retrieve resources when needed.

Appalachian State University, Boone, NC Spring 2018-Spring 2021
Department of Physics and Astronomy
Biophysics and Optical Sciences Facility
Undergraduate Research Assistant

- Worked on a project to measure forces and elasticity of a single sarcomere using automated optical tweezers by modifying the tweezer configuration to operate as a dual optical tweezer trap.
- Worked on a project to measure Elastic Modulus in Human Cells to design and construct a heat regulated sample chamber to keep cells in optimal conditions for cell microscopy.
- Cataloged and recorded weekly supplies.
- Edited research group website using Drupal 6 software.
- Trained 5 new members in laser safety and basic optics training. The training regime included 30 hours per member of training, learning to construct a telescope, construct a microscope, and align a laser through different optical elements.

North Carolina Section of the American Association of Physics Teachers Fall Meeting Fall 2020
Davidson College and Wingate University, Virtual Meeting

- Poster Presentation
- Poster Title "*Homeothermic Sample Chamber to Maintain Optimal Conditions for Biological Cell Microscopy"*

State of North Carolina Undergraduate Research and Creativity Symposium Fall 2019
Duke University, Durham, NC

- Poster Presentation
- Poster Title "*Heat Regulated Sample Chamber to Maintain Optimal Thermal Conditions for Biological Cell Microscopy"*

Celebration of Student Research and Creative Endeavors Spring 2019
Undergraduate Research Conference
Appalachian State University, Boone, NC

- Poster Presentation
- Poster Title "*Heat Regulated Sample Chamber to Maintain Optimal Thermal Conditions for Biological Cell Microscopy"*

Celebration of Student Research and Creative Endeavors Spring 2018
Undergraduate Research Conference
Appalachian State University, Boone, NC

- Poster Presentation
- Poster Title "*Dual Optical Tweezers Configuration for Measurement of Forces and Elasticity in Biological Systems"*.

## CO-AUTHORED RESEARCH PRESENTATIONS

Murphy, A. (Author and Presenter), Brown, C. (Author Only), Hester, B.C. (Author Only), State of North Carolina Undergraduate Research and Creativity Symposium, “Cell Culture Methodology for Physical Property Investigation using Automated Optical Tweezer Apparatus”, East Carolina University, Virtual Meeting, November 7, 2020 (talk)

Miller, J. (Author and Presenter), Brown, C. (Author Only), Hester, B.C. (Author Only), Celebration of Student Research and Creative Endeavors, “Determination of Elastic Modulus of Cells using Optical Tweezers”, Appalachian State University, Boone, NC, April 22, 2018 (talk)

Miller, J. (Author and Presenter), Brown, C. (Author Only), Hester, B.C. (Author Only), State of North Carolina Undergraduate Research and Creativity Symposium, “Determination of Elastic Modulus of Cells using Optical Tweezers”, North Carolina State University, Raleigh, NC, November 10, 2018 (poster)

Robertson, R. (Author and Presenter), Brown, C. (Author Only), Hester, B.C. (Author Only), Celebration of Student Research and Creative Endeavors,”Alignment of a Dual Optical Tweezers Apparatus for Investigating Pico-Newton Forces”, Appalachian State University, Boone, NC, April 22, 2018 (talk)

## FUNDED RESEARCH GRANT PROPOSALS

Pitz, R. (Principle), Brown, F.C. (Supporting), “Study of Carbon-Free Ammonia-Air Flames in a Tubular Burner", Sponsored by the Vanderbilt University Seeding Success Program, $79,088.00. Date Submitted for Funding: February 2022. (Funded: May 2022).

Pitz, R. (Principle), Brown, F.C. (Supporting), “Effect of Stretch and Curvature on Cool Flame Transitions and Structure using Tubular Flames", Sponsored by the NASA NSPIRES Program, $199,999.00. Date Submitted for Funding: January 2022. (Funded: August 2022).

Brown, C. (Principle), Hester, B. C. (Supporting), “*Development of Laser Tweezer Raman Spectroscopy Apparatus,"* Sponsored by the Appalachian State University Office of Student Research, $500.00. Date Submitted for Funding: March 2021. (Funded: April 2021).

Brown, C. (Principle), Hester, B. C. (Supporting), “*Construction of an Automated Optical Tweezer Apparatus*” Sponsored by the Appalachian State University Student and Faculty Excellence Fund, $200.00. Date Submitted for Funding: February 2020. (Funded: February 2020- Present).

Brown, C. (Principle), Hester, B. C. (Supporting), “*Investigation of Elastic Modulus to Determine Cell Elasticity,"* Sponsored by the Appalachian State University Office of Student Research, $400.00. Date Submitted for Funding: September 2019. (Funded: September 2019- May 2020).

Brown, C. (Principle), Hester, B. C. (Supporting), "*Engineering a Sarcomere Model for Measurements of Muscle Protein Performance,"* Sponsored by the Appalachian State University Office of Student Research, $300.00. Date Submitted for Funding: October 2018. (Funded: October 2018- November 2018).

Brown, C. (Principle), "*Spring 2018 North Carolina Space Grant,"* Sponsored by the North Carolina Space Grant, $1000.00. Date Submitted for Funding: January 2018. (Funded: January 2018-May 2018).

## AWARDS, HONORS, AND SCHOLARSHIPS

NASA University Student Launch Division Team Member — Spring 2022
3rd Place Overall

Vanderbilt University Graduate Fellowship — Fall 2021-Present
Russell G. Hamilton Scholar

Appalachian State University Physics and Astronomy Department — Spring 2021
Outstanding Senior Leadership Recognition
https://physics.appstate.edu/student-resources/scholarships-awards-and-senior-recognition

Appalachian State University Physics and Astronomy Department — Spring 2021
Outstanding Senior Research Recognition
https://physics.appstate.edu/student-resources/scholarships-awards-and-senior-recognition

Appalachian State University Chancellor's Scholarship — Fall 2017-Spring 2021
https://scholarships.appstate.edu/scholarships/first-year-scholarships/chancellors-scholarship

The Karl C. Mamola Award for Outstanding Undergraduate Physics and Astronomy Research — Received Spring 2020
https://physics.appstate.edu/student-resources/scholarships-awards-and-senior-recognition

The Andy Graham Lecture Demonstration Scholarship for Physics and Astronomy — Received Spring 2019
https://physics.appstate.edu/student-resources/scholarships-awards-and-senior-recognition

Appalachian State University College of Arts and Sciences — Received Spring 2019
Junior Marshal

Appalachian State University Chancellor's List — Fall 2017-Spring 2021
Cumulative GPA of 3.85 or higher

Appalachian State University Honors College — Fall 2017-Spring 2021

## LEADERSHIP AND SERVICE TO THE FIELD

NASA Student Launch Division — Fall 2021-Present
Graduate Outreach Mentory

- Planned and coordinated STEM engagement activities
- Engaged 983 participants in meaningful and impactful aerospace themed STEM outreach

Physics and Astronomy Club Vice President and Society of Physics Students Chapter Vice President — Fall 2020-Spring 2021

- Assisted the president in organizing events such as physics demos, biweekly meetings, and club activities.
- Maintained the club website.

Physics and Astronomy Club President and Society of Physics Students Chapter Co-President — Fall 2018-Spring 2020

- Two term Co-President
- Lead biweekly meetings, including discussion about research, professionalism, and student development.
- Organized events such as physics demos, biweekly meetings, and club activities.
- Delegated tasks to other officers including event and activity volunteers.

Student Government Association Honors Senator — Fall 2017-Fall 2018

- Weekly Senate Meetings
- Passed legislation to be enacted on Appalachian State University's Campus

Student Government Association Rules Committee Member — Fall 2017-Spring 2018

- Reviewed legislation for weekly senate meetings
- Gave feedback on bills presented

Student Government Association Academic Affairs Committee Member — Fall 2017-Fall 2018

- Researched legislation concerning academic affairs
- Wrote legislation concerning academic affairs on Appalachian State University's Campus

College of Arts and Sciences Grade Appeal Committee Member — Fall 2019-Spring 2021

- Reviewed grade appeals made within the College of Arts and Sciences

## VOLUNTEER WORK

Gear Up Science Demonstrations — Fall 2018-Spring 2021

- Transported demos to demo location
- Created “What Have You Learned” quizzes for demonstrations
- Performed in Physics Demonstrations

Science Technology Engineering and Mathematics Expo — Spring 2018-Spring 2021

- Set up and volunteered at Physics Booth
- Put together “Squishy Circuit” materials for physics booth

The Children's Playhouse Buildfest — Spring 2019

- Set up and volunteered at Physics Booth
- Put together “Squishy Circuit” materials for physics booth

North Carolina Gravity Games — Spring 2019

- Coordinated volunteers to work physics booth

## PROFESSIONAL SOCIETIES

Society of Physics Students Member — Fall 2017-May 2021
The Optical Society Member — Fall 2018- May 2021
American Astronomical Society Member — Fall 2017-May 2021
American Meteorological Society Member — Fall 2017-Fall 2018

## WORK EXPERIENCE

Vanderbilt University Mechanical Engineering Department — Fall 2021-Spring 2022
Senior Design Teaching Assistant

- Assisted 10 Senior Design Teams in completing a hands-on technical project
- Hosted weekly office hours in the Senior Design Lab
- Graded both weekly progress reports and periodic technical project reports, offering feedback

Appalachian State University Department of Physics and Astronomy — Spring 2021
Dark Sky Observatory Outreach Assistant

- Assisted in Public Nights at the Dark Sky Observatory
- Answered Attendee’s Questions
- Led an Open Space Software tour of the Universe

Appalachian State University Department of Physics and Astronomy Spring 2020
Analytical Methods in Physics and Astronomy Course Assistant

- Graded weekly homework assignments
- Proctored Midterm Exams

Camp Highlander Science Activity Counselor Summer 2019

- Lead Physics Demonstrations
- Designed STEM related group activities

## COMPUTER SKILLS

Proficient in C
Proficient in Python
Proficient in MatLab
Experienced in COMSOL
Experienced in Arduino
Experienced in LabVIEW
Experienced in Mathematica

## RELEVANT COMPLETED UNDERGRADUATE COURSES

MAT 2130, Calculus III
PHY 2010, Intermediate Physics I
PHY 3210, Modern Physics I
MAT 3130, Introduction to Differential Equations
MAT 2240, Introduction to Linear Algebra
AST 2001, Observational Astronomy
PHY 2020, Intermediate Physics II
PHY 3001, Analytical Methods in Physics and Astronomy
PHY 3560, Undergraduate Research
AST 2300, Public and School Outreach in Astronomy
PHY 2300, Classical Mechanics
PHY 3230, Thermal Dynamics
PHY 3532, Professional Development for Physics Majors
PHY 3020, Electromagnetism
PHY 2700, Computer Interfacing
PHY 2210, Physics Laboratory Techniques and Data Analysis
PHY 5330, Digital Electronics
PHY 5730, Analog Systems
PHY 4020, Computational Methods in Physics and Engineering
PHY 4640, Quantum Mechanics
PHY 4210, Methods of Experimental Physics
CS 2435, Introduction to Scientific Programming

**RELEVANT COMPLETED AND IN PROGRESS GRADUATE COURSES**

ME 8326, Gas Dynamics
ME 5265, Direct Energy Conversion
CHBE 5300, Fluid Mechanics and Heat Transfer
MW 5263, Computational Fluid Dynamics and Multiphysics Modeling
CHBE 6200, Transport Phenomena
ME 8366, Combustion
ME 8363, Conduction and Radiation Heat Transfer
ME 3224, Fluid Mechanics
ME 2220, Thermodynamics