The Physics Department has research opportunities for undergraduates in the areas of computational, educational, experimental, applied and theoretical physics. These opportunities have led to numerous publications, with some students writing theses as part of the Honors in Physics graduation requirement.

Below are recent independent study and summer projects carried out in the department.

**Professor Mario Belloni**

*Theoretical: Quantum Mechanics*

Kevin Gutierrez (Physics ’20) **Using a Recursive Algorithm to Find Eigenstates and Sum Rules for the Supersymmetric Infinite Well**, Summer 2018 (work supported by the Michael D. Jenks Summer Research Fund).

Henry Brooks (Physics ’19) **Creating and Testing Waves Lessons Across the Physics Curriculum for Improving the Performance of Women and Underrepresented Student Groups**, Fall 2018 (work in collaboration with Psychology professor Jessica Good).

Jamie Barnhill (Physics ’19) **Quantum-mechanical Scattering and Bound States Using the Spectral Method**, Spring/Summer/Fall 2018 (work supported by the Michael D. Jenks Summer Research Fund).

Esteban Leon (Physics ’19) **The Supersymmetric Infinite Square Well: Wavefunctions, Sum Rules, Wigner Functions, and Applications to Econophysics**, Summer 2017/Fall 2018

Esteban Leon (Physics ’19) **Utilizing Quantum Mechanics to Model and Study American Stock Market Returns** (work supported by a DRI Grant and in collaboration with Economics professor Mark Foley).


Poster, Fall Meeting of the North Carolina Section of the American Association of Physics Teachers, Davidson, NC. October 2015.

**Alex Tyner** (Physics ‘17), Bouncing Wave Packets, Spring 2016 (work in collaboration with Richard Robinett of Pennsylvania State University).

**Guy Scott** (Physics ‘16), The Physics of Archery, Fall 2015.

**Colin Malone** (Physics ’15), Bouncing Wave Packets, Spring 2015 (work in collaboration with Richard Robinett of Pennsylvania State University).

**Marcus Begley** (Physics ’15), Analytical Solutions to Quantum Wells Using the Spectral Method, Fall 2014.

**Jacob Simmonds** (Physics ‘16), Using the Spectral Method in Mathematica and MATLAB, Summer 2014 (work in collaboration with Richard Robinett of Pennsylvania State University).

**Professor Dan Boye**

Experimental: Volumetric X-ray Imaging, Optical properties of crystals, nanocrystals and glasses, Rare earth spectroscopy

**Carl Sukow** (Physics ‘21), Comparing the benefits of Digitome volumetric radiography and traditional 2D radiography, Summer 2018.


**Ryan Stempert** (Physics ‘18), Volumetric Radiography of Watermarks, Summer 2017.

**Greg Alspaugh** (Physics ‘18), **Haley Seligmann** (Mathematics ‘19), Applications of 2D and 3D X-ray Imaging, Summer 2017.

**Collin Epstein** (Physics ‘18), **Cody Herron** (Physics ‘17), **Ryan Stempert** (Physics ‘18), **Ryan Kozlowski** (Physics ‘16), Improvements in 2D X-radiography and volumetric X-ray tomosynthesis, Summer 2015 - Spring 2017.

**Takuya Wakayama** (Physics ‘18) Tb3+ Cross-Relaxation Dynamics in Core-Shell Tb:NaGdF4 Nanoparticles, Spring and Summer 2016


**Rebecca Garner** (Physics ‘16), **Ryan Kozlowski** (Physics ‘16), Examining paintings on wood or canvas using 3D X-rya imaging with Digitome, Spring 2016.


**Alex Demopoulos** (Classics/Astrophysics minor ‘17) Applying Histogram Analysis to 3D X-Ray Imaging, Summer 2015 (in collaboration with Professor Cain). Poster presented at the DRI Summer Research Poster session, Davidson College, September 2015.
Ryan Kozlowski (Physics ’16), 3D X-Ray Imaging of the Remains of Queen Anne’s Revenge, Summer 2014.


Professor Larry Cain
Experimental Condensed Matter Physics


Alex Demopoulos (Classics/Astrophysics minor ’17) Applying Histogram Analysis to 3D X-Ray Imaging, Summer 2015 (in collaboration with Professor Boye). Poster presented at the DRI Summer Research Poster session, Davidson College, September 2015.


Professor Tim Gfroerer
Experimental: Semiconductor Spectroscopy

Christina Chen (Physics ’19) Imaging Laser-Excited Blue LEDs, Summer 2017, “Imaging laser-excited blue LEDs,” 2017 Meeting of the Southeastern Section of the APS in Milledgeville, GA.


Grace Watt (Physics '15) **Why do blue LEDs become less efficient at high power?** Summer 2014. “Understanding LED function and mechanisms of energy loss,” 2015 APS Conference for Undergraduate Women in Physics at the Research Triangle.

Keyuan Zhou (Physics '15) **Recombination modeling for GaAs solar cells,** Summer and Fall 2014. "Recombination modeling for GaAs solar cells," 2014 Meeting of the Southeastern Section of the APS in Columbia, SC.

### Professor Anthony Kuchera

Nuclear Physics

Tan Phan (Physics ’18), Summer 2017. **Measurement of ⁹He ground and excited states,** awarded Davidson Research Initiative Fellowship, presented poster at the 2017 Fall Meeting of the American Physical Society Division of Nuclear Physics in Pittsburgh, PA. Honors thesis titled Experimental Nuclear Structure Studies of Light Nuclei.

Robbie Seaton-Todd (Physics ’20), Summer 2018. First measurement of excited states in neon nuclei, awarded Davidson Research Initiative Fellowship.

### Professor Michelle Kuchera

Computational: Nuclear, High Energy

Alex Karbo (Physics ’18) Studying High-dimensional supersymmetry models with neural networks, Summer and Fall 2017. Presented at the 2014 Meeting of the Southeastern Section of the APS in Milledgeville, GA.

Jack Taylor (Physics ’18) **Evaluating Machine Learning Methods for Event Classification in the Active-Target Time Projection Chamber,** Fall and Spring 2017. Presented at the American Physical Society Division of Nuclear Physics meeting in Pittsburgh, PA.

Christina Chen (Physics ’19) **Optimization Methods for Track Fitting in the Active-Target Time Projection Chamber,** Summer, Fall and Spring 2017. To be presented at the American Physical Society Division of Nuclear Physics meeting in Waikoloa, Hawaii.

### Professor Kristen Thompson

Observational Astrophysics

Sam Frederick (Physics ’19) **Modeling Stability of Magnetic Fields in Magnetars,** in collaboration with Dr. Michelle Kuchera, Fall 2018, Spring 2018. Honors thesis.

Sam Frederick (Physics ’19) **Studying the Behavior of Intermittent Pulsars,** Fall 2017. Poster presented at the Davidson College Alenda Lux Symposium, Davidson College, May 2018; the North Carolina Astronomers’ Meeting, Jamestown, NC, September 2018.


Bjorn Ordoubadian (Physics ’16) Determining Magnetic Field Strengths in Molecular Clouds via 21 cm HI Absorption, Fall 2015. Poster presented at the Summer Research Symposium, Davidson College, September 2014. Received award for best undergraduate poster at the fall meeting of the NCS-AAPT, Davidson College, October 2015.


Professor John Yukich
Experimental: Atomic, Molecular and Optical Physics


Colin Tyznik (Physics ’16), Photodetachment spectroscopy of the S₂⁻ anion, Summer 2014, and Photodetachment spectroscopy to the excited states of O, Summer 2015, presented at Southeastern Section of the American Physical Society, Mobile, AL, November 2015.

Shannon Eriksson (Chemistry ’15) Photodetachment spectroscopy of the S₂⁻ anion, Summer 2013.