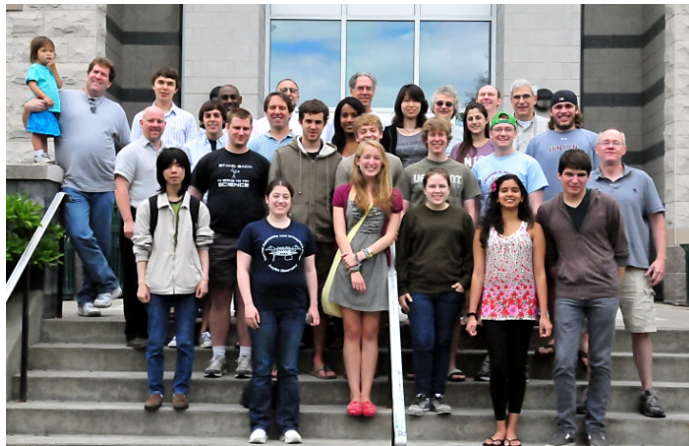
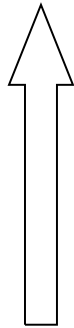


Physics & Astronomy

Summer Research Experience Opportunities



Benefits of Participation in Summer Research

- Experience what being a physicist is *really* like
- Hone practical skills (trouble shooting equipment, coding, etc.)
- Bolster your resume with real work experience, conference presentations, publications
- Travel (either for an off-site REU or to a conference)
- Get started on a senior thesis
- FUN!!!

Opportunities

- Off campus summer internships: Research Experience for Undergraduate (REU) sites & others
 - Especially for sophomores/juniors considering graduate school
- On-campus research with faculty in the Department of Physics and Astronomy
 - Many students do this after their freshman year!

Applying for an External REU

- Look through programs, and make a list of what you want to apply for, what's involved in the applications, and when the deadlines are. (Some may be over winter break!)
- Discuss your plans with your professors/former research advisors who might write you a letter of recommendation. **(Do this early!!)**
- Write a draft of a personal statement (refer to specific program requirements), and share it with your letter writer(s).
- Create a resume/CV for yourself. (If you need help, go to the Becker Career Center).

REU Sites

- NSF REU sites are listed at
 - http://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=69
- Also consider national labs (NIST, Los Alamos, etc), NASA Space Grant Program, SPS internships, etc.
- Programs are competitive...but there are lots of them!
- Compensation
 - *Amount varies from site to site*
 - *Stipend + housing (may be combined or split)*
 - *Travel expense (usually compensated)*

Research with Union Faculty

- Approach faculty whose projects are interesting to you, and discuss these projects in more depth.
- Make a (mutual) decision about who you want to work with, and what you want to work on.
- That faculty member will help you write a research proposal (2-3 pages) for the project.
- Create a resume/CV for yourself. (If you need help, go to the Becker Career Center).

Research with Union Faculty

- Apply for a Union College Summer Research Fellowship
 - Apply online at : <https://muse.union.edu/undergraduate-research/summer-research-applications/>
 - Application deadline mid-Winter term
- Compensation (based on last year's numbers: estimates)
 - Paid at a rate of \$475/week
 - Housing available for \$75/week (assuming we are in-person)



Prof. Cecelia Bores Quijano

Computational Biophysics

- Two students, for 4 or 6 weeks
- Find out how DNA folds
- Use 3D printing and/or augmented reality methods for modeling complex biological processes
- Gain experience with HPC environments, GPUs, python, and C++, and increase your knowledge about how macromolecules interact in biology



Prof. Scott LaBrake

UNION
COLLEGE



Ion-Beam Analysis Lab

- Looking for 1-2 student, for 4 weeks
- Two possible projects:
 - Heavy metal concentrations near bridges in NYC
 - Determining fluorine concentrations from PFAS chemicals



Prof. Nelia Mann

Theoretical and Computational Physics

- 1 student, for 4 or 6 weeks, preferably who has taken physics 122 before the project begins
- Projects exploring connections between quantum and classical mechanics
- Combine pen & paper calculations with computational tools (using Mathematica or Python)



Prof. Chad Orzel

Optics

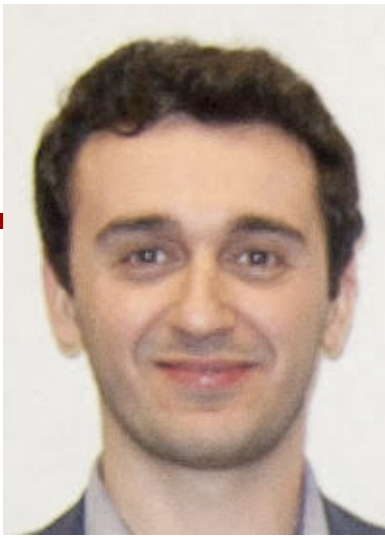
- 1-2 Students, 6 weeks preferred, could do 4 weeks
- correlated photon/quantum optics experiment
- scanning confocal laser microscope project



Prof. Heather Watson

Geophysics

- 1-2 students for 4 weeks each (depending on funding)
- Investigate the structure of Europa's icy crust and ocean, and other outer Solar System moons
- Possible other projects involving the accelerator (crystal growth and RBS)



Prof. Amin Abou Ibrahim

Particle Physics Theory and Phenomenology

- 1 student for 6 weeks, two possible projects:

Explore the production of dark matter in the early universe via the freeze-in mechanism. Derive the expression of the dark matter relic density and number density evolution equation for a particular model. Use the outcome of this model to constraint the different parameters based on the most recent experimental results from dark matter experiments. Requires knowledge of differential calculus, linear algebra and quantum mechanics. Basic coding skill is a plus.

Simulate the production and decay of a particle at the LHC as a result of proton-proton collisions. The simulation uses Monte-Carlo tools and other publicly available software to investigate the final state as a result of this decay. Using a specific model, we can predict the production cross-section (probability that such a process can happen). We then apply some techniques to discriminate between the signal that we are after from the ubiquitous background which tends to pollute the signal. Requires some knowledge in Python and/or C++.



Prof. Francis Wilkin

Observational Astronomy and Theoretical Astrophysics

- 1-2 students, can be in person **or** remote
- Observational Astronomy (Union Observatory and/or remote use of El Sauce Observatory in Chile):
 - Exoplanet Transits (4-6 weeks)
 - Cataclysmic variable stars (4-6 weeks)
 - Koronis asteroid family spin characterization (4-6 weeks)
- Theoretical astrophysics:
 - model supersonic winds/wind collisions in binary systems (6-8 weeks)
 - Computations in Mathematica, physics 230 recommended