Physics & Astronomy

Summer Research Experience Opportunities
Benefits of Participation in Summer Research

• Experiencing the rewards of designing a project, making discoveries, and sharing your findings
• Increasing your ability to think, learn, and work both independently and as part of a team
• Applying concepts learned in course-work to “real-life” situations
• Strengthening your oral and written communication skills
• Sharpening your critical thinking, problem solving, and data analysis skills
• Developing a close working relationship with a faculty mentor
• Preparing for graduate school
• Traveling to conferences, making connections, and working with people who share your interests
• Publishing your work
• Enhancing your resume
• Participating in and contributing to the life of your chosen field
• Getting a head-start on your senior thesis project
Opportunities

• Research Experience for Undergraduate (REU) sites
• On-campus research with faculty in the Department of Physics and Astronomy
REU Sites

• NSF REU sites are listed at:

• Application deadlines vary from site to site but many of them are soon, so get started now

• Compensation
  – Amount varies from site to site
  – Stipend + housing (may be combined or split)
  – Travel expense (usually compensated)
Partial List of REU Sites

- 2016 REU Program at the Maria Mitchell Association (MMA) in Nantucket, MA
  http://www.mariamitchell.org/get-involved/internships/reu
- 2016 REU in the Department of Astronomy of Cornell University
  http://astro.cornell.edu/specialprograms/reu/
- REU program at the University of Alabama at Birmingham (UAB) in Experimental and Computational Materials Research
  https://www.uab.edu/cnmb/research-experiences-for-undergraduates/application-process
- REU at Northwestern University in Materials Science
  http://www.mrsec.northwestern.edu/content/educational_programs/reu.htm
- REU program at Kansas State University in Interactions of Matter, Light and Learning
  http://www.phys.ksu.edu/reu
On-campus

• Approach faculty and convince them to take you as a student
• Apply for a Union College Summer Research Fellowship
  – Apply online at: http://muse.union.edu/undergraduate-research/summer-research/
  – Application deadline is February 11th
  – Prepare a research proposal (faculty will help you)
  – Prepare a resume
• Compensation
  – 8 weeks = $3800
  – 6 weeks = $2850
  – 4 weeks = $1900
  – Housing available for $75/week
Prof. Samuel Amanuel

Nano scaled materials and properties

- Thermodynamics of nano scaled materials
- Mechanical Properties of polymer nanocomposites
- Coffee Project: Thermal and molecular vibrations
- 1-2 students
Optical and radio observations of nearby galaxies, including work on the ALFALFA (Arecibo Legacy Fast ALFA) project using the Arecibo Observatory 305-m telescope near Arecibo, Puerto Rico, the world's largest single-reflector telescope.

The ALFALFA project is a search for emission from neutral hydrogen (HI) in other galaxies. Possible summer research projects include analysis of ALFALFA and optical images of galaxies in groups, analysis of optical images to determine star formation properties, and design of outreach tools to communicate galaxy science to secondary school students and the public. Most projects will involve programming in python or IDL. A summary of recent student projects at this page: http://minerva.union.edu/koopmanr/research.html.

2 students, dependent on funding: apply to college program, apply to ALFALFA undergrad grant (competition among ~19 schools)
Ion-Beam Analysis Lab

Profs. Scott LaBrake and Mike Vineyard

- Ion-beam analysis of
  - Atmospheric aerosols
  - Soil samples
  - Lake sediment samples
  - Geological samples
  - Cultural heritage samples
  - Coffee beans (with Sam)

- ~2 students for 6 weeks
Prof. Nelia Mann

Theoretical Particle Physics

1) String theory inspired models for particle interactions
   - compare different models by fitting them to data (freshman/sophomore, computational)
   - developing a more sophisticated model (junior/senior, theoretical)

2) Assorted other projects (most have a computational component and some also a theoretical component, assorted levels)
   - numerical approaches to pathological terms in wave equations (inspired an analogy between relativistic electrons and photons)
   - comparing "old quantization" results with computational solutions to Schrödinger's equation
   - the many-body physics of macroscopic spherical magnets (inspired by the desk toy "Buckyballs")

I plan to take 1-3 students, depending on funding
This summer, I can use the assistance of one or two students in making observations with the MIT Haystack Radio Observatory (located in Westford, MA) as development of undergraduate radio astronomy labs. MIT’s Haystack Observatory has recently finished the complete reconstruction of their large radio telescope (37-meters in diameter). Some of the available observing time will be devoted to an NSF education initiative. As part of that education initiative, I will devise and test-run some observations using this state-of-the-art professional telescope that can be conducted as labs for undergraduate astronomy courses. For example, one lab is the observation of emission by ammonia molecules in a disk of molecular gas known to be orbiting the Galactic center – this is similar to the observations that first yielded evidence for the existence of a supermassive black hole in the center of the Milky Way. Labs that we determine to be successful will be listed (with instructions) both on the Haystack Observatory web page under suggested projects, as well as on the labs web page that will accompany a new radio astronomy textbook to be published this year (by Marr, Snell, and Kurtz).
Prof. Francis Wilkin

Observational Astronomy

- Possible projects include:
  - Modeling of astrophysical shock waves due to stellar wind collisions
  - Study extrasolar planet transits
  - "Terraforming Earth"
- Up to 2 students