

The background of the entire cover is a Cosmic Microwave Background (CMB) fluctuation map. It features a complex pattern of orange, yellow, and blue regions, representing temperature variations in the early universe. Overlaid on this are numerous thin, blue, wavy lines that trace the paths of galaxy clusters and filaments, creating a web-like structure. The overall effect is a vibrant, scientific visualization of the universe's large-scale structure.

Carleton College Department of Physics and Astronomy

Official Handbook 2015-16

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INTRODUCTION

Welcome to the Department of Physics and Astronomy! We hope this handbook will show you how to take advantage of the many opportunities that are available in the department. We have written it to give you an introduction to the department: the curriculum and requirements, the faculty and support staff, advising and career counseling, and the possibilities for departmental involvement. We hope that the handbook will help some of you decide whether or not to become a physics major and others of you to understand the many options available to you in the department. If you have any questions, suggestions, or comments about the handbook, please contact us and share your ideas.

GOALS

To be a physicist is to have knowledge of certain core subjects, as well as acquaintance with more specialized areas. The core subjects include classical mechanics and special relativity, electricity and magnetism, quantum physics, thermodynamics, and methods of computational and experimental physics. Further study may be in advanced courses in the above fields, or in astrophysics, electronics, computational physics, statistical mechanics, or solid state physics. The most relevant topics are covered at a more elementary level, emphasizing classical mechanics, electricity and magnetism, and optics, in a series of courses generally taken by students majoring in other sciences.

We expect our students, both majors and non-majors, to develop a number of skills while taking physics courses. Some of these are general skills: the ability to communicate clearly in written work and oral presentation; the ability to locate information through library research and other means; the ability to continue learning on a largely independent basis. Especially relevant to majors are skills in logical problem-solving and mathematical analysis, experimental design and the use of measurement apparatus, and the use of computers in modeling physical phenomena and for data acquisition and analysis.

The structure of our overall curriculum and of individual courses is designed to advance the goals outlined above. Core courses for potential majors are sequenced in a way that allows flexibility for first-year students undecided among majors, balancing the need for mathematical prerequisites with our goal of introducing a diverse body of knowledge at an early stage. Courses emphasizing advanced knowledge in specific areas are electives not required for the major and are usually taken by students bound for graduate school in physics, astronomy, or engineering. There are additional courses designed almost exclusively for other science majors and pre-med students, or for non-science majors.

Problem-solving skills are a key concern of every course, typically developed through regular problem set assignments. In introductory or non-major courses instructors and student tutors are available to support students as they learn physics problem-solving techniques.

A laboratory component is present in most courses for non-majors, and about half the courses for majors. In addition to providing a “hands-on” appreciation of various physical phenomena, the labs acquaint students with progressively more sophisticated apparatus and techniques of analysis.



Olin Hall of Science. The department occupies the second and third floors.

Computing plays an important role throughout the curriculum for majors. Presentation tools, graphics display programs, spreadsheets, the symbolic math package Mathematica, and the LabVIEW programming package are introduced at appropriate times in the curriculum.

We strongly encourage students to engage in collaborative research with faculty, as research is the heart of the physics enterprise. Many of our students do this at some point in their Carleton career, whether with a faculty member on campus, or with a summer research program off-campus. An internship coordinator disseminates information about off-campus research opportunities, and many students take advantage of such programs. Students find that research experience allows them to integrate various physics topics and gives them practice as independent learners and productive members of cooperative research groups.



THE CURRICULUM

Lower-level Courses for the Major

Students who major in physics usually start by taking two of our half-term introductory physics courses, PHYS131 or 132 or 141 or 142, and PHYS151, and two or three terms of calculus. Physics 131/2 deal with Newtonian mechanics, PHYS141 applies Newtonian mechanics to gravitation and the cosmos, PHYS142 takes a bottom-up atomic perspective to Newtonian mechanics,



Students with Professor Arjendu Pattanayak
in an introductory lab.

and PHYS151 concentrates on special relativity and particles. Students with a particularly good high school introduction to mechanics are encouraged to take PHYS141 (Gravity and the Cosmos) or PHYS142 (Matter and Interactions). Next students will ordinarily take PHYS228 (Atomic and Nuclear Physics, fall term) and two 5-week courses, PHYS229/230 (Classical Mechanics/Computational Mechanics, winter term). The content of Atomic and Nuclear Physics emphasizes the

experimental and empirical side of the discipline, while that of Classical Mechanics stresses its theoretical and mathematical aspects as well as computational problem solving techniques. While some students may feel more at home with pencil and paper or computers, and others with wires and switches and meters, our curriculum is designed to give you experience and appreciation for all parts of modern physics theory, experiment, and computation.

Following Classical and Computational Mechanics in the normal physics sequence is PHYS235, Electricity and Magnetism, offered in the spring term. It combines some circuit theory and laboratory work with the electromagnetic theory leading up to Maxwell's equations.

Every spring term, both prospective and declared majors are encouraged to take PHYS123 (What Physicists Do). This one-credit course brings to campus alums and others who are making active use of their background in physics or astronomy. Each visitor gives a talk on his or her work and students have ample opportunity for more personal interaction, at lunch and over cookies after the talk.

Most prospective majors take PHYS131/2 or PHYS141/2, and PHYS151 their first year at Carleton and PHYS228 and PHYS229/230 as sophomores. If they declare a physics major, it will be while continuing in PHYS235 in spring term. Some students enter the major having delayed PHYS131/151 until as late as winter term sophomore year. It is still easily possible to complete the major after a late start, though most students in this situation will not be able to take some of the upper-level elective courses. (See below for possible course sequences.)



Students in PHYS 344 - Optics

Upper-level Courses for the Major

Upper-level courses required for the major are Quantum Mechanics (PHYS335) and Contemporary Experimental Physics (PHYS342), and one other upper-level applied physics course of the student's choosing (Astrophysics, Electronics, Materials Science, Computer Simulations, Waves, Classical and Quantum Optics, and Medical Physics). Courses offered in other departments that involve a significant and broad application of physics may count toward this requirement if specifically approved by the department.

Other courses are optional. Students planning graduate work in physics or astronomy should take PHYS346 (Thermodynamics and Statistical Mechanics), PHYS352 (Advanced Electricity and Magnetism), and PHYS355 (Advanced Mechanics). PHYS234 (Computer Simulations) gives students valuable experience using computers to investigate physical problems. PHYS343 (Electronics) is particularly appropriate for students considering experimental physics and astronomy, engineering, or computer science.

ENTS265 (Materials Science) integrates the fields of physics needed to understand the properties of solid materials. ENTS265 and PHYS354 (Solid State Physics) are generally offered alternate years. PHYS261 (Medical Physics) covers topics in electromagnetism and nuclear physics as applied to medical and biological phenomena. PHYS341 (Waves) explores oscillations and waves in a wide variety of physical systems and examines the interaction of sound and light with matter. PHYS344 (Classical and Quantum Optics) investigates classical optical phenomena such as interference and diffraction as well as quantum optical applications. PHYS341 and PHYS344 are also offered alternate years. Each faculty member has an active research program and welcomes student participation through Special Projects (ASTR/PHYS356). For more information, see Student Work and Research, p. 15. The opportunity also exists for independent study courses; these courses are initiated by students and are supervised by individual faculty members.

Astronomy and Astrophysics

Physics plays an important role in modern astronomical research. The best way to prepare for study in astronomy is to have a solid physics background. Students wishing to pursue careers in astronomy should major in physics and take A113 (Observational and Laboratory Astronomy) and one or both of A/P232, 233 (Astrophysics I, II).



Goodsell Observatory

Astronomy 113 (Observational and Laboratory Astronomy) presents the theory and practice of basic techniques in observational and laboratory astronomy. Use is made, when appropriate, of the 16-and 8-inch telescopes in Goodsell Observatory. In recent years this course has been augmented to include modern CCD digital imaging technologies. Astronomy 232 (Astrophysics I) is an intermediate level course on the fundamentals of the physical structure of stars and star systems, stellar evolution, neutron stars and black holes. Astronomy 233 (Astrophysics II) covers the interstellar medium, our galaxy, external galaxies, quasars and cosmology. ASTR232 and ASTR233 are

not prerequisites for each other; students may take either or both. The two courses are offered in alternate years.

Both Cindy Blaha and Joel Weisberg gather data at major observatories, including Arecibo and the Parkes observatory in Australia, and analyze them on workstations at Carleton with the assistance of student researchers who sign up for Special Projects, ASTR356. Consult Cindy or Joel for details about the Astrophysics program and research opportunities.

Other Support Courses

Several courses offered in other departments and programs have particular relevance to students majoring in physics. Most obvious are those in mathematics. Physics courses depend heavily on mathematics, and majors are urged to begin early with their courses in that department. Math 111

(Introduction to Calculus), 121 (Calculus II), 211 (Multivariable Calculus) and 232 (Linear Algebra) are required for the physics major. Math 241 (Differential Equations) and Math 341 (Partial Differential Equations) are highly recommended to physics majors planning postgraduate work in physics, engineering, and related fields, and are prerequisites for one or more of the optional advanced physics courses in our curriculum. Further, many students recommend that Math 241 be taken with or before PHYS229/230, and Math 341 is generally helpful for the senior level physics courses. Math 351 (Functions of a Complex Variable, offered alternate years) is also valuable for students going on for advanced work in physics. Students wanting further mathematical background of particular relevance to physics often take Math 332 (Advanced Linear Algebra).

Good programming principles and the Java language are taught in Computer Science 111 and 127. These are very useful skills for physicists.

Chemistry 123 (Principles of Chemistry) is taken by many physics majors; We recommend it for the background it provides in a closely allied field.

The Environment and Technology Studies (ENTS) Program offers courses that look at the interaction of science, government, and society in an interdepartmental fashion, and will be of interest to some physics majors.

Typical Programs of Study

In the programs suggested below, the courses in parentheses are optional; the others are required for the major. Keep in mind that these programs are flexible and are intended only as guidelines for planning a sequence of courses for the physics major.

PROGRAM A: The most common sequence.

	Fall Term	Winter Term	Spring Term
Frosh	MATH 111: Intro to Calculus	MATH 121: Calculus II *PHYS 131/151 ² or PHYS 141 ¹ /151 ² : Intro sequence	MATH 211: Multivariable Calculus [CHEM 123: Principles of Chemistry] [CS 111: Intro to Computer Science]
Soph	MATH 232: Linear Algebra PHYS 228: Atomic & Nuclear	[MATH 241: Ordinary Diff Eq] PHYS 229 ¹ /230 ² : Mechanics	[MATH 341: Fourier Series] PHYS 235: Electricity and Magnetism
Junior		PHYS 335: Quantum Mechanics	PHYS 342: Contemporary Experimental PHYS/ASTR Elective

The senior year is open except for comps, which normally demand work equivalent to a six-credit course. For students planning on graduate work in physics, a typical senior year is as follows:

	Fall Term	Winter Term	Spring Term
Senior	[PHYS 355] Advanced Mechanics	PHYS 400 Comps	PHYS/ASTR Elective

* Note that 131 may be skipped upon consultation with the department, with 141 taken as a replacement for 131.

1. Three-credit course offered first half of term.
2. Three-credit course offered second half of term.

[] Strongly recommended elective course

PHYS/ASTR Elective Courses

PHYS 234: Computer Simulations in Complex Physical Systems
 PHYS 261: Medical Physics
 PHYS 341: Waves
 PHYS 343: Electronics
 PHYS 344 Classical and Quantum Optics
 PHYS 346: Thermodynamics & Statistical Mechanics
 PHYS 347 General Relativity
 PHYS 353 Advanced Electricity and Magnetism
 PHYS 354: Solid State Physics
 PHYS 355: Advanced Mechanics
 ENTS 265: Materials Science

PROGRAM B: For a student who begins calculus late and thus must postpone Physics 131*/151 until the sophomore year.

	Fall Term	Winter Term	Spring Term
Frosh		MATH 111: Intro to Calculus	MATH 121: Calculus II [Chem 123: Principles of Chemistry] [CS 111: Intro to Computer Science]
Soph	MATH 211: Multivariable Calculus *PHYS 131/151 ² or 142 ¹ /151 ² : Intro sequence	MATH 232: Linear Algebra PHYS 229 ¹ /230 ² : Mechanics	PHYS 235: Electricity and Magnetism PHYS/ASTR Elective
Junior	PHYS 228: Atomic & Nuclear [PHYS 346: Thermodynamics & Statistical Mechanics]	[MATH 241: Ordinary Diff Eq] PHYS 335: Quantum Mechanics	[MATH 341: Fourier Series] PHYS 342: Contemporary Experimental
Senior	Same as program A	Same as program A	Same as program A

* Note that 131 may be skipped upon consultation with the department, with 142 taken as a replacement for 131.

1. Three-credit course offered first half of term.
 2. Three-credit course offered second half of term.
- [] Strongly recommended elective course

PHYS/ASTR Elective Courses

PHYS 234: Computer Simulations in Complex Physical Systems
 PHYS 261: Medical Physics
 PHYS 341: Waves
 PHYS 343: Electronics
 PHYS 344 Classical and Quantum Optics
 PHYS 346: Thermodynamics & Statistical Mechanics
 PHYS 347 General Relativity
 PHYS 353 Advanced Electricity and Magnetism
 PHYS 354: Solid State Physics
 PHYS 355: Advanced Mechanics
 ENTS 265: Materials Science

PROGRAM C: For a student who does not begin calculus until the sophomore year.

Same as Program A, delayed by a year. This is possible since the only requirement in the normal senior year is comps, which can be taken concurrently with PHYS 335.

PROGRAM D: For a student pursuing the 3-2 program in engineering with a Carleton major in physics.

	Fall Term	Winter Term	Spring Term
Frosh	MATH 111: Intro to Calculus	MATH 121: Calculus II PHYS 131 or 141 ¹ /151 ² : Intro sequence	MATH 211: Multivariable Calculus CHEM 123: Principles of Chemistry
Soph	MATH 232: Linear Algebra PHYS 228: Atomic and Nuclear	MATH 241: Ordinary Diff Equations PHYS 229 ¹ /230 ² : Mechanics	PHYS 235: Electricity and Magnetism CHEM 230: Equilibrium & Analysis
Junior	PHYS/ASTR Elective	PHYS 335: Quantum Mechanics	Phys 342: Contemporary Experimental

The non-physics courses listed are required by the engineering schools involved.

* Note that 131 may be skipped upon consultation with the department, with 142 taken as a replacement for 131.

1. Three-credit course offered first half of term.
2. Three-credit course offered second half of term.

Integrative Exercise (Comps)

Passing an integrative exercise, or “comps,” is part of the requirement for completion of the baccalaureate degree at Carleton. Comps is usually taken during the senior year, although in some cases (double majors, 3-2 program) comps may be taken during the junior year.

Comps is a learning and sharing experience for both students and faculty. The integrative exercise in physics consists of an extensive study by each student in some field and/or topic in physics, culminating in a 60-minute presentation during the winter or spring term. Each year the final written papers will be bound and made available to the public in the library and at the departmental office; students also have the option of storing their comps electronically in the library. The topic chosen may involve a currently active field of research, a significant development in the history of physics, or an integrative theme from the physics curriculum. It must be sufficiently broad to allow the student to synthesize material from the various courses required for the major. Past topics have included

- solar satellite power systems
- the aurora borealis,
- gravitational waves
- optical fibers
- universality in chaos
- controlled nuclear fusion
- atmospheric tides
- scanning tunneling electron microscopy
- residential application of solar power
- superfluid helium and its vortices

Comps represents a stringent test of student’s integration of knowledge, research and independent study skills, and writing and speaking ability. It also involves group interaction, with students listening to, questioning, and offering written critique of each other’s presentations and papers.

ADVISING AND CAREER COUNSELING

All department majors are assigned to a physics/astronomy faculty member as their academic advisor. Because of the relatively small size of the department, majors have had most faculty members as teachers and also have had considerable additional contact with them through colloquia and special events. Consequently, most majors feel free to consult any department member about academic matters and post-Carleton career plans; the staff are always willing to discuss such important matters with students.

Graduate Schools

Because many of our graduates pursue further study in physics or closely related fields, the entire physics and astronomy faculty plays a large role in advising these majors about graduate schools. About two-thirds of our graduating physics majors continue on to graduate school, many in physics, but others in fields such as engineering, applied mathematics, computer science, astrophysics, biophysics, geophysics, medicine, and architecture. Majors planning to apply to graduate schools in physics or closely related disciplines are encouraged to discuss their selections in consultation with several faculty members, and the faculty look upon writing letters of reference as an important part

of their responsibility.

Engineering

Carleton provides options for a 3-2 Engineering Program, also called the Combined Plan Program or Dual-Degree Program. The 3-2 program allows students to spend three years at Carleton and two years at an engineering school receiving dual degrees, a B.A. from Carleton and a B.S. in engineering from a partner engineering institution. We currently have formal partnerships with Columbia University and Washington University. There are also 4-2 (B.A./B.S.) and 3-3 (B.A./B.S./M.S.) versions of the program available to interested students.

More detailed information about the program can be found at https://apps.carleton.edu/curricular/physics/for_students/department_links/engineering/

Other Directions

Physics is an excellent major for those interested in pursuing medical professions. Nelson Christensen serves as the physics member of the Advisory Committee on Health Professions Programs. Students interested in medicine as a career are urged to consult with him early in their studies.

Careers in science education are also common among physics majors. A number of our graduates have gone on to teach physics or mathematics in Teach for America, the Peace Corps, or at private schools throughout the United States. Certification as a public high school teacher is also an option, which should be explored with the Educational Studies Department. Several of our graduates have chosen to pursue further education by obtaining advanced degrees in physics education.

Other graduates go in a wide variety of directions because the skills of a good physicist are widely applicable and in high demand. A number of students choose physics simply as an interesting liberal arts major, with no particular intention of staying with the discipline after graduation. They pursue careers ranging from business to social work. Some physics graduates will seek employment in technical jobs armed only with the bachelor's degree. The approach often used in physics - simplifying a situation to its basics, understanding phenomena in terms of models, devising mathematical theories to match observed data - can be transferred successfully to a wide variety of fields.

Career Coordinator

Due to the increasing diversity of career choices of our graduates, the department's Career Coordinator, Cindy Blaha, serves an important role. With the help of Trenne Fields, our Administrative Assistant, Cindy collects, organizes, and publicizes information on graduate study in physics, astronomy, and a variety of other fields as well as summer internship information for undergraduates and technical employment opportunities for graduates. This information can be found in displays on Olin second floor, on our departmental web pages, and in the weekly bulletin, *Radiations*. Another function of the career advisor is to serve as a connecting link between our majors and our physics alumni. The table that follows shows some data on recent physics graduates and their immediate post-Carleton pursuits.

FIGURE 1: DATA ON RECENT PHYSICS GRADUATES

Graduation Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Phys & Astro Grad School ¹	12	6	9	7	9	9	7	6	4	8	8
Engineering ²	0	3	1	0	0	4	3	1	2	3	5
Other Grad School ³	0	1	1	1	0	0	0	2	2	1	2
Other ⁴	11	9	4	2	10	10	5	17	7	14	8
Total Majors	23	19	21	10	19	23	15	26	15	27	23

(1) Physics and astronomy graduate schools attended, listed by year of Carleton graduation:
 2002: Ohio, Michigan Pennsylvania, Washington, Purdue, Colorado, Maryland, Rutgers, Harvard, Minnesota.

2003: Wisconsin, Carnegie-Mellon University, Rice, Oregon, Illinois, Texas A&M, Northwestern, Minnesota.

2004: William and Mary, Arizona, Wisconsin, Illinois, University of Manchester (GB), Boston University, Texas (2), Boulder.

2005: Berkeley, Washington, Minnesota, Wisconsin (2), Boulder.

2006: MIT (3), George Washington, Columbia, Rice, Penn State, Illinois, Duke

2007: Princeton, Cornell, SUNY Stony Brook, Colorado, Penn State, New Mexico

2008: Washington, Michigan, Georgia Tech, Duke, Stanford, Purdue

2009: Colorado School of Mines, UNM-Albuquerque, University of Rochester, Wisconsin, Penn State

2010: Stanford, MIT, Rochester, West Virginia

2011: Harvard, Johns Hopkins, Northwestern, University of Wisconsin

2012: CalTech, University of Chicago, Cornell, Harvard, Michigan, Swinburne University, Washington University,

(2) Engineering schools attended, 1994-2012:

Arizona, Cal. Tech., Colorado, Columbia, Cornell, Duke, Illinois, Massachusetts, Michigan, Minnesota, MIT, North Dakota State, Northwestern, Oregon State, Princeton, Purdue, Rice, Stanford, Washington (St. Louis), Wisconsin, UCLA, UT Austin.

(3) Other graduate programs chosen by physics majors, 1994-2012:

Mathematics, applied mathematics, statistics, geophysics, physical chemistry, medicine, architecture, materials science, computer science, meteorology, law, technology and public policy, linguistics, hydroclimatology, oceanography, cognitive studies, meteorology, biophysical chemistry, film making, education, library science, science writing.

(4) Other careers chosen by physics majors, 1994-2012:

Computers, actuary, high school teaching, Teach for America, theater, business administration, canvasser, industry, pottery, public policy, unskilled labor, counselor, software engineer, actor, Peace Corps, business management, research assistant.

OTHER OPPORTUNITIES

The Seminar Program

The department sponsors seminars given by faculty and students from Carleton and by speakers from colleges, universities, business, and the technological community. Seminars, with refreshments before or after the talk, bring physics majors, prospective majors, faculty, and anyone interested in physics together in both an academic and social setting. Seminars have been offered on a wide range of subjects, including pollution in the environment, energy and solar heating, particle physics, student summer research, and the origins of the universe. The seminars are an important component of our career guidance program. Students should attend as many as possible and meet and talk with the visitors to find out more about career opportunities. During the spring term, we offer PHYS123 (What Physicists Do), a series of five lectures specifically designed to give first and second year students some perspective of career options available to physicists. Juniors and seniors are also encouraged to attend the seminars that focus around the ongoing work of the guest speakers who are active in academic, industrial or governmental research. Occasionally, trips are taken to attend seminars at St. Olaf or the University of Minnesota in Minneapolis.

Physics/Astronomy Table

Physics/Astronomy Table meets once a week for lunch. The time and day are specified each term depending on individual schedules and preferences. This is an opportunity for students and faculty to get together informally. Often we don't even talk about physics; likely subjects are current national or school events. Sometimes the guest speaker for the afternoon's seminar will come to lunch with us, giving us a chance to learn about various fields of physics in a more personal setting than the seminar itself. Physics/Astronomy Table offers a great way to get to know others in the department, both students and faculty. Everyone is welcome!

Departmental Curriculum Committee

This committee is made up of two faculty members and students from each of the sophomore, junior, and senior classes. It meets occasionally throughout the year to discuss the curriculum, gather information about the department (both formally through questionnaires and informally through the student representatives), and talk about other activities relevant to the department. The student representatives connect with the department to let them know the students ideas, opinions, gripes, and feelings about what is going on. All the DCC meetings are open, and we would encourage you to attend and give us some feedback.

Student Departmental Advisors

Two students in the department serve as student departmental advisors (SDAs) and are available to answer questions you might have about courses, curriculum and the department generally. While they may not know the answer to every question you might have, they probably know whom to contact to find the answer. The SDAs for 2015-2016 are Berit Goodge and Brandon Nelson.

Prospective Student Liaisons

The department's prospective student liaisons (PSLs) take an active role in putting interested high school and potential transfer students in contact with current majors. Their role is to set up informal lunches with visiting students, give tours around the department, and speak on the phone or

by email. The PSLs do not report back to professors or admissions, but merely offer insight and a student perspective on the department. Students interested in becoming Liaisons should contact the department chair. Prospective students are encouraged to contact the current PSLs.

Student Work and Research

Physics students are encouraged to work for the department sometime during their stay at Carleton. Formal work contracts are given out for graders, lab assistants, shop helpers, equipment repairers, and tutors. The work assignments are coordinated by Bill Titus and requests for work are made by her during the spring term for the following academic year. Working in the department is a unique way to interact with faculty and students outside of the formal classroom setting; needless to say, such work experience looks good on resumes for jobs and graduate school.

Research work for students is also available. Students can arrange to do research through Special Project (PHYS/ASTR-356) or Independent Study (PHYS/ASTR-291/391) courses. Summer research positions are usually available in the department itself, while a large number of the junior majors and some of the sophomores participate in physics- and astronomy-related work elsewhere during the summer. Students' success in these settings depend heavily on their ability to learn independently, to integrate various parts of their background, and to function well as members of a research group. The Departmental Career Coordinator, Cindy Blaha, is a good resource person to check with if you are interested in such an experience.

Radiations, the Weekly Physics Bulletin

We compile and send via email a weekly list of events of interest to physics students. Majors are automatically placed on the mailing list; others interested in receiving the bulletin should see Trenne Fields in Olin 331.

Departmental Web Pages

The department maintains a presence on the internet at <http://apps.carleton.edu/curricular/physics/>. This site is loaded with information, including Radiations, links to physics/astronomy career and internship opportunities, and much more.

Robotics Club

The Carleton Robotics Club enables students to pursue their interest in robotics by participating in annual robotics competitions across the country, including the Trinity College Firefighting Contest, and working on their independent projects in the well equipped robotics lab. They operate under the watchful eye of Tom Baraniak, our Electronics & Laboratory Manager.

WhIMS

WhIMS exists as an internal support network and an external outreach program for women interested in math and science. A major goal is to provide Carleton women with new opportunities, information and encouragement in their pursuit of math and science-related careers. We do so by offering conference attendance opportunities, trips to Twin Cities science venues and regular meetings with female math and science faculty. As an outreach program, WhIMS works with organizations such as the Girl Scouts to plan math and science activity days designed to expose a younger group to the possibilities of math and science. [Excerpted from the WhIMS student orgs website.]

WIPs

WIPs (Women in Physics) is an informal group encouraging female physics majors to socialize and bond. We organize events about once a term; past events include movies, pizza making and other games as well. These events are open to all women interested or majoring in physics and is a great way to relax and hang out in a non-academic setting! For more information please contact Berit (goodgeb@carleton.edu).

FACILITIES

Most of the physics and astronomy classes and labs are held in Olin Hall of Science although on occasion some classes may be held in Mudd and Goodsell. In addition, the physics and astronomy labs (Olin 204, 210, 211, 219, 301, 302 and Goodsell 104) and the students lounge on the second floor provide excellent areas to get together with other students to work on problem sets, study for exams, and fiddle around with lab and computer equipment (with appropriate care). You might even locate an older, and perhaps wiser, physics major to help you out with some problem or just chat about physics and life. Keys to Olin and our lab areas are available; see Trenne Fields for the appropriate forms. Only those students with keys are permitted to use the building after midnight and during the weekend times when outside doors are locked. Qualified telescope observers can obtain keys to Goodsell Observatory and access to the 8- and 16-inch telescopes and the Astronomical Imaging Laboratory by contracting Cindy Blaha or Joel Weisberg.

Olin Hall has excellent teaching laboratories, research areas and computer facilities, providing students ready access to modern research equipment, including extensive electronic instrumentation and laboratory computers, a HPGe gamma detector, a 7" laboratory electromagnet, an optical spectrograph, a dye laser, x-ray diffraction equipment, an ultra-high vacuum system, and a scanning tunneling/atomic force microscope. The department also maintains a 24-node Beowulf-class supercomputer, housed in the Center for Mathematics and Computing.

In support of departmental emphasis on computing throughout our curriculum, numerous Macintosh, Windows, and Unix/Linux workstations are available to our students. These machines support a variety of software tools including spreadsheets, the symbolic math package Mathematica, C and Java programming languages, and the virtual instruments program LabVIEW for use with labs, lectures and student assignments.

FACULTY

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Melissa is an experimental condensed matter physicist. Her research interests lie in studying the electronic and magnetic properties of materials. Smith B.A., University of Minnesota Ph.D.

Eric Hazlett

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Eric is an experimental physicist with interests in optics, including laser cooling and trapping of atoms to investigate quantum phenomena. B.S, Colorado State, Ph.D Penn State

Frank McNally

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Frank is an experimentalist and Carleton grad teaching on campus this year while Joel Weisberg is on sabbatical. Frank studies cosmic-ray anisotropy, and has spent the last few years working on the IceCube project. Carleton, B.A., University of Wisconsin-Madison, Ph.D.

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