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Cover: by Rusty Orr, Class/Lab Support Group, Department of Physics

UNIVERSITY OF CALIFORNIA, BERKELEY

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BERKELEY, CALIFORNIA 94720-7300

DEPARTMENT OF PHYSICS
366 Le Conte Hall #7300
TEL: 510/642-7166
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Dear Prospective Physics Student:

On behalf of faculty, students and staff, I would like to welcome you to the Department of Physics at the University of California, Berkeley.

Our Department has a long tradition of excellence. For over fifty years the department has been recognized as the home of one of the world's top physics programs. We work surrounded by reminders of our rich history from which emerges a thriving department, engaged in research at the cutting edge of modern physics. With its outstanding resources, the Department of Physics is a leader in physics research and education.

Our undergraduate program begins with courses designed to help you build a strong foundation, regardless of your prior background in physics. Upper division work deepens your understanding of the basics while introducing more modern and advanced topics. The program culminates in our upper division lab course, where you have a unique opportunity among physics departments nationwide to choose from many different experiments, ranging from classic Nobel Prize winning work (e.g., Optical Pumping or the Mossbauer Effect), to areas of current research interest (nonlinear dynamics and laser manipulation of atoms, among others). We also strongly encourage all of our undergraduates to participate in current research with physics faculty, or with faculty from another Departments (such as Material Science, Electrical Engineering, or Biology), or with scientists from Lawrence Berkeley National Laboratory or Space Sciences Laboratory, both located minutes away in the hills above campus.

Our aim is to help prepare you for whatever career you choose, be it in industry or consulting, teaching, or continuing on to do graduate work. We believe that a strong background in physics is good preparation for whatever lies ahead. To help develop a program that is appropriate for you, we encourage you to speak with an advisor as soon as possible---even before you take your first physics course. Please visit our Undergraduate Student Services Office in 368 or 376 LeConte Hall for advising.

We also believe in making the Department a pleasant and productive place for students and for one another. Our Society of Physics Students, Physics Scholars Program, and Society for Women in the Physical Sciences are very active groups and would welcome your participation. If you are interested in receiving information about academic and social activities in our Department please sign up in 368 or 376 LeConte Hall.

Our alumni take their places among the nation's scientific leaders, in both academia and industry. It is with this in mind that I encourage you and invite you to be a part of the Physics Department.

I wish you luck and a successful academic experience, and hope to meet you in person soon.

Sincerely,

Professor Steven Boggs
Chair

DEPARTMENT OF PHYSICS
UNDERGRADUATE STUDIES

The Department of Physics

All educational and administrative functions of the Physics Department are housed in the LeConte-Birge complex located in the northeast quadrant of the main campus. In the foreground stands Sather Tower, better known as the Campanile. The lush wooded hills in the background are part of the Lawrence Berkeley National Laboratory complex. The majority of the Department's "cutting edge" research is carried out within the area of LeConte-Birge complex, Lawrence Berkeley Laboratory and Space Sciences Laboratory; however, UCB Physics personnel have been involved in projects in Argonne and Fermi Laboratories, Hawaii, Japan and as far away as Antarctica.

The Department offers undergraduates a broad and thorough understanding of the fundamentals of physics. The educational emphasis of the Department is primarily theoretical; however, some specialized courses in applied physics are among the options available to students.

The undergraduate major consists of two years of lower division physics and math courses (which must be completed before declaring the major) and then approximately two years of upper division physics. You may take additional physics, math or other science courses in addition to the courses required by the University, the College of Letter and Science (L&S) and the major. In addition to the required curriculum the Department offers an undergraduate honors program.

Students with a strong interest in another field have the option of declaring a double major (if the other major program is in L&S) or enrolling in the simultaneous degree program (if the other major program is another college or school).

Many students choose to supplement their classroom experience with research; both volunteer and some paid positions do exist in individual groups in physics and other science fields.

Students whose academic focus is in another field, but wish further study in physics have the option of declaring a minor in physics. The minor consists of two years of lower division physics and math and then five upper division courses.

For more information regarding the physics major, minor, courses or clarification of information contained herein contact the Undergraduate Student Affairs Officer in 368 or 376 LeConte Hall.

Undergraduate Physics Major and Minor Program

The undergraduate major program in physics is under the jurisdiction of the College of Letters and Science (L&S) and is subject to the rules and regulations of the College in addition to the University. Each academic year L&S publishes an announcement covering topics from A.B. requirements, grading regulations to withdrawing (and applying for readmission). The ultimate responsibility of completing requirements to graduating within the parameters set by the University, College and Department rests with the student. Consult the Undergraduate Student Affairs Officer or an L&S Advisor (206 Evans) for any clarification.

The program is designed to give students a solid foundation in physics to prepare them for work in the field or a physics graduate program.
Prerequisites: Students may declare a physics major after completing Physics 7A -7C (or H7A-H7C), Math 1A-1B and Math 53-54 (or their equivalent).
NOTE: Students may declare the physics major when all of the prerequisites for the major have been completed with a minimum 2.0 grade point average in the prerequisites and a minimum 2.0 grade point average in all University courses.

The Department also offers a minor program in physics. Students may petition for the minor in physics only after they have completed all required courses for the minor program. Please see "Completing the Minor in Physics" section for more information.

Requirements for the Physics Major and Minor

The Major

Lower Division: Physics 7A-7C and H7A-H7C are designed to give a potential physics major a solid foundation in physics for upper division coursework. Students may declare a physics major after completing Physics 7A-7C (or H7A-H7C), Math 1A-1B, Math 53 and Math 54 (or their equivalent) with a grade of "C" or better (minimum 2.0 GPA requirement).

Completing Advanced Placement courses or exams in physics is not considered sufficient preparation for upper division work in physics; therefore, it is the general policy of the Department not to waive the Physics 7A-7C prerequisite except under unusual circumstances. Physics H7A-H7C (honors Physics 7A-7C) sequence is recommended for students who feel that the Physics 7 series is not academically challenging enough.

Lower Division Honors Physics Sequence: Physics H7A-H7C corresponds to Physics 7A-7C but with greater emphasis on theory as opposed to problem solving. Expect to be challenged and stimulated by interaction with the curriculum and with your classmates in a small classroom setting. We recommend the honors sequence to potential physics majors, who have the appropriate background - high school physics or an equivalent, Math 1A and concurrent enrollment in Math 1B are the minimum requirements, as it enables students who are interested in physics to work together during their freshman and sophomore years. Physics H7A-H7C need not be taken to qualify for the honors program.

Upper Division: Physics students may take the upper division physics courses in a variety of sequences. Analytic Mechanics (105) and Quantum Mechanics (137A-137B) are most often taken during the junior year while Electromagnetism and Optics (110A-110B) is taken during the senior year. The Modern Physics and Advanced Electrical Laboratory (111) is a variable unit course, six units of which are required for the major. Statistical and Thermal Physics (112) and a Physics elective may be taken whenever you choose.

The following list is one possible four year sequence of required courses in the physics major; keep in mind that all University and L&S requirements must also fit within this program. We strongly suggest that most, if not all University and L&S requirements be completed prior to declaring. Consult the L&S Announcement for more details regarding the University and L&S requirements.

	First Semester	Second Semester
Freshman	Math 1A	Math 1B Physics 7A
Sophomore	Math 53 Physics 7B	Math 54 Physics 7C
Junior	Physics 137A Physics 111 BSC (3 units)*	Physics 137B Physics 105 or 110A
Senior	Physics 110A or 105 Physics 112	Physics 111 Adv (3 units)* Physics elective

- The first time you take Physics 111 you must enroll in the BSC portion (Sec. 1) for 3 units
- Effective Fall 2001, Physics 110B is no longer required but it is strongly recommended for those continuing onto graduate school in physics.

The physics major is a challenging program. It is important for students to request assistance and discuss major plans with an advisor. Assistance and resources are available!

PROPOSED TIMELINE

Students should include College of Letters & Science and University Requirements.

This timeline is based on a four year program beginning in the fall; students may need an extra year to complete requirements and should plan accordingly - See the Undergraduate Advisor in 368 or 376 LeConte Hall for assistance.

Students must be enrolled in a minimum of 13.0 units per semester to be considered full time students.

Freshman Year**	**Sophomore Year****
1st Semester: Math 1A	***3rd Semester:*** Math 53, Physics 7B
Units: 4	*Units: 8*
2nd Semester: Math 1B, Physics 7A	***4th Semester:*** Math 54, Physics 7C
Units: 8	-> Declare your major here
	Units: 8
Junior Year**	**Senior Year****
5th Semester: Physics 137A & 111 BSC	***7th Semester:*** Physics 105 or 110A
-> Begin research here	-> GRE
-> Jr. Transfer students begin here*	-> Letter of Recommendation File
Units: 7	-> http://career.berkeley.edu
	Units: 8
6th Semester: Physics 137B & 105 or 110A	***8th Semester:*** Physics 111 Adv & Physics Elective
Units: 8	-> Graduation!!
	Units: 7 or 8

*Students who transfer as juniors should see the Undergraduate Advisor – 368 or 376 LeConte - for transfer credit verification in the major - Check UCB Articulation Agreements with Junior & City Colleges at: http://www.assist.org/

**Total lower division units to be completed for the major by the end of sophomore year: 28.0 (16.0 lower division math units and 12.0 lower division physics units).

***Total upper division units to be completed for the major by the end of senior year: 29.0-30.0 (all upper division physics units).

Physics Four Year Planned Program

Students should include L&S requirements.

Freshman/Sophomore Level Courses

Fall	Units	Spring	Units
Math 1A	4.0	Math 1B	4.0
		Physics (H)7A	4.0

Fall	Units	Spring	Units
Math 53	4.0	Math 54	4.0
Physics (H)7B	4.0	Physics (H)7C	4.0

**Students should have completed the lower division Math and Physics pre-requisites by the end of their sophomore (second) year at CAL.*

Junior/Senior Level Courses

Fall	Units	Spring	Units
Physics 111 (BSC)	3.0	Physics 137B	3.0
Physics 137A	4.0	Physics 105 or 110A	4.0

Fall	Units	Spring	Units
Physics 110A or 105	4.0	Physics 111 Adv	3.0
Physics 112	3.0	Physics Elective	4.0

**Students may complete the physics upper division requirements by the end of their senior (fourth) year at CAL. Students are strongly encouraged to conduct research during their junior/senior years, particularly if interested in continuing to a graduate program.*

**Students must be enrolled in a minimum of 13.0 units per semester to be considered full time students.*

The Minor

The physics minor program conforms to the College of Letters and Science specifications and consists of the following coursework:

Prerequisites:	Physics 7A, 7B and 7C (or their equivalent) Math 1A, 1B, 53 and 54 (or their equivalent) Each course in the physics series must be passed with a letter grade of "C " or better. The student must achieve a minimum GPA of 2.0 in the seven courses
Minor Requirements:	Physics 137A Physics 110A or Physics 105 Three additional upper division courses (to total at least 9 units for an upper division physics unit total of at least 17 units). All upper division physics courses must be taken for a letter grade (thus Physics H190, 198 and 199 will not count toward the minor program). A minimum of three upper division courses must be completed at Berkeley. An overall minimum GPA of 2.0 is required in upper division courses applied to the minor program. The following upper division courses will not count for the minor program: Physics 100, 132, H190, H195A-H195B, 198, or 199.

All courses required for the physics major or minor must be taken for a letter grade

Some Course Notes:

Mathematics: Most physics majors elect to take some upper division mathematics courses. The material covered in Math 121AB (Mathematical Tools for the Physical Sciences) covers various topics of applied mathematics appropriate for the upper division physics courses. Math 110 (Linear Algebra), Math 113 (Introduction to Abstract Algebra), Math 128AB (Numerical Analysis), Math 104 (Introduction to Analysis) and Math 185 (Introduction to Complex Analysis) are appropriate courses for students interested completing additional mathematics.

Just a note: Admission into a physics graduate program is based, in part, on the grades the applicant receives in upper division math and physics courses. Taking upper division math may make a graduate application more competitive; however, whether one takes upper division math or not should depend on the individual's interest in math. Students who decide to augment their math background, should discuss their upper division math choices with a faculty advisor or a professor with research in their field of interest.

Physics Elective Courses: To complete the major, a program must include a minimum of one elective course chosen from the following list: Electromagnetism and Optics (110B), Particle Physics (129), Quantum and Nonlinear Optics (130), Atomic Physics (138) Special Relativity (139), Solid State Physics (141A (and/or B)), Introduction to Plasma Physics (142), Special Topics (151), Relativistic Astrophysics and Cosmology (C161), Quantum Information Science and Technology (C191), Principles of Molecular Biophysics (177). Please note that the Department does not offer each elective each semester so plan your schedule accordingly. **Occasionally the department will allow a course from another department to be used as an elective**. Such substitutions must be approved by the Head Undergraduate Advisor prior to completing the course. Check the Schedule of Classes every semester for new and special course offerings.

Physics Honors Program: To graduate with honors in the major the student must complete the senior honors thesis (H195AB) and at least one semester of Physics H190 (undergraduate honors seminar) and have a minimum grade point average of 3.3 in the overall major, upper division courses in the major, and in all University courses. Honors Physics 195AB is a year long course designed to allow outstanding students to conduct research, prepare and submit a senior honor thesis. Students interested in this course must have a minimum grade point average of 3.3 in the major and in all University courses. Qualified students must choose a potential thesis advisor by the beginning of their senior year. (Read through the section on finding research under "Life after Physics") Students must develop a thesis proposal (abstract) which must be approved by the thesis advisor, a major advisor and the Chair.
A copy of the thesis is due in the Students Services Office with the thesis advisor's approval by the end of the semester in which the student enrolls in Physics H195B.

Note: In addition to graduating with honors in the major a student may graduate with honors in general scholarship. Each academic year the College of Letter and Science determines the grade point averages necessary to graduate with honors and their categories

(Distinction, High Distinction and Highest Distinction). Consult the L&S Announcement (under Honors) for more information on Distinction in General Scholarship and the L&S Office of Undergraduate Advising, 113 Campbell, to learn the minimum grade point average in effect for the current academic year.

Special Physics Courses: Physics 198 - 199 are experimental or otherwise special courses in physics. Physics 199 is a variable unit course designed to permit a student to engage in independent research or study. Any physics major who has at least 60 semester units and the approval of a faculty member (who will supervise the work) may enroll in the 199 course. Approval of the Chair must be obtained on the basis of a written proposal that specifies the nature of the study, the number of units to be assigned and the for grading. The course is graded on a pass/no pass basis and carries 1-3 units of credit. Consult the Undergraduate Advisor for information regarding special courses.

Declaring Physics as a Major or Minor

Pre-Major Advising: Pre-major advising is available in 368 or 376 LeConte for all students who would like some academic counseling prior to declaring a major in physics. Although students cannot declare until the lower division prerequisites (Math 1A-B, 53 & 54 and Physics 7A-C or their equivalent) are finished, **any student interested in the Physics major should come in for pre-major advising as soon as possible**.

Declaring the Major: Students may declare a physics major when all of the prerequisites for the major have been completed. The prerequisites are as follows: minimum of 30 semester units which must include Physics 7ABC; Math 1AB and Math 53 and 54 or their equivalent with a 2.0 grade point average in the prerequisites and a 2.0 grade point average in all University courses.

The Department will consider applications to declare the physics major throughout the academic year. Students declaring (continuing and transferring) must furnish a copy of their grade record or past transcripts which include the prerequisite courses or their equivalents. Students must have their records reviewed and have a departmental file prepared by the Undergraduate Advisor in 368 or 376 LeConte Hall prior to seeing a faculty major advisor for departmental approval of the petition to declare a physics major. Students should be prepared to discuss a tentative schedule of their upper division courses.

Warning: L&S students with 80 or more semester units must declare a major or run the risk of having their registration for the following semester blocked by the College.

Multiple Majors Program and Simultaneous Degrees: Students may simultaneously complete requirements for another major while completing their physics requirements. If both majors are in the College of Letters and Science then the student must complete a petition to declare a double major. If the other major program is in another college (e.g. mechanical engineering in the College of Engineering) then the student must petition for a simultaneous degree. Please consult the L&S Announcement for specific procedures and regulations pertaining to double major and simultaneous degrees.

Transfer Students: L&S holds orientations for transfer students at the beginning of each semester. After the L&S orientation students are sent to departmental offices for specific information on the major. During the departmental visit students should make an appointment to have their math and physics courses evaluated. For more information on this orientation contact the CalSO Office or the College of Letters and Science.

Warning: Transfer students must declare a major by the end of their first semester here, or run the risk of having their registration for the following semester blocked by the College.

Faculty Major Advisors are physics faculty members who have been appointed to advise students throughout the academic year. Students will be assigned to an advisor at the time they declare their major. During the first meeting the advisor and student should construct a tentative two-year program in the major.

Physics majors are required to see a faculty major advisor at least once each semester to have their course of study approved. They are also available on a drop-in basis throughout the year (consult the Undergraduate Advisor in 368 or 376 LeConte for availability).

Physics majors must take their student file whenever seeing their faculty advisor. In this manner the faculty advisor can make appropriate notations in each file to help document progress in the program. Return the file to 368 or 376 LeConte after each meeting.

Petitioning for the Minor: Students may petition for the minor in physics only after they have completed all required courses for the minor in physics. Graduating seniors must petition no later than two weeks after the end of the term. To petition students must furnish

transcripts (official or unofficial) to the Department's Undergraduate Student Affairs Officer (in 368 or 376 LeConte Hall) to show work completed and grade point average in physics and math.

Academic Assistance

Tutoring in physics is available. The following are a few resources:

* **Residence Hall Tutoring - Undergraduate Dorms** for students living in the residence halls, Housing and Dining Services provides free drop in tutoring for residents. Updates and current schedules are available at:
http://www.reshall.berkeley.edu/academics

* **Student Learning Center** offers drop in hours for physics tutoring.. Current schedules and more information is available at:
http://slc.berkeley.edu/

The Student Learning Center is located in lower sproul plaza; they may be reached at:

University of California at Berkeley
Academic Partnership for Excellence (APEX)
198 Cesar Chavez Student Center #4220
Tutorial Services
Berkeley, CA 94720-7300

* **Private Tutoring** may also be possible. Current lists are available in the Undergraduate Student Services Office, 368 LeConte Hall.

Remember

* *It's never too early to start pre-major advising - stop by the Undergraduate Student Services Office - 368 or 376 LeConte - as soon as possible.*
* *A minimum GPA of 2.0 in the physics prerequisites and a minimum of 2.0 in overall UC GPA is required to declare the physics major.*
* *All major and minor program courses must be taken for a letter grade.*
* *At least 29-30 upper division units are required for the physics major. At least 17 upper division units are required for the physics minor.*
* *Request a degree audit from L&S before your last semester.*
* *Academic Assistance and resources are available - ask about them!*

Research Opportunities

Finding Research: There many resources on campus listing research opportunities for undergraduate students. Check for opportunities and listings on the boards outside of the Student Services Office, 368 LeConte Hall.

The Research Opportunities in Physics lists ongoing research projects within or in conjunction with the Department at the time of printing. Information lists research ranging from Astrophysics to X-ray Optics. If your research interests are still vague, use our web site to help you focus them. Students who already have a field of interest may use the web site to find out who is working in that field. Visit the Physics Department web site at: http://physics.berkeley.edu/. Click on "research".

The Berkeley Physics Undergraduate Research Scholars Program is designed to encourage Physics majors to engage in research. The Physics Department will award a monetary stipend to several students involved in research with Physics faculty. Interested students must apply. Berkeley Physics Undergraduate Scholars will be selected for the program by a committee of Physics faculty, based on evaluation of the student's enthusiasm and record, quality of the project, and level of involvement of the professor. Students selected for this program will be called the Berkeley Physics Undergraduate Research Scholars. Faculty take their mentoring roles very seriously, and will only sign-on students who are committed to their physics projects. The project may be a research paper, authorship on a published paper, or a senior thesis. For additional information and a copy of the application, stop by the Undergraduate Student Services Office.

The Office of Undergraduate Research is an on-line clearinghouse for information about the undergraduate research opportunities on the UC Berkeley campus. Their web site provides up-to-date information on undergraduate research programs, as well as links to summer opportunities and extra-campus programs. They are located in 5 Durant Hall.

Visit their web site at: **http://research.berkeley.edu/**

The Undergraduate Research Apprentice Program - Highly motivated undergraduates may apply for semester or year-long opportunities to work closely with faculty mentors on faculty-led research projects. Undergraduates with a 2.0 GPA or above are eligible to apply and those selected may enroll in Undergraduate and Interdisciplinary Studies (UGIS) 192 (1-4 units, P/NP). Descriptions of projects are available during the semesters. Applications are due the first day of the second week of classes.

Visit their web site at: **http://research.berkeley.edu/urap/**

UC LEADS Program - UC Leads is a two-year program designed to identify educationally or economically disadvantaged UC undergraduates in mathematics, engineering, or science who show promise of succeeding in doctoral degree programs. The program provides students with educational experiences that prepare them to assume positions of leadership in industry, government, public service, and academia. Contact the Program Director for additional information: Diana Lizarraga, UC LEADS Program Director, University of California, Berkeley, Stephens Hall, room 230-C, phone: 510/643-8978, ladiana@berkeley.edu.

Consult other departments and programs for literature regarding their ongoing research projects.

Four nonacademic centers where students may find research opportunities are:

Center for Extreme Ultraviolet Astrophysics (CEA) at 2150 Kittredge St.

Space Science Laboratory (SSL) located at the top of Centennial Drive.

Visit their web site at: **http://ssl.berkeley.edu/**

Lawrence Berkeley National Laboratory (LBNL), One Cyclotron Rd., in Berkeley.

Visit their web site at: **http://www.lbl.gov/**

Call (510) 486-4372 or (510) 486-5369 for more information.

Contact the Office of Undergraduate Research at: http://research.berkeley.edu/
or the Undergraduate Student Services Office for new information and special opportunities.

Summer Opportunities

The Cooperative Education Internship Service (2111 Bancroft) administers Survey of Career Options through Professional Experience (SCOPE). SCOPE staff run workshops on how to find internships; develop paid internships with business, industry, government and non-profit organizations; assist students develop their own internship; evaluate and monitor internships; advise students on career/life planning and assist students with readmission and withdrawal paper work. Physics students have interned with companies such as INTEL and IBM among many others.

For Internship Opportunities on campus visit their web site at: **http://career.berkeley.edu** to access the current "Cal Internship Directory". This directory compiles the many Berkeley campus sources from which students can learn about internship opportunities. It includes resources for community service, fieldwork, paid jobs and volunteer positions.

The Segre Internship is designed for undergraduate or graduate students who have taken the advanced laboratory course (Physics 111). It is a full-time eight-week commitment (during the summer) to work with faculty and professional staff in the laborartory; the goal is to develop new experiments to be used in future semesters in the Physics 111 laboratory. A modest amount of experience with electronic and laboratory equipment and experimental practices is necessary.

Applications for the Segre Internship are available mid-April and due at the end of April every year. Please contact the Physics Undergraduate Student Affairs Officer - 368 LeConte Hall - for more information.

The Center for Science and Engineering Education (CSEE) at the Lawrence Berkeley National Laboratory – has undergraduate research opportunities for students in the summer. Please visit their web site at: http://www.lbl.gov/Education/CSEE/ for more information. There will be links with specific information on research for undergraduates posted every summer at this web site. The Lawrence Berkeley National Laboratory is always to good place to check for research opportunities both in the summer and during the regular academic year. Visit them at: http://www.lbl.gov.

The Space Science Laboratory (SSL) – offers a space grant summer fellowship every year. These summer fellowships are available to support outstanding UC undergraduate and graduate students who are interested in entering the fields of space sciences and space engineering. Detailed information and applications are available at: http://www.ssl.berkeley.edu/

The National Science Foundation (NSF) has Research Experience for Undergraduates (REU) Programs . REUs support undergraduate research participation and encourage students to join research projects each summer at universities around the country. Detailed information is available at the NSF web site: http://www.nsf.gov. To search for an REU site, go to: http://www.nsf.gov/crssprgm/reu/reu_search.cfm and click on "physics" or desired. The direct link to the REU sites in the field of physics is: http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=69.

SURF: Summer Undergraduate Research Fellowships (for L&S students – physics is under their jurisdiction) - The Summer Undergraduate Research Fellowship program (SURF) is designed to allow Berkeley undergraduates in the College of Letters and Science to spend the summer doing concentrated research in preparation for a senior thesis or another major capstone research project. Fellows will receive a $2500 summer stipend, which is intended to cover basic living expenses for two months. Details can be found at: http://research.berkeley.edu/surf/index.html.

Summer Research Opportunities Program (Graduate Division) - The Summer Research Opportunity Program (SROP) at the University of California, Berkeley, was established to promote access to graduate education among undergraduates who have been educationally or economically disadvantaged, and who may not have had exposure to the academic environment of a research university. Detailed information is available at: http://www.grad.berkeley.edu/gop/srop.shtml.

Flyers advertising undergraduate summer internships and job opportunities are posted on the bulletin board outside 368 LeConte.

Contact program administrators in a timely manner; deadlines are usually highlighted and are as early as beginning of spring semester (January)!! Always plan ahead.

Student Organizations

The Society of Physics Students (SPS)

Introduction

The Society of Physics Students at Berkeley is only one of 600 chapters of the SPS at colleges and universities nationwide run under the auspices of the American Institute of Physics (AIP). At Berkeley, our mission is to create a sense of community among the undergraduates in the physics department and to reach out to future physics students. To these ends, we engage in a variety of activities throughout the year that include pre-colloquium lunches, guest speakers, physics movie nights, tours to physics research facilities and science museums, providing department tours and contacts to future students, peer counseling maintaining a WWW site, staffing an office, organizing and staffing the physics table at Cal Day (open house for U.C. Berkeley), and other special events.

Although SPS at Berkeley is run entirely by students, we work closely with a faculty advisor and the administration. This ensures that we are able to address the needs of physics undergraduates and that we have access to the resources of the physics department itself.

How Do I Get Involved?

Step 1: Fill out an application. Your application and membership fee ($15/yr.) will start the ball rolling by giving you the full benefits of the national SPS including a subscription to Physics Review, free registration at American Physical Society meetings for undergraduates, access to a career placement service upon graduation, and the opportunity to apply for members only scholarships and research grants. If you aren't interested in the above benefits (or are strapped for cash), fill out an application (so you can get on the local roster) and write "Local Membership Only" across the top. Even if you don't fill out the application, you're still welcome to come to all our meetings and events. We want your opinions and ideas.

Step 2: Attend our special campus events. Including social and academic activities like our pre-colloquia talks for undergraduates, tours to research facilities such as LBNL, and free pizza lunches.

Step 3: Attend our (optional) planning committee meetings. Held every week, this is where the Society discusses issues relevant to students, reports on the status of its projects, and plans future activities.

Step 4: Join a current SPS project. Among the projects we are currently working on:

1) Special Events, including pre-colloquia lunches
2) Tutoring for all levels of physics classes (early stages)
3) Graduate School Info and Career Planning Assistance (early stages)
4) The SPS at Berkeley Web Site
5) Touring Scientific Research Facilities.

Step 5: Start your own SPS project - We're always on the lookout for new ideas.

How to Contact SPS:

The SPS Office is located on the second floor of LeConte, Room 275. You may reach them via telephone at (510) 642-2197. Check the postings outside their office for changes and updates every semester.

Visit the SPS webpage at: **http://sps.berkeley.edu/**

Society for Women in the Physical Sciences (SWPS)

Program Description

The Society for Women in the Physical Sciences is an informal group of women in physics, astronomy, geology and related fields. As the women in these fields are often rather isolated from one another by virtue of their small numbers, the goal of this program is for these women to have the opportunity to meet each other to form friendships, study groups, working collaborations, etc. Although we (the graduate women coordinators of the program) hope that this program will benefit all the women who may not yet have declared a major. These are women who we would like to see become scientists. The program will provide these women with both formal mentoring relationships with graduate women and informal opportunities to socialize with one another and other members of the department.

Undergraduate mentoring description:

Graduate student women will be matched with three or four undergraduate women who have indicated an interest in majoring in physics, astronomy, geology or a related field. We wish especially to involve undergraduate women still taking introductory series' (for example the 7 series in physics; however, we welcome women at any point in their studies. We will attempt to have all the undergraduate women assigned to one graduate woman be in the same class (i.e. all in 7A this semester). The graduate women will meet with their undergrads about once a week for approximately an hour at times and places convenient for all involved. There is no set agenda fro these meetings. We think that the women involved should determine for themselves the most beneficial way to spend this time. In an initial organizational meeting with the graduate student women we were able to outline some more esoteric goals of these meetings and some specific activities that could occur during these meetings.

Goals:

* The graduate women should act as a resource for the undergraduate women by acquainting them with various programs and people that the department has available for them: colloquia, faculty advisors, department activities (ex. physics department poster session), undergraduate clubs (ex. Society of Physics Students), undergraduate assistants, etc.

* The graduate women should provide encouragement and advice to the undergraduate women when their classes seem overwhelming, frightening, or impossible (because we've been there too!). This is one of the most important goals of this program. Anecdotal evidence indicates that many of the graduate
women in the department have someone in their past who filled this role when they were undergrads.

* The graduate women should facilitate the women in their group getting to know each other so they can form study groups and friendships. Again, anecdotal evidence among the graduate women in the department indicates that many of them had women with whom they studied and interacted on a regular basis in their undergraduate science classes and that they found this very beneficial.

Monthly Social Activities:

Approximately once a month an informal get together will be planned to which everyone in the relevant departments will be invited (both men and women). The events will probably be a round table discussion with a theme relevant to women's issues. For example, we may invite several women who have families and are grad or undergrad students or faculty to discuss their experiences. We will also plan a number of purely social events that will enable the women in the department to get to know each other. We welcome suggestions of events that would be interesting or useful.

Contact Information:

We would like to thank the Letters and Science Dean's Office and the Department of Physics for providing the funds and support for this program. If you would like to participate in any capacity (mentor, mentee, assist with events) please contact the program's graduate student coordinator via email at: swps@physics.berkeley.edu. Administrative oversight of this program is handled by Colette Patt, Director of the Physical Sciences Student Diversity Program.

Visit the SWPS website at: http://socrates.berkeley.edu/~swps/

Life after Physics

Some early post-graduation planning can go far in enhancing a student's undergraduate curriculum.

If work in the technical field is part of the student's immediate plans then he/she should look into getting "practical" experience through supervised independent or group research, working (paid or non paid) with a research group on campus or internship programs. Practical experience can make, an otherwise, theoretical curriculum more marketable when applying for jobs.

Graduate School - The Admissions Committee looks at the following criteria when considering admission to the Ph.D. graduate program at Berkeley: grades in upper division math and physics (3.7 and above), score in the GRE, Advanced Subject Test in Physics (870), letters of recommendation, research experience (if applicable), and Statement of Purpose. Applications for fall admission (we only admit graduate students in the fall) are due January fifth of any given year.

Informational flyers from various graduate programs offered nationwide are posted on the last bulletin board along the west corridor of the third floor in LeConte. The Physics Library has the directory of Graduate Programs published by American Institute of Physics (AIP). Instructors and advisors are valuable source of information regarding graduate school.

For a list of graduate programs in physics at different universities visit:
http://www.gradschoolshopper.com/

Neatness Counts!: Make photo copies of your application forms first. Complete sections and revise until you are satisfied with your entries. **Type** the final form neatly and accurately. Reviewers have to read hundreds of applications, and typed forms are easier to read. Keep on top of the deadlines!

Letters of Recommendation: There are no standard recommendation forms available through the Department. Ask the recommender to write a general letter commenting on your abilities as a scholar and/or scientist. A written request which includes courses taken with the instructor, and when; a short description or your academic or career goals; and what the recommenders should comment on may be helpful, especially if you did not have very much contact with them.
Note: Letters of Recommendation forms included in the application material for the National Science Foundation (NSF) Graduate Fellowship and Hertz Foundation Fellowship must be completed by your recommenders.

Physics majors only may open a recommendation file. Recommenders should send their letter to Student Services, 368 LeConte Hall where the original will be kept on file. The Undergraduate Student Affairs Officer (SAO) will send out photo copies of the originals in the file to prospective employers, fellowships, graduate schools and summer internship programs. Contact the Undergraduate SAO for specific details. All other students may visit the Career Center at: http://career.berkeley.edu for information on the letter of recommendation service.

Fellowships: Information regarding fellowships general or specific to UC can be obtained from the Graduate Division (318 Sproul Hall); information regarding fellowships specific to schools can be obtained from the departmental bulletin board (LeConte, third floor, west corridor); and information regarding general fellowships (i.e. NSF) can be obtained from 368 LeConte.
These are a few of the major fellowships and their approximate deadlines:

National Science Foundation (NSF) Graduate Research Fellowships
Deadline: first week of November, annually.

Hertz Foundation Graduate Fellowships in the Applied Physical Sciences
Deadline: second week of October, annually

National Physical Science Consortium Graduate Fellowships in the Physical Sciences
Deadline: no later than November 5, annually.

National Defense Science and Engineering Graduate (NDSEG) Fellowship Program
Deadline: second week of January, annually.

For Fellowship Opportunities visit : http://cuinfo.cornell.edu/Student/GRFN/list.phtml?category=PHYSICALSCIENCES

Graduate Records Examination (GRE): Because completed graduate applications are due late December or early January at most universities, the October test date is optimal for admission and fellowship reviews. Test dates later than December will delay your application from admissions review and preclude it from fellowship review. Consult your regional Educational Testing Services Office for test dates: http://www.ets.org. Physics students may borrow a set of practice GRE Physics Tests to copy from the Undergraduate Advisor; you'll be asked to leave a collateral.

For the Graduating Seniors

Tele-BEARS will query seniors if they are graduating. A positive response will put a student on the official degree list. Changes to a student's intent to graduate must be processed at the Office of the Registrar once a choice is made on Tele-BEARS. Well before Phase I of your last semester, you should go through an L&S degree check which will disclose whether or not you have satisfied the University and L&S graduation requirements. Contact the Undergraduate Assistant to confirm that all major requirements are, or will be, completed by graduation. (See Graduation Checklist).

Graduation Ceremony: Graduation ceremony for the Astrophysics/Astronomy, Physical Science and Physics Departments is usually held shortly after Spring final examinations (~20th of May). Graduating seniors should receive an invitation to participate in the ceremony by early March. Students graduating in the following Fall semester may participate with the approval of their department. Contact the Under-graduate Assistant for more details.

A. B. Graduation Checklist

There are four categories of requirements which you must satisfied in order to graduate.

I. **General Requirements:** A. Subject A; B. American History; and C. American Institutions**.** Consult the Office of Undergraduate Admission (110 Sproul) for information.
II **Berkeley Campus Requirement:** A. American Culture
III. **Major Requirements:** See Major Requirements; Completion of 12 Upper Division units in residence
IV. **L & S Requirements:**

A. Essential Skills: 1. Reading and Composition; 2. Quantitative Reasoning; 3. Foreign Language
B. L&S Breadth Requirements:

Seven-Course Breadth Requirement:

Seven courses totaling a minimum of 19 semester units outside of the major field (Breadth courses must carry at least 2 unit - see L&S. Announcement for distribution). The breadth requirements may have been satisfied if the Intersegmental General Education Transfer Curriculum (IGETC) has been completed prior to admission or by the UC Reciprocity for transfer students.

1. Arts and Literature
2. Biological Science
3. Historical Studies
4. International Studies
5. Philosophy and Values
6. Physical Science
7. Social and Behavioral Sciences

C. Unit Requirements:

1. 120 total units
2. at least 60 L&S units
3. 36 must be Upper Division L&S units
   3a. 6 Upper Division L&S units outside the major
   3b. 18 Upper Division L&S units in residence

D. P (passed) Rule:

A maximum of 1/3 of the units successfully completed at U. C. Berkeley (excluding UC Extension) from Fall 1970 until graduation may be graded "P"

E. Senior Residence

After ninety units have been accumulated, at least 24 units must be completed at U. C. Berkeley over at least two semesters

F. Scholarship Requirement:

Minimum 2.0 (C) overall grade point average
Minimum 2.0 (C) grade point average for courses required for the major and in upper division courses required for the major.

Visit: **College of Letters and Science - Office of Undergraduate Advising:** http://ls.berkeley.edu/ **f**or complete information.

Physics Course Descriptions

Lower Division Courses

7A. Physics for Scientists and Engineers. (4) Three hours of lecture and four hours of laboratory/workshop per week. Prerequisites: High school physics; Math 1A or 1AS; Math 1B or 1BS (which may be taken concurrently). Mechanics and wave motion. (F,SP)

7B. Physics for Scientists and Engineers. (4) Three hours of lecture and four hours of laboratory/workshop per week. Prerequisites: 7A, Math 1A-1B, Math 53 (may be taken concurrently). Heat, electricity, and magnetism. (F,SP)

7C. Physics for Scientists and Engineers. (4) Three hours of lecture, one hour of discussion, and three hours of laboratory per week. Prerequisites: 7A-7B, Math 1A-1B, Math 53, 54 (Math 54 may be taken concurrently). Electromagnetic waves, optics, relativity, and quantum physics. (F,SP)

H7A-H7C. Physics for Scientists and Engineers. (4;4;4) Three hours of lecture, one hour of discussion, and three hours of laboratory per week. Prerequisites: High school physics; Math 1A or 1AS; Math 1B or 1BS (may be taken concurrently); Math 53; Math 54. Honors sequence corresponding to 7A-7B-7C, but with a greater emphasis on theory as opposed to problem solving. Recommended for those students who have had advanced Physics on the high school level and who are intending to declare a major in physics. Entrance into H7A is decided on the basis of performance on an examination given during the first week of class or the consent of the instructor, and into H7B-H7C on performance in previous courses in a standard sequence. (F,SP)

8A. Introductory Physics. (4) Students with credit for 7A will not receive credit for 8A. Three hours of lecture and four hours of discussion/laboratory week. Prerequisites: Mathematics 16A or equivalent or consent of instructor. Introduction to forces, kinetics, equilibria, fluids, waves, and heat. This course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper division study in biology and architecture. (F,SP)

8B. Introductory Physics. (4) Students with credit for 7B or 7C will not receive credit for Physics 8B. Three hours of lecture and four hours of discussion/laboratory section per week. Prerequisites: 8A or equivalent.Introduction to electricity, magnetism, electromagnetic waves, optics, and modern physics. The course presents concepts and methodologies for understanding physical phenomena, and is particularly useful preparation for upper division study in biology and architecture. (F,SP)

10. Descriptive Introduction to Physics. (3) Three hours of lecture and one hour of discussion per week. Prerequisites: Open to students with or without high school physics. The most interesting and important topics in physics, stressing conceptual understanding rather than math, with applications to current events. Topics covered may vary and may include energy and conservation, radioactivity, nuclear physics, the Theory of Relativity, lasers, explosions, earthquakes, superconductors, and quantum physics. (F,SP) Muller

C10. Descriptive Introduction to Physics. (3) Students will receive no credit for C10 after taking 10. Three hours of lecture and one hour of discussion per week. Prerequisites: Open to students with or without high school physics. The most interesting and important topics in physics, stressing conceptual understanding rather than math, with applications to current events. Topics covered may vary and may include energy and conservation, radioactivity, nuclear physics, the Theory of Relativity, lasers, explosions, earthquakes, superconductors, and quantum physics. Also listed as Letters and Science C70V. (F,SP) Muller

C21. Physics and Music. (2) Two hours of lecture and one hour of discussion per week. Prerequisites: Open to students with or without high school physics. What can we learn about the nature of reality and the ways that we humans have invented to discover how the world works? An exploration of these questions through the physical principles encountered in the study of music. The applicable laws of mechanics, fundamentals of sound, harmonic content, principles of sound production in musical instruments, musical scales. Numerous illustrative lecture demonstrations will be given. Only the basics of high school algebra and geometry will be used. Also listed as Letters and Science C70W. (SP)

24. Freshman Seminars. (1) Course may be repeated for credit as topic varies. One hour of seminar per week. Sections 1-2 to be graded on a letter-grade basis. Sections 3-4 to be graded on a passed/not passed basis. The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester. (F,SP)

39. Lower Division Physics Seminar. (1.5-4) Course may be repeated for credit. One and one-half to four hours of seminar per week. Sections 1-2 to be graded on a letter-grade basis. Sections 3-4 to be graded on a passed/not passed basis. Prerequisites: Enrollment by consent of instructor during the week of pre-enrollment. Consult bulletin boards outside 366 Le Conte for more information. Enrollment limited to 20 students per section. Physics seminar course designed for both non major students and students considering a major in physics. Topics vary from semester to semester. (F,SP)

49. Supplementary Work in Lower Division Physics. (1-3) Course may be repeated for credit. Meetings to be arranged. Students with partial credit in lower division physics courses may, with consent of instructor, complete the credit under this heading. (F,SP)

84. Sophomore Seminar. (1,2) Course may be repeated for credit as topic varies. One hour of seminar per week per unit for fifteen weeks. One and one half hours of seminar per week per unit for 10 weeks. Two hours of seminar per week per unit for eight weeks. Three hours of seminar per week per unit for five weeks. Sections 1-2 to be graded on a passed/not passed basis. Sections 3-4 to be graded on a letter-grade basis. Prerequisites: At discretion of instructor. Sophomore seminars are small interactive courses offered by faculty members in departments all across the campus. Sophomore seminars offer opportunity for close, regular intellectual contact between faculty members and students in the crucial second year. The topics vary from department to department and semester to semester. Enrollment limited to 15 sophomores. (F,SP)

98. Directed Group Study. (1-4) Course may be repeated for credit as topic varies. Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog. One to four hours of directed group study per week. Must be taken on a passed/not passed basis. Prerequisites: Restricted to freshman and sophomores only; consent of instructor. (F,SP)

99. Supervised Independent Study. (1-4) Course may be repeated for credit as topic varies. Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog. One to four hours of independent study per week. Must be taken on a passed/not passed basis. Prerequisites: Restricted to freshmen and sophomores only; consent of instructor. (F,SP)

Upper Division Courses

Physics 7A-7C (regular or honors), Math 1A-1B, 53-54, or their equivalents are prerequisite to all upper division courses except Physics 132.

100. Communicating Physics and Physical Science. (2) Two hours of lecture/fieldwork per week. For undergraduate and graduate students interested in improving their ability to communicate scientific knowledge by teaching science in K-12 schools. The course will combine instruction in inquiry-based science teaching methods and learning pedagogy with 10 weeks of supervised teaching experience in a local school. Students will practice, with support and mentoring, communicating scientific knowledge through presentations and hands-on activities. Approximately three hours per week including time spent in school classrooms. (SP)

105. Analytic Mechanics. (4) Three hours of lecture and one hour of discussion per week. Newtonian mechanics, motion of a particle in one, two, and three dimensions, Larange's equations, Hamilton's equations, central force motion, moving coordinate systems, mechanics of continuous media, oscillations, normal modes, rigid body dynamics, tensor analysis techniques. (F,SP)

110A-110B. Electromagnetism and Optics. (4;4) Three hours of lecture and one hour of discussion per week. A course emphasizing electromagnetic theory and applications; charges and currents; electric and magnetic fields; dielectric, conducting, and magnetic media; relativity, Maxwell equations. Wave propagation in media, radiation and scattering, Fourier optics, interference and diffraction, ray optics and applications. (F,SP)

111. Modern Physics and Advanced Electrical Laboratory. (1-3) Course may be repeated for a maximum of 9 units. Six units required for physics major; nine units may be taken for credit. No more than 3 units may be completed in one semester. Eight hours of laboratory per week. Prerequisites: 137A or consent of instructor.The first semester (3 units), on Basic Semiconductor Circuits (BSC), covers introductory analog and digital circuits. The class meets for two 4-hour afternoon lab sessions, and a 1-1/2 hour weekly lecture. In the second semester, Advanced Lab (3 units), students complete 4 of 20+ advanced experiments. These include many in atomic, nuclear, classical, and solid-state physics, among others. Students may, with approval, enroll in an optional third semester for variable units. (F,SP)

112. Introduction to Statistical and Thermal Physics. (4) Three hours of lecture and one hour of discussion per week. Basic concepts of statistical mechanics, microscopic basis of thermodynamics and applications to macroscopic systems, condensed states, phase transformations, quantum distributions, elementary kinetic theory of transport processes, fluctuation phenomena. (F,SP) Staff

129. Particle Physics. (4) Three hours of lecture and one hour of discussion per week. Prerequisites: 137A, 137B (may be taken concurrently), or consent of instructor. Formerly 129A. Tools of particle and nuclear physics. Properties, classification, and interaction of particles including the quark-gluon constituents of hadrons. High energy phenomena analyzed by quantum mechanical methods. Course will survey the field including some related topics in nuclear physics. (F)

130. Quantum and Nonlinear Optics. (3) Three hours of lecture and one hour of discussion per week. Prerequisites: 110A and 137A-137B, or consent of instructor. Detailed theory and experimental basis of quantum and nonlinear optics, exhibiting concepts of quantum measurement, noise, stochastic processes and dissipative quantum systems. Topics include second-quantization of electromagnetic fields, photodetection, coherence properties, light-atom interactions, cavity quantum electrodynamics, nonlinear optical systems, squeezed light, aspects of quantum information science, and contemporary research. (F,SP)

132. Contemporary Physics. (3) Not open for credit to students who have completed 137A. Three hours of lecture and one hour of discussion per week. Prerequisites: 8A-8B or equivalent or consent of instructor. A general descriptive course of selected topics in contemporary physics. Subject matter will vary and may include topics from special and general relativity, atomic and nuclear physics, radiation, fundamental particles and their symmetries, superconductivity and superfluidity, solid state physics, astrophysics, and cosmology. (SP)

137A-137B. Quantum Mechanics. (4;4) Three hours of lecture and one hour of discussion per week. Introduction to the methods of quantum mechanics with applications to atomic, molecular, solid state, nuclear and elementary particle physics. (F,SP)

138. Modern Atomic Physics. (3) Three hours of lecture and one hour of discussion per week. Prerequisites: 137A-137B. This course covers atomic, molecular, and optical physics as a quantitative description of atoms and fields, a generalized toolbox for controlling quantum systems, and a vibrant research area. Topics covered include atomic structure and spectra, atom-field interactions, topics in quantum electrodynamics, methods of resonant manipulation of quantum systems, resonance optics, and experimental techniques. (F,SP)

139. Special Relativity and General Relativity. (3) Three hours of lecture and one hour of discussion per week. Prerequisites: 105, 110A or consent of instructor. Historical and experimental foundations of Einstein's special theory of relativity; spatial and temporal measurements, particle dynamics, electrodynamics, Lorentz invariants. Introduction to general relativity. Selected applications. Designed for advanced undergraduates in physics and astronomy. (SP)

141A-141B. Solid State Physics. (4;3) Three hours of lecture and one hour of discussion per week. Prerequisites: 137A-137B; 137B may be taken concurrently. A thorough introductory course in modern solid state physics. Crystal symmetries; classification of solids and their bonding; electromagnetic, elastic, and particle waves in periodic lattices; thermal magnetic and dielectric properties of solids; energy bands of metals and semi-conductors; superconductivity; magnetism; ferroelectricity; magnetic resonances. (F,SP)

142. Introduction to Plasma Physics. (4) Three hours of lecture and one hour of discussion per week. Prerequisites: 105, 110A-110B (110B may be taken concurrently). Motion of charged particles in electric and magnetic fields, dynamics of fully ionized plasma from both microscopic and macroscopic point of view, magnetohydrodynamics, small amplitude waves; examples from astrophysics, space sciences and controlled-fusion research. (SP)

151. Elective Physics: Special Topics. (3) Course may be repeated for credit as topic varies. Three hours of lecture and one hour of discussion per week. Prerequisites: Consent of instructor. Topics vary from semester to semester. The subject matter level and scope of the course are such that it is acceptable as the required elective course in the Physics major. See Department of Physics course announcements. (F,SP)

C161. Relativistic Astrophysics and Cosmology. (4) Three hours of lecture and one hour of discussion per week. Prerequisites: 110A-110B and 112 (may be taken concurrently). Formerly C160B and Astronomy C160B. Elements of general relativity. Physics of pulsars, cosmic rays, black holes. The cosmological distance scale, elementary cosmological models, properties of galaxies and quasars. The mass density and age of the universe. Evidence for dark matter and dark energy and concepts of the early universe and of galaxy formation. Reflections on astrophysics as a probe of the extrema of physics. Also listed as Astronomy C161. (SP) Arons, Boggs, Davis, Holzapfel, A. Lee, Ma, Quataert

177. Principles of Molecular Biophysics. (3) Three hours of lecture and one hour of discussion per week. Prerequisites: 112 or consent of instructor. We will review the structure of proteins, nucleic acids, carbohydrates, lipids, and the forces and interactions maintaining their structure in solution. We will describe the thermodynamics and kinetics of protein folding. The principles of polymer chain statistics and of helix-coil transitions in biopolymers will be reviewed next, together with biopolymer dynamics. We will then cover the main structural methods in biology: X-ray crystallography, MNR and fluorescence spectroscopy, electron and probe microscopy, and single molecular methods. (SP)

H190. Physics Honors Course. (2) Course may be repeated for credit. Must be taken on a passed/not passed basis. Prerequisites: Consent of instructor. A seminar which includes study and reports on current theoretical and experimental problems. Open only to students officially in the physics honors program or with consent of instructor. (SP)

C191. Quantum Information Science and Technology. (3) Three hours of lecture/discussion per week. Prerequisites: Mathematics 54, Physics 7A-7B, and either Physics 7C, Mathematics 55, or Computer Science 170. This multidisciplinary course provides an introduction to fundamental conceptual aspects of quantum mechanics from a computational and informational theoretic perspective, as well as physical implementations and technological applications of quantum information science. Basic sections of quantum algorithms, complexity, and cryptography, will be touched upon, as well as pertinent physical realizations from nanoscale science and engineering. Also listed as Chemistry C191 and Computer Science C191. (F,SP) Crommie, Vazirani, Whaley

H195A-H195B. Senior Honors Thesis Research. (2;2) Credit and grade to be awarded on completion of sequence. Prerequisites: Open only to students in the honors program. Thesis work under the supervision of a faculty member. To obtain credit the student must, at the end of two semesters, submit a satisfactory thesis. A total of four units must be taken. The units may be distributed between one or two semesters in any way. (F,SP)

198. Directed Group Study. (1-4) Course may be repeated for credit. Must be taken on a passed/not passed basis. Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog. (F,SP)

199. Supervised Independent Study. (1-3) Must be taken on a passed/not passed basis. Enrollment restrictions apply; see the Introduction to Courses and Curricula section in this catalog. (F,SP)

Directory

Quick guide to important telephone numbers, office locations and web sites

Career and Graduate School Services http://career.berkeley.edu/
2111 Brancroft Way
General Information (510) 642-1716

College of Letters and Science - Office of Undergraduate Advising http://ls.berkeley.edu/
206 Evans Hall

General Information	(510) 642-1483
Advising/Dean's Appointments	(510) 642-1483
Evaluation Unit	(510) 642-7391
Transfer Credit/AB Degree Candidates	

Financial Aid Office http://uga.berkeley.edu/fao/default.htm
250 Sproul Hall

Undergraduate Assistance	(510) 642-6442
Emergency Loan	(510) 642-0470

Physics Department http://physics.berkeley.edu/
366 LeConte Hall

Undergraduate Matters	(510) 642-0481	
368 LeConte Hall		
Graduate Matters	(510) 642-0596	
370 LeConte Hall		
Society of Physics Students	(510) 642-2197	http://sps.berkeley.edu/
275 LeConte Hall		
The Society for Women in the Physical Sciences		http://socrates.berkeley.edu/~swps/

Registrar's Office http://registrar.berkeley.edu/
120 Sproul Hall

General Information	(510) 643-7490	
Transcripts	(510) 642-4721	
Verifications	(510) 642-1883	
Registration Matters		
TeleBEARS	(510) 642-3400	http://registrar.berkeley.edu/
InfoBEARS	(510) 642-9400	http://registrar.berkeley.edu/
Bear Facts		http://bearfacts.berkeley.edu/

Undergraduate Admissions Office http://www.uga.berkeley.edu/ouars/
110 Sproul Hall

General Information	(510) 642-3175
Application Requests	(510) 642-0569

University Extension Office http://extension.berkeley.edu/
1995 Univesity Ave, Suite #110

Information & Registration	(510) 642-4111
Transcripts	(510) 642-4171
Registrar	(510) 642-4454