

**Physics 391—Independent Study
Computational Physics
Course Description, Fall 2015**

Instructor: Andrew Dougherty
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Class Meetings: We will normally meet Monday and Thursday afternoon, and other times throughout the week as needed. Students are expected to engage in significant independent work as well.

Office Hours: I will usually be either in my office or lab during the free times indicated on my schedule. Please feel free to call, e-mail, or stop by at any time and ask a question or set up an appointment.

Classes on Snow Days and Other Emergencies: If I am unable to make it to class, I will leave a message on my voice mail (610-330-5212).

Description:

This course is an introduction to the use of computers in physics. The emphasis will be on simulating systems that are difficult to analyze analytically. A second important goal will be to learn to use the Java programming language to address scientific computing problems.

Texts: The main text for this course is *Introduction to Computer Simulation Methods* (third edition), by Harvey Gould, Jan Tobochnik, and Wolfgang Christian (Addison-Wesley, 2006). We will also be using the supplementary text *Open Source Physics: A User's Guide With Examples*, by Wolfgang Christian (Addison-Wesley, 2006). The web page for the text is <http://physics.clarku.edu/sip/>.

Assignments: I expect that this course should require on average about ten hours of your time per week. Most of that time will be spent working through the text, developing and running programs, analyzing the results, and writing up your results.

There will be three main types of assignments:

Exercises: The text contains a number of useful exercises that extend the material in the chapter in a variety of ways. Most of these are fairly straightforward and self-explanatory. Specific assignments will be made for each chapter covered.

Problems: The text also contains a number of more complex problems. These are typically much more involved and open-ended than the exercises.

Projects: We will also try to do two significant projects, where we explore, in depth, a particular physical system via numerical simulation. These projects are much more in the spirit of an exploratory lab than an end-of-chapter homework assignment. Reports for these should be modeled after the suggested format in Appendix 1A of the text.

Tentative Syllabus

We will do the first 3 chapters in detail, since they provide the basis for the rest of the text. You will work through many of the exercises in these early chapters; specific assignments will be given weekly. The remaining chapters will be chosen based on your interests.

Week Starting		
Aug.	31	Chapter 1: Introduction
Sept.	7	Chapter 2: Tools for Doing Simulations
	14	Chapter 2: (<i>continued</i>): Object-Oriented Programming
	21	(<i>continued</i>)
	28	Chapter 3: Simulating Particle Motion
Oct.	5	(<i>continued</i>)
	12	<i>Fall Break</i>
	19	Chapter 3 (<i>continued</i>)
	26	First project
Nov.	2	(<i>First project, continued</i>)
	9	Finish first project.
	16	Second project
	23	<i>Thanksgiving</i>
	30	(<i>Second project, continued</i>)
Dec.	7	Finish second project.

Learning Outcomes: After completing this course, a student should be able to:

- Create a program to simulate single particle motion under a variety of physical conditions,
- Create a program to simulate the *collective* behavior of a system of particles,
- Interpret the results of simulations in physical terms,
- Explain the main limitations of those particular simulations, and
- Be able to present the background, methods and results to an audience of physics faculty and students.

Federal Credit Hour Statement: The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office web site

<http://registrar.lafayette.edu/additional-resources/cep-course-proposal/> for the full policy and practice statement.

My Schedule:

Andrew Dougherty Fall 2015 Office: Hugel Science Center 030 Lab: Hugel Science Center 025 610-330-5212 doughera@lafayette.edu					
Time	Mon.	Tues.	Wed.	Thurs.	Fri.
8:00					
8:30					
9:00		Phys 131 Lab HSC 119			
9:30					
10:00	<i>prep</i>		<i>prep</i>	Phys 495 HSC 025	<i>prep</i>
10:30					
11:00	Phys 131		Phys 131		Phys 131
11:30	HSC 142		HSC 142		HSC 142
12:00					<i>Physics Club</i>
12:30					
1:00	<i>prep</i>	Phys 495		<i>prep</i>	
1:30		HSC 025			
2:00	Phys 391	<i>Office</i> <i>Hours</i>	<i>Office</i> <i>Hours</i>	Phys 391	
2:30	HSC 040			HSC 040	
3:00					
3:30					
4:00	Department	Committee	<i>Physics Club</i>		
4:30	Meeting	Meeting			

Academic Honesty:

The fabric of science, and indeed any intellectual endeavor, is built on the integrity of all involved. Accordingly, I take academic honesty very seriously. I expect that all students will abide by the "Principles of Intellectual Honesty" appearing in the Lafayette College Student Handbook.