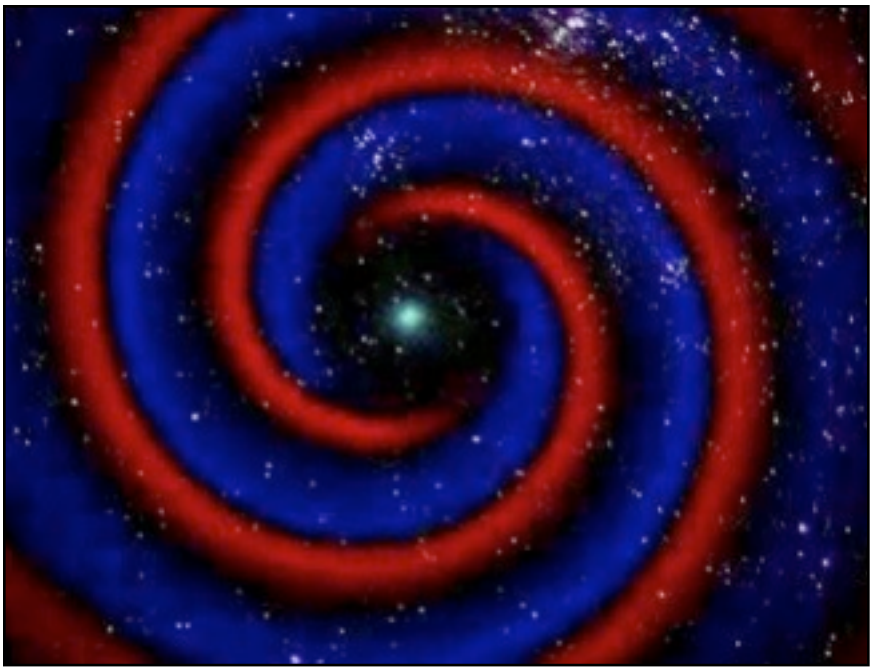
Computational Physics



Course Objectives

The purpose of this course is to introduce students to numerical methods as one of the tools for pursuing research in physics. Class time will be spent reviewing a numeral method and discussing its potential applications. While the class is not a computer programming class, you will be exposed to and expected to reproduce good coding technique. Examples will cover a variety of topics in physics including astrophysics, condensed matter, cosmology and hydrodynamics.

In class applications will also review programing, specifically Matlab. If you are proficient in another language, you are welcome to submit homework in that language.

The course grades will be based on homework and a team project. You are encouraged to find students that identify a similar interest in physics so your project can be in an area you like.

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Office Hours T 3-4:30 PM W 4-5:30PM & By Appointment
Class Logistics T/Th 12:05-1:25PM Howey S104
Prerequisites Phys 2212 or 2232

Textbook
Our textbook is Computational Physics with Python by Mark Newman, with a corresponding website http://www-personal.umich.edu/~mejn/computational-physics/. Another useful text is Numerical Recipes by William H. Press, Saul A. Teukolsky, William T. Vetterling and Brian P. Flannery (Cambridge University Press 2007).

Academic Integrity
Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code.

Course Grades
The entire course grade will be earned from the 7 homework assignments plus class participation.
- 95% Homework
- 5% Class Participation

HOMEWORK (95%)
There will be seven homework assignments during the semester (subject to change). Homework problems will typically require writing computer programs based on the numerical algorithms discussed in class. Computer programs MUST be written completely from scratch, with the essential steps fully commented. The structure of the program can, however, be based, if necessary, on programs written or discussed by the instructor. The instructor reserves the right to request the student the reproduction of results submitted in homework assignments. Delays in the submission of homework sets will be penalized 5 percent per day. All input and output will be standardized to ascii unless otherwise stated.

Homework Grades
- 5 points = correct solution, code compiles/runs and well documented
- 4 points = missing documentation, correct solution and compiles/runs
- 3 points = small errors but code complies/runs
- 2 points = incorrect solution
- 1,0 points = code does not compile/run

Class Participation (5%)
I will ask one or two students to prepare to discuss the topic to be covered each day. We will also to in-class projects. Your class participation will be computed based on your completion of a discussion and your engagement during in-class projects. I will randomly assign discussion leaders after the first few days of class.

Course Grades
The entire course grade will be earned from the 7 homework assignments plus class participation.
- 95% Homework
- 5% Class Participation

	Tuesday	Thursday
	12 Introduction to Class	**14** 2. Python & Your Laptop
JAN	**19** 2. Python Basics	**21** 2. Python Codes **Due**: HW1
	26 2. Python Codes	**28** 3. Graphics
FEB	**2** 4. Speed & Accuracy	**4** 5. Integrals & Derivatives **Due**: HW2
	9 5. Adaptive Methods	**11** 5. Gaussian integration
	16 5. Differentiation	**18** 6. Simultaneous Equations **Due**: HW3
	23 6. Nonlinear Equations	**25** 6. Maxima & Minima
MAR	**1** 7. Fourier Transform	**3** 7. Fast Fourier Transforms **Due**: HW4
	8 8. ODEs	**10** 8. Higher Order Equations
	15 8. Adaptive Methods	**17** 8. Boundary Value Problems **Due**: HW5
	22 SPRING BREAK (No Class)	**24** SPRING BREAK (No Class)
	29 9. PDEs	**31** 9. PDEs
APR	**5** 9. Forward Time Methods	**7** 9. Spectral methods **Due**: HW6
	12 10. Random Processes	**14** 10. Monte Carlo Integration
	19 10. Monte Carlo Simulations	**21** 10. Simulated Annealing
	26 Summary **Due**: HW7	**28** READING DAY (No Class)