

Welcome!

Physics 410-510: Computational Physics

- Monday/Wednesday 12:30-13:45
- Required textbook: Computational Physics by Mark Newman
 - It's not expensive, and very well written. We will follow it closely (though not always), and most of the assignments and a lot of the work will come from it. **READ THE BOOK!!!**
- A lot of material here and in assignment is taken directly or indirectly from this wonderful course by Sal Rappoccio: <https://indico.cern.ch/event/831093/timetable/#20190826.detailed>
 - May not be a bad resource for you, either!

What we will cover (partially following the text)

1. Pseudocode and how to be a good programmer and computational physicist
2. What is happening inside computers?
3. A bit of accuracy vs speed discussion + python extras!
4. How to fit distributions
5. Integrals and derivatives
6. Linear and non-linear equations
7. Fourier transforms
8. Ordinary differential equations
9. Partial differential equations
10. Random processes and MC methods

Textbook has early chapters on python and visualization. We will not go over them, but if you don't know python (or even if you do!) they are an important and useful read

Grading

- Problem sets every ~2 weeks, each with the same weight: combined total, 70% of grade
 - All to be due roughly 1 week after we finish a chapter/ topic. Due dates are on the syllabus
 - Start the HW early **and if time allows (it should!), in class**
 - If you get stuck and need help, make an appointment to talk to me. **The homework is NOT short**, but you also have no exams in the course, so I expect you to put in many hours on them
 - Please ask for help if you don't understand solutions (we'll briefly go over them in class, but not over everything)
- Final assignment (which is just like another big HW assignment): 30% of grade

- After weighting problem sets and final presentation, the grades will be:
 - A: 94-100%
 - A-: 88-94%
 - B+: 83-88%
 - B: 78-83%
 - B-: 73-78%
 - C+: 68-73%
 - C: 63-68%
 - C-: 58-63%
 - D: 50-58%
 - F: 50% or less
- I reserve the right to shift this scale, but only in the direction that helps you

On late assignments

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- Assignments are due when class begins
- Assignments submitted after class begins on the date they are due will have a 5% penalty applied to them if they are submitted within 24 hours. Submission 24-48 hours after the due date will lead to a 10% penalty, 48-72 hours will be 15%.... and so one
- Without strong justification, no late final assignment will be accepted
- This syllabus contains all the due dates, so enter them in your calendars, now!
- I'm happy to work with you, but late assignments without penalty are only accepted with a really valid excuse. Talk to me in advance or as soon as possible

On homework and assignments

- I don't want to keep you from working with others, but any work that you hand in must be your own
 - Solutions found on the web are a form of plagiarism
 - "Can I copy your solutions?" are also plagiarism
 - Plagiarism is a violation of the NIU Student Code of Conduct and will be treated as such (<https://www.niu.edu/conduct/process/index.shtml>)
- I do want you to help your classmates, however... and don't forget that office hours are there for those who need assistance, too

- The use of generative AI tools such as chatGPT and BARD is allowed if you need help with programming syntax, but not otherwise
 - Otherwise you learn nothing, which is the goal here!
 - Use these tools in the same way that you would ask a super knowledgeable (but not always trustworthy) friend
 - You shouldn't (and wouldn't, I hope!) ask your friend to do your HW for you
- Note that these tools anyway are not guaranteed to provide the correct answer
- The use of AI to solve problems beyond simple programming syntax is considered plagiarism in this course

- Monday 2-3 pm or Friday 12-1 pm on campus or virtually, or by appointment
 - If we meet virtually, I am happy to meet via ‘ol fashioned phone, Zoom, Skype or even (reluctantly) via Teams. Please e-mail me (jahred.adelman@niu.edu) to set up a time.
 - If you are planning on meeting virtually, when you write to me to schedule an appointment, please include your availability for the week that you’d like to meet so that I can compare to my calendar and come up with a mutually agreed-upon slot (just requesting to meet at a specific time is likely not going to work)

Attendance

- Please come to our virtual class (shouldn't need to ask this of you, but I state it anyway)
 - The work that we go over will be important to follow and understand
 - I am not taking attendance - but this course should be **fun**, and you **will not learn as much if you don't come to class**

We will follow the schedule outlined on the next slides. When we finish material for one topic, it is time for you to start exploring the code in-class, to ask questions, and if you are up for it, to start your homework assignments! We are a small enough group that I can help you individually, as needed. Should help make the homework less daunting

Tentative schedule

Date	Chapter we'll be covering during class	Homework due at start of class that day
Jan 17	4 + intro stuff	
Jan 22	4	
Jan 24	4	
Jan 29	Numpy / fitting / Python	
Jan 31	Numpy / fitting / Python	HW #1 (Chapter 4)
Feb 5	5	
Feb 7	5	
Feb 12	5	HW #2 (Fitting)

Tentative schedule

Date	Chapter we'll be covering during class	Homework
Feb 14	5	
Feb 19	5	
Feb 21	6	
Feb 26	6	HW #3 (Chapter 5)
Feb 28	6	
March 4	6	

Tentative schedule

Date	Chapter we'll be covering during class	Homework
March 6	7	
March 18	7	
March 20	7	HW #4 (Chapter 6)
March 25	8	
March 27	8	
April 1	8	HW #5 (Chapter 7)

Tentative schedule

Date	Chapter we'll be covering during class	Homework
April 3	8	
April 8	9	
April 10	9	
April 15	9	HW # 6 (Chapter 8)
April 17	10	
April 22	10	
April 24	10	HW #7 (Chapter 9)

Tentative schedule

Date	Chapter we'll be covering during class	Homework
April 29	10	
May 1	10	

Chapter 10 homework and final exam both due May 8 at 12:30 pm (no late submissions accepted for either)

Note on class time

On a few occasions there may be computational HEP virtual seminars that overlap with this class. On those days, class will be canceled in lieu of attendance at the seminars. Attendance for students in C²-THE-P² is mandatory at the seminars, strongly encouraged for all others

Disability statement

If you need an accommodation for this class, please contact the Disability Resource Center **as soon as possible**. The DRC coordinates accommodations for students with disabilities. It is located in the Campus Life Building, Suite 180, and can be reached at 815-753-1303 or via drc@niu.edu. Also, please contact me privately as soon as possible so we can discuss your accommodations. Please note that you will not be required to disclose your disability, only your accommodations. The sooner you let me know your needs, the sooner I can assist you in achieving your learning goals in this course.

My aim is for you to enjoy this course and to learn the material - please let me work with you so that we can achieve our goals. If you are not an NIU student by need an accommodation, please reach out to me to discuss this ASAP

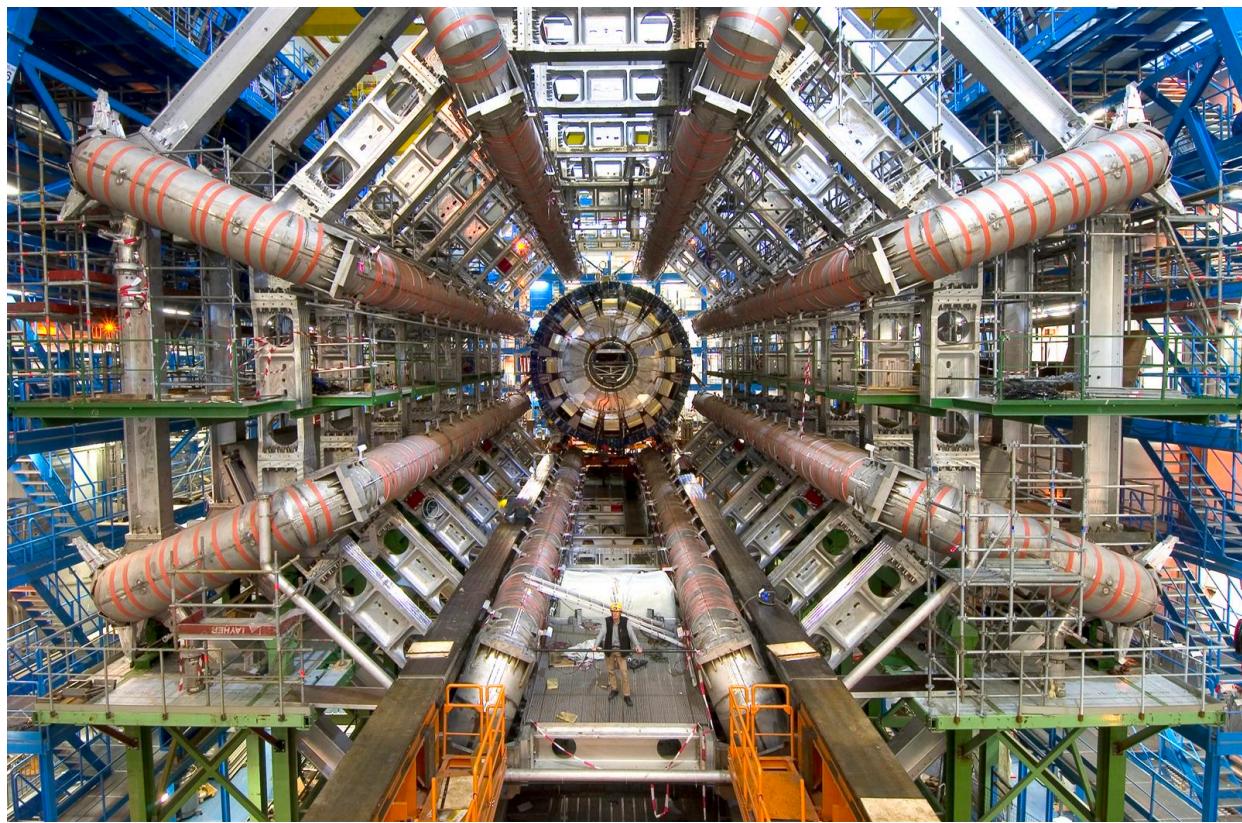
On mental health

I understand that college students and graduate students may experience a range of academic, social, and personal stressors, which can be overwhelming. You are not alone. Well-being at NIU offers resources, programs, and services. If you need assistance with comprehensive or crisis mental health support, Counseling and Consultation Services (CCS) at 815-753-1206 is ready to help.

If you are not an NIU student and still need help, please reach out to your faculty mentors at home. If you cannot do this, please let me know and I will do my best to help remotely

About me ... and you

- I am a particle physicist working on measurements of and searches for new physics with Higgs bosons using the ATLAS experiment at the LHC (at CERN)
 - I'll try and point out my research during the class, as appropriate



About me ... and you

- I'll try to update my teaching style as the semester goes on, based on my experience, observations and your feedback
 - If I am going too fast... or too slow, or if my style is incomprehensible, please speak up



- Not a “computational physicist” per se, but we are heavily reliant on computation for pretty much all of particle physics
 - Note that all areas of physics are focusing more and more on computation, too!



About me ... and you

- This is only the second time I'm teaching the course (and a lot of the material is new), so apologies in advance for bugs, typos, unclear items, my confusion and my failures
 - Please help me to make this course better!
 - The material is a LOT of fun, so we should be enjoying ourselves this semester

