PHYSICS 3910
Intermediate Computational Modeling of Physical Systems
Spring 2023
Lecture, Physics Bldg 204, TTh 12:30PM – 1:50PM

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Office Hours: Tuesdays 2–3pm, and by appointment

Optional Textbooks:
The following textbooks are optional. Lecture notes will be mainly adapted from these two text and distributed as Jupyter notebooks on Canvas.

- *Computational Physics – Problem Solving with Python* by Rubin H. Landau, Manuel J Páez, Cristian C. Bordeianu, Wiley-VCH (2015)
- *Computational Physics* by Mark Newman, CreateSpace Independent Publishing (2012)

Topics and General Information:
Building upon the foundations of PHYS 3510, PHYS 3910 will resemble a lab course in design, where we will focus more on hands-on practice and group work in exploring some more advanced topics listed below.

> **Modeling uncertainty and randomness:** Nonlinearity in discrete and continuous dynamics, including the logistic map, period-doubling bifurcation, the Mandelbrot set, chaotic pendulums, phase-space orbits; thermal systems, including Monte Carlo methods, the Ising model, thermal equilibration, and molecular dynamics.
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> **Matrix computation:** Basic linear algebra operations in Python, eigenvalue problems, coupled oscillator models, solving the stationary Schrödinger equation.
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> **Data analytics:** Curve fitting, basic machine learning, and applications in physics.

By the end of the course, you should be able to:

- Model and analyze complexities arising in dynamical systems and statistical mechanics.
- Apply linear algebra routines available in python in solving physics problems in quantum mechanics and classical mechanics.
- Extract physical insight from experimental or numerical data.
- Use Github for version control.
- Establish a toolset and mindset of a computational scientist that will be useful for all your other coursework and future opportunities in research.

Grading: Grading will be based on the completion of course modules distributed as interactive Jupyter notebooks, to be worked out collaboratively in groups (of 3–4 members) in class, and submitted individually through Github. 2–4 of the larger modules will also require a presentation from each group. We expect every member of each group to present at least once.

Completing in-class modules	70%
Presentations	30%

Other Information

Canvas. The Canvas module section will be used to post course materials, lecture notes, announcements, grades, and the most up-to-date version of this syllabus (https://unt.instructure.com/). You may use your UNT EUID and password to log on and select this course.

Course Evaluation – Student Perceptions of Teaching (SPOT). Student feedback is an essential part of participation in this course. Providing the student evaluation of instruction instrument is a requirement for all organized classes at UNT.

A short SPOT survey will be made available **Apr 17 – May 4** to provide you with an opportunity to evaluate how this course is taught. You will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Simply click on the link and complete your survey.

Once you complete the survey you will receive a confirmation email. For additional information, please email spot@unt.edu.

Office hours: Connect with me through attending office hours on Tuesdays 2–3 pm right after class! During busy times my inbox may be rather full - if you contact me and don't receive a response within two business days, please send a follow-up email. A gentle nudge is always appreciated.

ADA Policy: The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Access (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the studentFor additional information, refer to the Office of Disability Access website at https://studentaffairs.unt.edu/office-disability-access. You may also contact ODA by phone at (940) 565-4323.

Academic Integrity: UNT policy on Academic Dishonesty can be found at: https://vpaa.unt.edu/ss/integrity

COVID Impact: Please inform me if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community. If you are experiencing any symptoms of COVID (https://www.cdc.gov/coronavirus/2019-ncov/symptoms testing/symptoms.html) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider prior to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.