PHYS 7810
Hydrodynamics
Spring 2024

OVERVIEW

Lectures: TTh 3:30-4:45 PM; Duane G131

Instructor: Andrew Lucas (`andrew.j.lucas@colorado.edu`); Duane F629.
Office hours: Friday 3-4 PM

Canvas: https://canvas.colorado.edu/courses/98862

Books and References: N/A.

Recommended prerequisites: The standard undergraduate sequence in physics, and PHYS 5210, or equivalent.

COURSE OUTLINE

▶ random walks, stochastic processes, dissipative effective theories   ($\approx$ 2 weeks)

▶ diffusion and the onset of hydrodynamics   ($\approx$ 2 weeks)

▶ Navier-Stokes equations and viscous fluid flow   ($\approx$ 6 weeks)

▶ hydrodynamics from kinetic theory   ($\approx$ 2 weeks)

▶ spontaneously broken symmetries: superfluids and elastic solids   ($\approx$ 2 weeks)

▶ hydrodynamics with exotic symmetries: magnetohydrodynamics and fractons   ($\approx$ 1 week)

COURSE POLICIES

▶ All documents are found by clicking appropriate links on the homepage of Canvas.

▶ Lectures will be recorded via Zoom. I intend to allow students to watch the lectures via Zoom instead of in-person, but reserve the right to take away this option.

▶ When I am traveling, I will try to hold class synchronously via Zoom; if this is not possible I will schedule an alternate time.

▶ Standard university policies regarding appropriate conduct on campus also apply to this class, and can be found in writing on the course website.

GRADES

▶ **100% homework:** Homework can be found on the course website, and on Canvas. Homework is **due at or before 11:59 PM on the due date**. Solutions will be posted on Canvas on the third day after the due date. You must upload every homework assignment electronically into Canvas. I anticipate 6-7 homework assignments in this class.

Late/drop policies: Every student starts with 2 extensions, which can be tracked in the ungraded "Extensions Left" assignment in Canvas. Extensions can be used as follows:

  ▶ To receive a no penalty 48 hour extension on the due date for a homework assignment.

  ▶ To drop a homework which was not turned in, *or* a homework which was turned in late but is (at the end of the class) below your average homework score.

  ▶ To drop a low score. (Remaining extensions will be used this way at the end of the class.)

Assuming no apocalypse, I will not give more extensions or push back deadlines. I apply these rules automatically, in the order above, so you do not need to ask for permission to use these extensions.

You can work together on homework, but you must write up your own solutions. Solutions which do not appear original could be given no credit at the discretion of course staff.

Grade cutoffs will be chosen to avoid students being just below a cutoff. The cutoff for A-range grades will be $\leq 80\%$. I expect everyone will get an A-range grade in this advanced class.

The holistic grading method for this class can be found on the course website. Partial credit is assigned on the basis of the entire (sub)problem taken together, and is primarily given based on demonstrated conceptual understanding. Note that you can get full credit with minor (math) mistakes.

Each homework/exam will be graded out of 100 points. The numbers besides each (sub)problem denote the number of points it is worth. If a (sub)problem is worth $5k$ points, you'll receive 0, k, $2k$, $3k$, $4k$ or $5k$ points according to the holistic grading scheme. **There will always be more than 100 points that can be earned. Scores over 100 are possible.** You should expect that the last problem(s) could be very difficult (and rewarding), which is why you do not "need" to solve them to get "full credit" of 100 points.

Consequences for cheating will, at minimum, include receiving a 0 on the assignment(s) in question and a university-required referral to the Honor Code board. Further consequences may occur, at the discretion of the course instructor and graders.