PHYS 5210
Graduate Classical Mechanics
Fall 2022

OVERVIEW

This is a first-year graduate level course on classical Lagrangian and Hamiltonian mechanics. We will cover both broad physical themes (e.g. the effective theory approach to physics) and sketch mathematical concepts (e.g. manifolds, differential forms) in a physics context.

Lectures: 10:10-11:00 AM, MWF, University Club 13

Instructor: Andrew Lucas (`andrew.j.lucas@colorado.edu`); Duane F629.
   Office hours: Sunday 3-4 PM (on Zoom), Monday (in office) 11:10 AM-12:00 PM

Canvas: https://canvas.colorado.edu/courses/82915

Books and References: Not required, but recommended for background reading.

> ▶ J. V. José and E. J. Saletan. *Classical Dynamics: a Contemporary Approach* (Cambridge University Press, 1998).

Recommended prerequisites: The standard undergraduate sequence in physics.

COURSE OUTLINE

▶ Lagrangian mechanics; configuration space as a manifold; effective theories (≈ 4 weeks)

▶ Lagrangian field theory; elastic solids and ideal fluids (≈ 4 weeks)

▶ Hamiltonian mechanics and symplectic geometry (≈ 2 weeks)

▶ Hamilton-Jacobi equation (≈ 2 weeks)

▶ classical chaos (≈ 3 weeks)

COURSE POLICIES

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

▶ Suggested reading is optional, and is posted next to each lecture on the Canvas homepage.

▶ You are free to choose whether to attend class in person or remotely via Zoom. Zoom links will appear via the Canvas Zoom plug-in. Zoom will be used to record lectures. I will try to check the Zoom chat every few minutes, but please remain muted. If I am traveling, I will try to hold class synchronously via Zoom; if this is not possible I will schedule an alternate (likely evening) 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

▶ **60% 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 13 or 14 homework assignments in this class.

Late/drop policies: Every student starts with 3 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.

▶ **40% exam:** We will have a take home exam at the end of the class. You must complete the exam on your own and submit it to Canvas. The exam will be posted at 12 PM on Friday, December 9, and will be due at 11:59 PM on Monday, December 12. **Late submissions may not be graded.**

Grade cutoffs will be chosen to avoid students being just below a cutoff. Guiding principles are:

grade:	A/A–	B+/B/B–	C+/C/C–
curve will not be harsher than:	90%	60%	40%
% of class that should receive at least a...:	$\geq 40\%$	all?	all???

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.