Physics 701: Classical Mechanics

Thornton Hall 210, San Francisco State University — Fall 2017, Tu-Th 5:00-6:30PM

Contact Information

Professor: Andisheh Mahdavi
Email: amahdavi@sfsu.edu (**best way to contact me**)
Website: http://physics.sfsu.edu/∼amahdavi/p701
Office Hours: Tuesday 4-5PM

Office: Thornton Hall 527
Telephone: (415) 338-1697

Prerequisite

Physics 460 (may be taken concurrently). Physics 785 recommended.

Course Description

Lagrangian and Hamiltonian mechanics; motion in arbitrary central force potentials; canonical transformation theory; Liouville's theorem; computer visualizations of phase space trajectories and topologies; collisionless Boltzmann equation applied to stellar and galactic dynamics; Jeans theorems, orbital anisotropy, and phase space distribution functions.

Expected Student Learning Outcomes

At the end of the course, the successful student will be able to use the principle of least action to solve for the time evolution of dynamical systems; to explain the relationship between symmetries and conserved quantities in the Lagrangian; to state and prove basic theorems regarding phase space distribution functions; to use phase space diagrams to shed greater insight into the behavior of dynamic systems; to use moments of the phase space distribution function to describe systems of particles in spherical and axisymmetric galactic potentials.

Textbooks, Materials, and Other Requirements and Fees

- **Textbooks:** Landau and Lifshitz, *Mechanics*; Binney & Tremaine, *Galactic Dynamics*
- **Homeworks**: 8 to 10 assignments, 20% of the grade
- **Two In-class Midterms**: 40% of the grade.
- **Computational Projects:** Numerical calculations carried out via Mathematica or students' preferred scientific computing tool, 10%
- **Take home final:** 30% of the grade.
- **Mathematica:** Mathematica, a computer program for symbolic calculus, will be used throughout the course. It is installed for free use on the machines in the Physics & Astronomy Computer Laboratory (Thornton 123), or you can install it free of charge on your own computer while you are a registered SFSU student. Please contact Alan Der (ader.@sfsu.edu or the COSE helpdesk (http://cosecomputing.sfsu.edu/helpdesk/) for an installation key.

Grading Policy and Key Dates

There is no curve in Physics 701; grading is fixed according to the following scale:
Grading scale: A: 90-100%; A-: 80-90%; B+: 74-80%; B: 67-74%; B-: 60-67%; C+: 54-60%; C: 47-54%; C-: 40-47%; D+: 34-40%; D: 27-34%; D-: 20-27%
Late assignments will receive only partial credit.

Statement on Sexual Harassment

SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Dean of Students. To disclose any such violence confidentially, contact:
The SAFE Place - (415) 338-2208; http://www.sfsu.edu/ safe_plc/.
Counseling and Psychological Services Center - (415) 338-2208 http://psyservs.sfsu.edu/
For more information on your rights and available resources: http://titleix.sfsu.edu.

Students with Disabilities

Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is located in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472) or by email (dprc@sfsu.edu)

Physics 701 Course Calendar

This is a *tenative* calendar of the general order of topics we will cover. It will change as the course evolves.

Month	Topics	Chapters	Notes
August	Mechanics Review	L1	
	Lagrangian mechanics	L1	
September	Constraints		
	Conservations Laws	L2	
	Kepler problem	L3	
	Generalized central force problem	L3	First midterm late September
October	Scattering	L4	
	Hamiltonian mechanics	L7	
	Poisson brackets	L7	
	Liouville's theorem and phase space densities	L7	
November	Potential theory	B&T 2	Second midterm early November
	Orbits of stars in arbitrary potentials	B&T 3	
December	Collsionless boltzmann equation	B&T 4	
	Jeans equations	B&T 4	
	Review		