

Physics 331 – Advanced Mechanics Projects

Schedule: Missing these deadlines or poor work on the intermediate assignments will adversely affect your grade on the project.

- Sept. 25 Deadline to pick a topic. Turn in a paragraph describing what you have in mind.
- Oct. 18 Preliminary bibliography due (not exclusively internet sources or the course text).
- Nov. 1 In consultation with the instructor, come up with a set of calculations, computations, or experiments. Turn in a page describing these.
- Dec. 10 Completed projects presented in poster form in class.

Topics: Your project must have computational aspect to it. The following are some suggestions, but you are welcome to come up with your own. The associated part of the textbook is listed for most of them.

Noether's Theorem – symmetry & conservation laws (7.8)

Lagrangian for electromagnetism (7.9)

Lagrange multipliers & constraints (7.10)

Gravitational slingshot (~ch. 8)

Dark matter (~ch. 8)

Lagrange points (~ch. 8)

Asteroid belts (~ch. 8)

Tides* (9.2)

Foucault pendulum* (9.9)

Tennis racket theorem* (~10.8)

Coupled oscillations (ch. 11)

Chaos (ch. 12) – many possible systems to study

Hamiltonian mechanics (ch. 13)

Collision theory (ch. 14)

Continuum mechanics / waves (ch. 16)

Physics of a sport (pick one)

Inverted pendulum

* The background for these topics is covered somewhat late in the semester, so they will be more challenging.

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Resources: The following are some possible sources of material.

Books: The department has recently acquired a collection of texts you may wish to peruse, you'll find the first four books below in the library, and I have the fifth.

- *Mechanics*, K. Symon
- *Classical Mechanics: A Modern Perspective*, V. Barger and M. Olsson
- *Mechanics*, L.D. Landau and E.M. Lifshitz
- *The Flying Circus of Physics*, J. Walker
- *Classical Mechanics with MatLab Applications*, J. E. Hasbun

Journals: Abstracts for the following can be searched online. The second and fourth cover less advanced material. The first two are available in the library, but articles from the latter two must be requested through interlibrary loan. That takes time, so plan ahead.

- *American Journal of Physics* – <http://scitation.aip.org/ajp/>
- *The Physics Teacher* – <http://scitation.aip.org/tpt/>
- *European Journal of Physics* – <http://www.iop.org/EJ/journal/EJP>
- *Physics Education* – <http://www.iop.org/EJ/journal/PhysEd>