

Capstone Physics 4300

COURSE TITLE: PHYS 4300 – Senior Research Project

PREREQUISITES: Senior standing in the major and permission of the instructor.

COURSE DESCRIPTION: Senior project. 1 to 3 hours. May be repeated once. Total of four hours required for the general education capstone. Research project, experimental, theoretical or computational, to be arranged with individual faculty leading to a senior thesis. Group seminars, practice talks and general discussions of topics of current interest in physics and astronomy, especially those involving scientific ethics.

PARTICIPATION: All students must participate in the “Capstone Experience”.

SPECIFICS:

All majors in their senior year are to complete a research project leading to a final 30-min presentation to be given at the end of their second term and a written thesis. Each project is under the direction of an individual faculty member, and will be extended through both semesters of the senior year, i.e. typically, the final two consecutive semesters (excluding summer) prior to graduation, unless special permission is obtained from the course instructor.

Projects can be experimental, theoretical or computational, or a combination thereof. Successful projects will take an academic year to complete, so students will enroll in PHYS 4300 during both semesters of their senior year for a total of four credit hours, preferably two hours each semester. Typically the student should work about 8 hours per week on the project part of their capstone.

In parallel with the project there will be classroom meetings most Fridays from 4:00 to 5:30. During these meeting the following will take place.

- 1) All students will present a 5 min. introductory talk at the start of their first term and a 15 min. progress talk at the start of their second term. These talks will be the basis for discussions on how to make a good viewgraph and the elements of a good talk.
- 2) All students, in pairs, will present a 15-min. “Ethics” talk on some topic that explores the ethics of doing scientific research. Topics typically involve cases of scientific fraud.
- 3) During the course students will develop a detailed outline both for their talks and final paper. These outlines will be the basis for discussions on how to make a good outline and how to develop that into a good scientific paper. Details of the pitch and style of the paper are to be decided by the Capstone Advisor (not the co-ordinator). For some advisors and certain projects the paper can even be a draft of a paper to be submitted to a journal!

Both the thesis and the final talk should be written to be intelligible to other senior physics and astronomy majors not directly familiar with the research topic. Although, original research is encouraged, no new original research is absolutely necessary. However, the Capstone

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Experience is more than just an extensive library search. For experimentalists typically the Capstone student independently builds up a new apparatus within the lab of his thesis advisor. Similarly computational projects involve the development of models and computer programs within the lab of the advisors. For theory it is very difficult to do truly original work, in this case the student should independently apply theoretical techniques learned from the literature.

The final grade will be a combination of what several different categories. These are listed below along with who grades this work.

- 1) What was achieved toward the completion of the
Capstone Project based on the day to day work. (50% - advisor)
- 2) The final Capstone paper. (20% - advisor)
- 3) The final Capstone talk (20% - advisor and co-ordinator)
- 4) Class participation (10% - co-ordinator)