

## Physics and Astronomy

Tutor: David J. Helfand

Email:

Office:

Phone: (office)

(home)

Office Hours:

### Overview

This course is designed to provide you with a perspective on your place in the Universe, to highlight the limitations of the unaided human senses, and to explore our uniqueness in the cosmos. We will develop a quantitative understanding of our place in space and time, and an appreciation of the origin of the elements of which we are made. We will emphasize quantitative reasoning skills as well as cultivate reflections on the implications of the Copernican Revolution which, once and for all, removed the Earth from the center of the Universe.

### Course work

The course work will consist of lectures, directed discussions, and interactive activities performed in small groups. Evaluation will be based on the following components:

- Four 1- to 2-page essays on assigned topics (20%)
- Four problem sets (20%)
- Class participation (15%)
- Midterm (in-class) exam (with collaborative followup) (20%)
- Final (in-class) exam (with collaborative followup) (25%)

Expectations concerning collaboration: On problem sets, I encourage collaborative learning. Therefore you may work in group of up to three in number; each group should submit ONE set of solutions signed by each member of the group; all will receive full credit for the work accomplished. This provides the opportunity to simply sign your name to a problem set to which you have contributed little or nothing. While I consider this a violation of the honor principle, it is likely to go undetected -- until the exams, at which time students adopting this strategy are likely to fail; be forewarned. Essays should be strictly your own work; all sources, electronic or otherwise, should be cited. In general, however, these are not intended to be research papers, but a set of reflections on what I hope will be a changing view of your place in the Universe, so extensive sourcing will not be required in most cases. Exams, of course are intended to be your own work. You will be allowed to bring a sheet of paper with notes to the exams. All equations, physical constants, etc. will be provided on the exam - this is not a course about memorizing numbers, definitions, or equations -- it is about thinking in a quantitative way. To carry collaborative learning through to the exams, I will review your answers to the morning exam and then, should you choose to return in the afternoon, I

PHYSICS AND ASTRONOMY

will assign you to groups of 2 or 3 and give you one of the problems you missed to work on again as a group; all will receive credit for the new answer submitted. Any questions on any of these issues should be addressed to me EARLY in the semester to avoid any misunderstandings.

**Schedule**

The Class will meet from 9:30-11:30 and 2:30-3:30 every weekday. On Sundays at 6:30 (or a similar time TBD) there will be an optional tutorial.

| DAY   | AM TOPIC                            | PM TOPIC                              | READING      | ASSIGNMENT DUE           |
|-------|-------------------------------------|---------------------------------------|--------------|--------------------------|
| 1     | Our place in the Universe           | The Back of the Envelope              | Habits (1+2) |                          |
| 2     | The Physical Basis of our Senses    | Envisioning the World Anew            |              | ESSAY I ("Us")           |
| 3     | Measuring our Place in Space        | Special Relativity I (space and time) | Mermin       | Problem set 1 (BoE)      |
| 4     | Discovering Expansion               | Sp. Relativity II (simultaneity)      | Mermin       |                          |
| 5     | A Baby Picture of the Universe      | Sp. Relativity III (cause and effect) | Mermin       | ESSAY II (us, revisited) |
| 6,7   |                                     | HELP SESSION                          |              |                          |
| 8     | What is a Star?                     | H-R Activity                          |              | Problem set 2            |
| 9     | Taking Stellar Measurements         | Binary Stars                          |              |                          |
| 10    | Stellar Evolution -- the Sun's Life | Fate of the Solar System              | Habits (3)   |                          |
| 11    | Stellar Nucleosynthesis             | Changing the Binding Energy Curve     |              | Problem set 3            |
| 12    | Stellar Corpses                     | General Relativity                    |              | ESSAY III                |
| 13,14 |                                     |                                       |              |                          |

PHYSICS AND ASTRONOMY

| <b>DAY</b> | <b>AM TOPIC</b>  | <b>PM TOPIC</b>               | <b>READING</b> | <b>ASSIGNMENT DUE</b> |
|------------|--|-------------------------------|----------------|-----------------------|
| 15         | MIDTERM EXAM   | REDO 1 PROBLEM                |                |                       |
| 16         | Formation of the Solar System                                    | Designing a Different Outcome |                |                       |
| 17         | Extrasolar Planets   | How hard is it?               | Habits (6 + 7) |                       |
| 18         | Extrasolar Planets   | Future Prospects              |                |                       |
| 19         | Life in the Universe   | Extraterrestrials Debate      |                | Problem set 4         |
| 20,<br>21  |  |                               |                |                       |
| 22         | Our place in the universe: is it unique? (Why aren't they here?) | Review                        |                | ESSAY IV              |
| 23         | FINAL EXAM   | REDO 1 PROBLEM                |                |                       |
| 24         | Student Presentations  | Lunch and Reflections         |                |                       |