

# Syllabus:

(Also see <http://eeyore.astro.uiuc.edu/~lwl/classes/astro100/fall03/>)

## Astronomy 100: Perspectives in Astronomy

### Instructor and TA Info

|                      |  |               |                              |
|----------------------|--|---------------|------------------------------|
| <b>Instructor:</b>   | Prof. Leslie Looney                      | <b>Email:</b> | lwl @ uiuc . edu             |
| <b>Office:</b>       | 218 Astronomy                            | <b>Phone:</b> | 244-3615                     |
| <b>Office Hours:</b> | MTF, 10:30 – 11:30 am; or by appointment |               |                              |
| <b>TA:</b>           | Justin Lowry                             | <b>Email:</b> | jdlowry @ astro . uiuc . edu |
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| <b>Office Hours:</b> | TBA                                      |               |                              |

### Welcome to Astronomy!

You have chosen a great time to take this course. Astronomy is right now in a golden age, with an explosion of new images and data about the Solar System, the Galaxy, and indeed the whole Universe coming from many new ground-based and space-based telescopes. Our scientific view of the big picture--the nature of the physical universe--underwent a revolution in the 20th century, and further discoveries are on the horizon. In this course, you will get an understanding of the big astronomical picture. We will survey what astronomy teaches us about the physical universe, what are some of the fundamental mysteries that remain unsolved, and how the flood of new data will help to solve them.

### Course Goals

My goal is that a graduate of this course will understand our current scientific view of the universe, future discoveries and how they fit into, enlarge, or challenge our current ideas, and finally be able to make informed opinions about scientific policy. To this end, the course will focus on:

- *The Big Picture*--the basic organization of the cosmos from subatomic scales to the entire Universe
- *Basic Physical Laws*--the rules that nature follows, and how to apply them to understand astronomical observations and events
- *Key Discoveries*--the answers to questions such as: How does the Sun shine? How do stars form? What are black holes and what evidence for them exists? Why do we believe in dark matter? What will be the future fate of the universe, and how can we predict this?

Astronomy is an example of a vital, active science. Our survey of astronomical history, ideas, and methods gives use the opportunity to examine what science is, and how science works as a dynamic and human enterprise. We will in particular emphasize

- *the scientific method*--what it is, and how scientists breathe life into this approach
- *problem solving*--sometimes using a little algebra
- *"critical thinking"*-- i.e., careful, logical, rigorous thinking about problems.

### Credit Hours and Exclusions

This course gives 3 hours credit. Credit is **not given** to students with credit in ASTR 121 or 122. Also, this course is **not open** to students with credit in PHYCS 102, PHYCS 112, or equivalent. Students with credit in PHYCS 111 are encouraged to take ASTR 210.

# Course Requirements

| Requirement                            | Percentage of Grade |      | Points |
|--|---------------------|------|--------|
| Class Participation (best 5 of 7)      | 5 x 1% each         | 5%   | 50     |
| Homework and Observing (best 10 of 12) | 10 x 2.5% each      | 25%  | 250    |
| 2 Hour Exams                           | 2 x 20% each        | 40%  | 400    |
| Final Exam                             |                     | 30%  | 300    |
| <b>Total</b>                           |                     | 100% | 1000   |

## Grading

The following table shows the approximate grading scale in this course.

| Grade | Approximate Range |
|-------|-------------------|
| A     | 90-100%           |
| B     | 80-89%            |
| C     | 70-79%            |
| D     | 60-69%            |
| F     | < 60%             |

Final course grades will follow these guidelines. Plusses and minuses will be used.

The ranges are approximate in that I may have to adjust them if, for example, I give an exam that is a little too hard. In any case, I will not increase the minimum cutoffs for each letter grade.

## Text

Niel F. Comins & William J. Kaufmann, *Discovering the Universe*, 6th edition, 2003.

Earlier editions of this book are also acceptable, but will not have discussions of a few recent hot topics covered in the latest edition.

## Exams

Exams will consist of multiple choice and perhaps one-word or two-word answers. There will be two in-class hour exams and a comprehensive final exam. Dates are as follows.

- Hour Exam 1: In Class Friday, October 10th
- Hour Exam 2: In Class Friday, November 14th
- Final Exam: **7:00-10:00 pm Monday, December 15th**

## Homework

There will be 9 homework assignments given throughout the course. These will be multiple choice, and are meant to sharpen your thinking on the material covered in lecture and to help prepare you for the exams. Homework is due at the beginning of class or at the announced time, after which the answers will be made available. **No late homework will be accepted.**

Homework and observing together count for 25% of the final grade, with the top 10 grades counting and the lowest 2 scores dropped. If you do more than one observing assignment, then these may offset any missed or low homework scores. However, you are responsible for all of the material covered on all 9 homework assignments. Thus, it is to your advantage to do all 9 of the homework assignments, and hand them in on time.

## Observing

You are *required* to do at least **one** of the following observing projects. It is to your advantage to do more than one, however, since (a) additional observing scores can help to offset up to 2 missed or low homework scores, and (b) most students find that the observing sessions are fun, and it a chance for the instructor and TA to meet you more informally.

### Nighttime Observing

Evening observing sessions will be held for several weeks at the Campus Observatory. Dates and times for the observing sessions are posted on the class webpage.

At the session there will be 4 stations that you will visit. Expect to stay a full hour, and dress warmly. The weather is unpredictable, and some scheduled nights must be cancelled due to clouds, so it is best to go as early as possible.

While you only need to observe for one night, you must be available to do this for several evenings, since there is no way to guarantee that weather will permit observing on any one night. If you are unavailable for night observing, see the instructor immediately.

Report. A form is available in pdf format from the class webpage containing instructions and questions to be answered before, during, and after your session. The report will be graded out of 30 points. The report is **due one week after your session**. Late reports will be deducted -5 points per day.

### Solar Observing

Daytime sessions to observe the sun are held at the Campus Observatory. Dates and times for the observing sessions are posted on the class webpage. Sessions are held from 10:30am to 3:30 pm. You may go any time during these hours; the session will take about 30 min for observing and hearing a presentation from the TA on duty. As with nighttime observing, the weather is unpredictable, so go early.

While you only need to observe for one day, you must be available to do this for several days, since there is no way to guarantee that weather will permit observing on any one night. If you are unavailable for daytime observing, see the instructor immediately.

Report. A form will is available in pdf format from the class webpage containing instructions and questions to be answered before, during, and after your session. The report will be graded out of 30 points. The report is **due one week after your session**. Late reports will be deducted -5 points per day.

### "Virtual" Observing: Planetarium

Special presentations designed for Astronomy 100 students will be held at Staerke Planetarium at Parkland College at 2400 W. Bradley Ave. in Champaign.

**Show dates:** Shows will be held on September 3, 8, 9, 15, 16, 17, and 18. Each session begins at 6:30 pm and runs for one hour. Although weather is not a factor for the planetarium, seating is limited, so again it is in your interest to go early in the semester. **You must reserve a seat in advance** at <http://www.astro.uiuc.edu/classes/planetarium/reservation.php>.

**Admission Charge:** A **\$3 charge is required** and must be paid *in cash at the planetarium*. Bring exact change.

**Transportation and Location:** You are responsible for your own transportation; maps and bus schedules are available online at <http://www.astro.uiuc.edu/classes/planetarium>.

**Report:** A form is available in pdf format from the class webpage, containing a series of questions about what you learn during your visit. The report will be graded out of 30 points. The report is **due one week after your show**. Late reports will be deducted -5 points per day.

Remember that the planetarium will be dark!

## Class Participation

You are expected to attend the lectures. I will cover material here that will not always be in the text, and the lecture material will be included on the exam.

Class time is the most valuable for you if you come prepared, having done the reading and ready to actively engage the material. To encourage your engagement, the lectures will often be punctuated by opportunities for your feedback, in the form of asking questions, "voting" on the possible outcomes of observations or demonstrations, or brainstorming answers to open-ended questions. To reward your participation in these activities, you will occasionally be asked to write down and hand in your response.

These *participation surveys* are not "quizzes" in the usual sense, in that you are not required to get all answers right. Rather, to get full credit you simply must offer a *scientifically reasonable* response. The point of this is that the survey is always an opportunity to gain points as long as you are actively engaged, even if you are still a little confused. Indeed, the most difficult and potentially confusing subjects are precisely those that most require your participation!

Each survey is worth 10 points. Of these, your name is worth 5 points, while you will receive the remaining 5 points for any *scientifically reasonable* (but not necessarily correct!) response. There will be a number of these through out the semester, but only 7 will be handed in for credit and your total participation score will be the 5 best of 7. This means that you can miss 2 surveys without penalty.

## Academic Integrity and Collaborative Work

Academic honesty is essential to this course and the University. Any instance of academic dishonesty (including but not limited to cheating, plagiarism, falsification of data, and alteration of grade) will be documented in the student's academic file. In addition, the particular exam, homework, or report will be given a zero.

*Guidelines for collaborative work:* Discussing course material with your classmates is in general a good idea, but each student is expected to do his or her own work. On homework, you may discuss the questions and issues behind them, but you are responsible for your own answers. In writing observing and planetarium reports, you may discuss with classmates during the activity, but again, you are must give your own answers in your own words. Finally, on exams your work and your answers must of course be your own.

For further info, see [http://www2.uiuc.edu/admin\\_manual/code/rule\\_33.html](http://www2.uiuc.edu/admin_manual/code/rule_33.html).

## Accessibility Statement

To insure that disability-related concerns are properly addressed from the beginning, students with disabilities who require reasonable accommodations to participate in this class are asked to see the instructor as soon as possible.

# Course Schedule

**Course Schedule.** Note that the lecture material may vary, but the assignment dates are fixed. Visit this webpage to see updates to the topics.

| Date                                     | Topic                                       | Reading  | Assignment Due    |
|--|---|--|-------------------|
| Aug 27                                   | Introduction                                | Syllabus, Essentials I                         |                   |
| Aug 29                                   | Night Sky                                   | Ch 1-1 to 1-4                                  |                   |
| Sept 1                                   | Labor Day -- no class                       |  |                   |
| Sept 3                                   | Phases of the Moon                          | Ch 1-5 to 1-8                                  |                   |
| Sept 5                                   | Eclipses                                    | Ch 1-9 to 1-11, 2-1                            | <b>HW 1</b>       |
| Sept 8                                   | Planetary Motion                            | Ch 2-1 to 2-3                                  |                   |
| Sept 10                                  | Kepler's laws                               | Ch 2-3, 2-4                                    |                   |
| Sept 12                                  | Galileo and Newton                          | Ch 2-4, 2-5                                    | <b>HW 2</b>       |
| Sept 15                                  | Newton's Laws                               | Ch 2-5, 2-6                                    |                   |
| Sept 17                                  | Gravity and Planet Motion                   | Ch 2-6   |                   |
| Sept 19                                  | Introduction to the Solar System            | Essentials II 4-5                              |                   |
| Sept 22                                  | Solar System Composition, Earth as a Planet | Ch 4-5, 5-3                                    |                   |
| Sept 24                                  | The Earth and the Moon                      | Ch 5-1, 5-2, 5-3, 5-5, 5-6, 8-7, 8-9, 8-10     |                   |
| Sept 26                                  | The Moon, the Inner Planets: I              | Ch 5-7, 5-8, 6-1, 6-2, 6-5, 6-6, 6-7, 6-8      | <b>HW 3</b>       |
| Sept 29                                  | Inner Planets: II                           | Ch 6-9 thru 6-14                               |                   |
| Oct 1                                    | Outer Planets                               | Ch 7-1, 7-2, 7-3, 7-9, 7-10, 7-12 thru 7-17    |                   |
| Oct 3                                    | Asteroids & Comets                          | Ch 8-1, 8-3, 8-4 thru 8-8                      | <b>HW 4</b>       |
| Oct 6                                    | Formation of the Solar System               | Essentials II-1 thru II-5                      |                   |
| Oct 8                                    | Exoplanets                                  | Essentials II-6                                |                   |
| Oct 10                                   | <b>Hour Exam 1</b>                          |  |                   |
| Oct 13                                   | The Sun                                     | Ch 9-1, 9-4, 9-5                               |                   |
| Oct 15                                   | Structure of the Sun                        | Ch 9-1, 9-4, 9-5, 9-7, 9-8                     |                   |
| Oct 17                                   | Solar Energy                                | Ch 9-7, Ch 4-5                                 |                   |
| Oct 20                                   | Fusion in the Sun                           | Ch 9-7, 9-8, 9-9                               |                   |
| Oct 22                                   | Properties of light                         | Ch 3-1, 3-2, 3-3, 3-4                          |                   |
| Oct 24                                   | Telescopes                                  | 3-5 thru 3-12                                  | <b>HW 5</b>       |
| Oct 27                                   | Light and atoms                             | Ch 4-1 thru 4-4, 4-6                           |                   |
| Oct 29                                   | Properties of Stars                         | Essentials III-1, Fig III-3, Ch 10-1 thru 10-4 |                   |
| Oct 31                                   | Masses and Lifetimes of Stars               | Ch 10-7, 10-8                                  | <b>HW 6</b>       |
| Nov 3                                    | Stellar Life Cycle: 1 $M_{\text{sun}}$      | Ch 11-1, 11-7, 11-9, 11-10, 12-1, 12-2         |                   |
| Nov 5                                    | Stellar Life Cycle: Massive Stars           | Ch 11-6, 11-11, 11-12, 12-4, 12-5, 12-6, 12-7  |                   |
| Nov 7                                    | Neutron Stars                               | Ch 12-9, 12-10, 13-1, 13-2                     | <b>HW 7</b>       |
| Nov 10                                   | Black Holes: I                              | Ch 13-1, 13-2                                  |                   |
| Nov 12                                   | Black Holes: II                             | Ch 13-3, 13-4, 13-5, 13-6                      |                   |
| Nov 14                                   | <b>Hour Exam 2</b>                          |  |                   |
| Nov 17                                   | The Search for Extraterrestrial Life        | 18-1 to 18-6                                   |                   |
| Nov 19                                   | The Milky Way Galaxy                        | Ch 14-1 to 14-7                                |                   |
| Nov 21                                   | Galaxies                                    | Ch 15-1 to 15-5                                |                   |
| Nov 24-Nov 29                            | Thanksgiving Break                          |  |                   |
| Dec 1                                    | Active Galaxies and Clusters                | Ch 15-6 to 15-12                               |                   |
| Dec 3                                    | The Big Bang                                | Ch 15-10 to 15-12, 17-1 to 17-5                |                   |
| Dec 5                                    | The Primeval Fireball                       | Ch 17-9, 17-11                                 | <b>HW 8</b>       |
| Dec 8                                    | Big Bang Nucleosynthesis                    | Ch 17-8, 17-13 to 17-15                        |                   |
| Dec 10                                   | Finale: The Very Early Universe             | Ch 17-8  |                   |
| Dec 12                                   | Review                                      |  | <b>HW 9</b>       |
| <b>7:00-10:00 pm, Monday December 15</b> |   |  | <b>FINAL EXAM</b> |