

Astronomy 100

Section 2– MWF 1200-1300

100 Greg Hall



Leslie Looney

Phone: 244-3615

Email: lwl @ uiuc . edu

Office: Astro Building #218

Office Hours:

**MTF 10:30-11:30 a.m. or by
appointment**

Aug 27, 2003

Astronomy 100 Fall 2003

Welcome to Astro 100



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.

Aug 27, 2003

Astronomy 100 Fall 2003

Course Goals



- *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?
- *"critical thinking"*—i.e., careful, logical, rigorous thinking about problems

Aug 27, 2003

Astronomy 100 Fall 2003

Astronomy is not Astrology!



- Although they come from similar origins, there is no longer any correlation at all.
- There are more than 12 constellations on the ecliptic— it's a random thing really.
- The zodiac signs were picked 2000 years ago, and since then the Earth has precessed, and someone born "in" Virgo is actually a Libra.
- We'll see more of this next week.

Aug 27, 2003

Astronomy 100 Fall 2003



Astronomy: The Big Picture



Aug 27, 2003

Astronomy 100 Fall 2003

Type of Course



I expect some interactivity and responses,
not just my voice.

For example: What have you seen in the
sky?

Aug 27, 2003

Astronomy 100 Fall 2003

Power of Tens



<http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/index.html>

Aug 27, 2003

Astronomy 100 Fall 2003

The Night Sky



Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap010627.html>

Our Earth

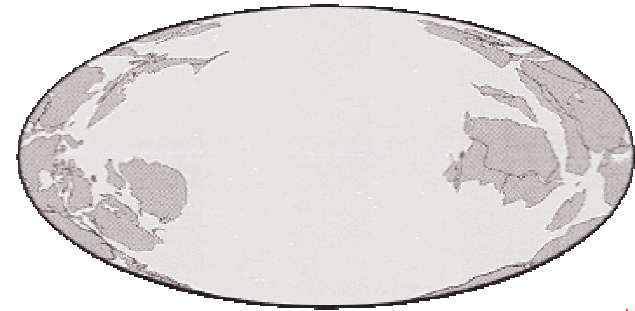


Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap010204.html>

Earth as a Planet



Million of years ago

<http://www.ucmp.berkeley.edu/geology/anim1.html>

Aug 27, 2003

Astronomy 100 Fall 2003

The Moon

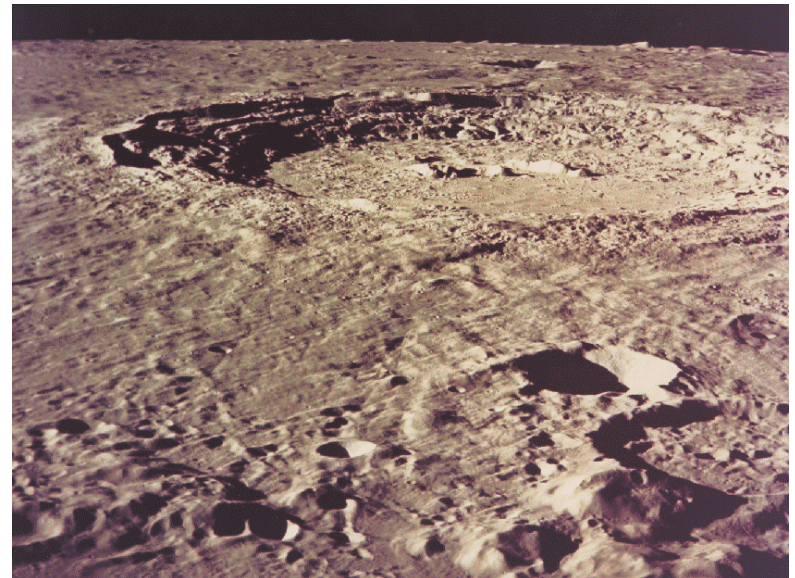


Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap000113.html>

Craters (Copernicus)

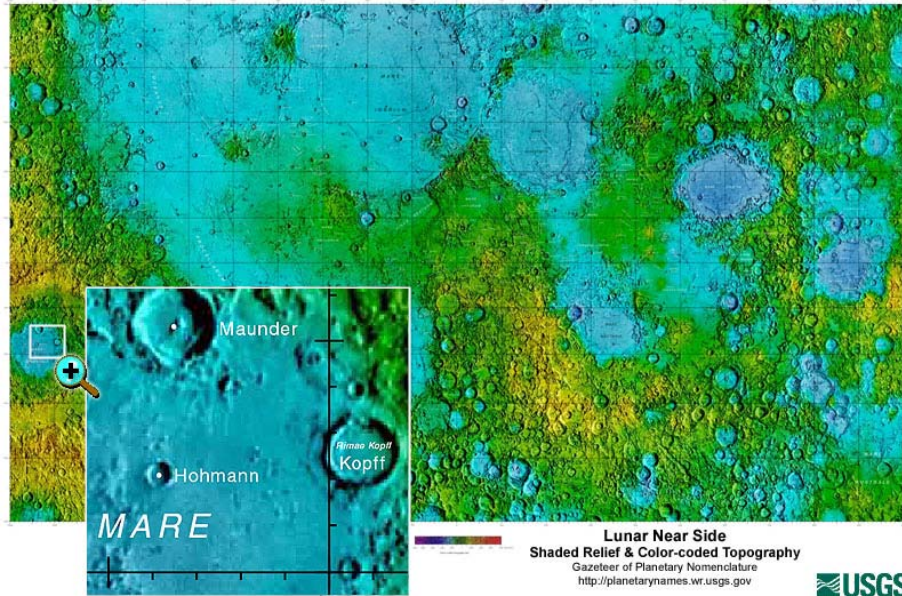


Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap980909.html>

Craters

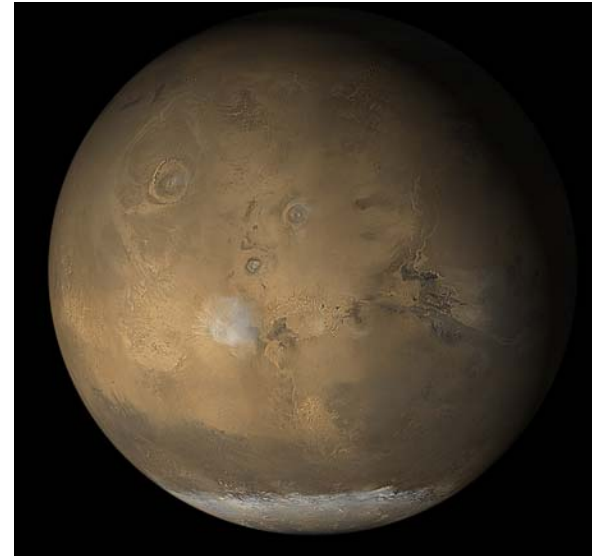


Aug 27, 2003

Astronomy 100 Fall 2003

http://planetarynames.wr.usgs.gov/luna_ccsr.html

Mars



Aug 27, 2003

Astronomy 100 Fall 2003

http://www2.jpl.nasa.gov/files/images/hires/6_10_tharsis_high.jpg

What's Up with Mars?



Mars was closer to the Earth today than it has been in the last 60,000 years!

At 4:50 this morning, Mars was only 34,646,418 miles (55,758,006 kilometers) away from the Earth. But Mars will appear big and bright for weeks.

Mars will appear about 5 times larger than usual.

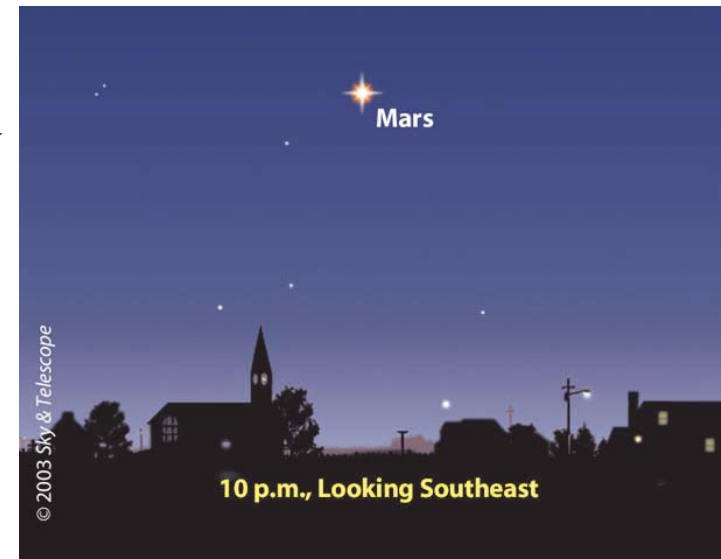
Aug 27, 2003

Astronomy 100 Fall 2003

Where is Mars?



This means that Mars looks like a bright star in the late evening sky. You can't miss it! You should notice the planet's yellow-orange hue.



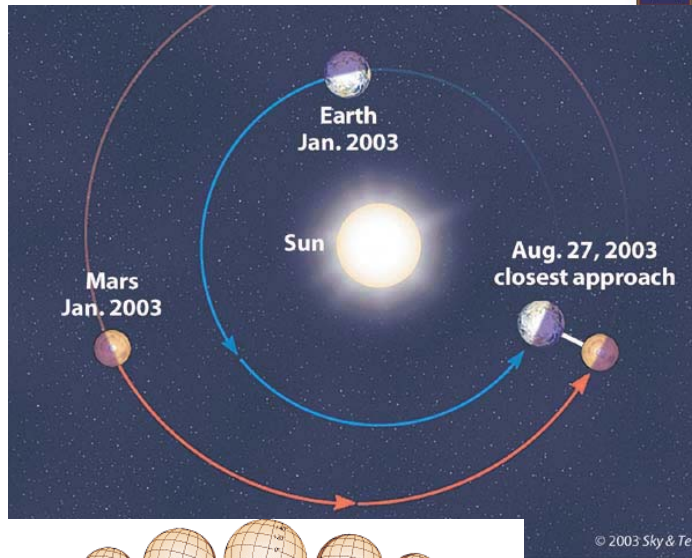
Aug 27, 2003

Astronomy 100 Fall 2003

Is this a big deal?



Mars gets close to Earth every 15 or 17 years. Varying in distance from about 35 million miles to 249 million miles. But due to orbit factors, this is the closest until August 28, 2287!



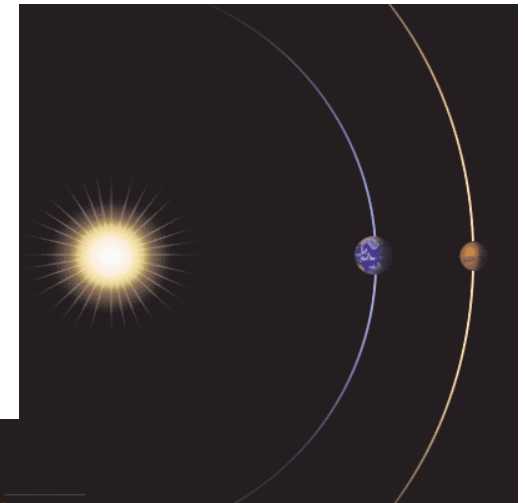
Aug 27, 2003



Why?



1. The Earth and Mars are at opposition— The Sun and Mars are on opposite sides of the sky.
2. Orbital tugging modifies elliptical and tilted orbits slightly.



Fall 2003

<http://mars.jpl.nasa.gov/allabout/nightsky/nightsky03.html>

Jupiter's Spot



Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap990718.html>

Neptune's Spot (spotless?)

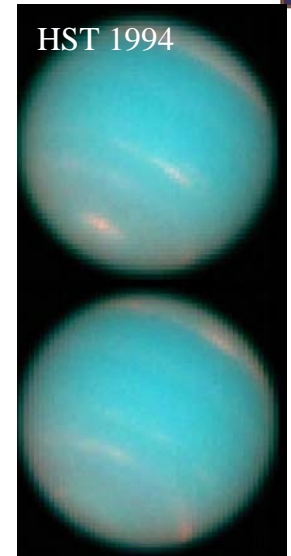


Voyager 1989



Aug 27, 2003

HST 1994



Astronomy 100 Fall 2003

http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-neptune.html

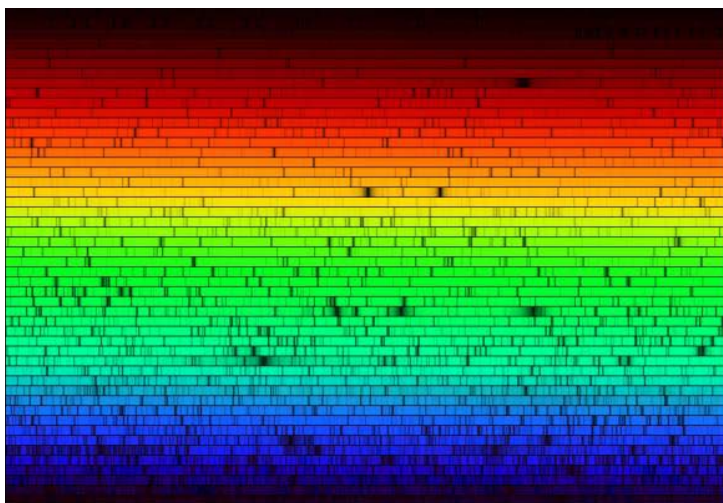
What Color is Sunlight?



Spectrum of Sun (prism-like). Is indeed brighter in the yellow/green.

Dark spots are absorption from the surface.

Helium was first detected in the Sun.

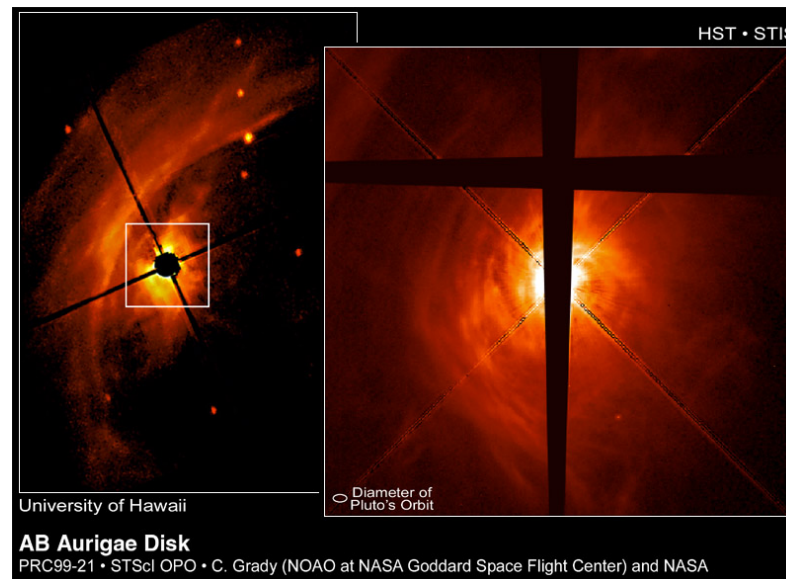


Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap000815.html>

Formation of Stars and Planets



University of Hawaii

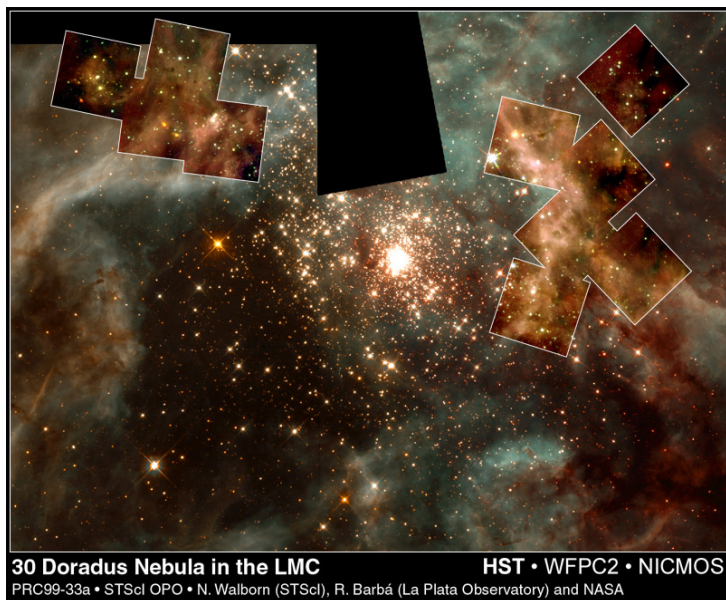
AB Aurigae Disk

PRC99-21 • STScI OPO • C. Grady (NOAO at NASA Goddard Space Flight Center) and NASA

Aug 27, 2003

Astronomy 100 Fall 2003

Young Massive Stars



30 Doradus Nebula in the LMC

PRC99-33a • STScI OPO • N. Walborn (STScI), R. Barbá (La Plata Observatory) and NASA

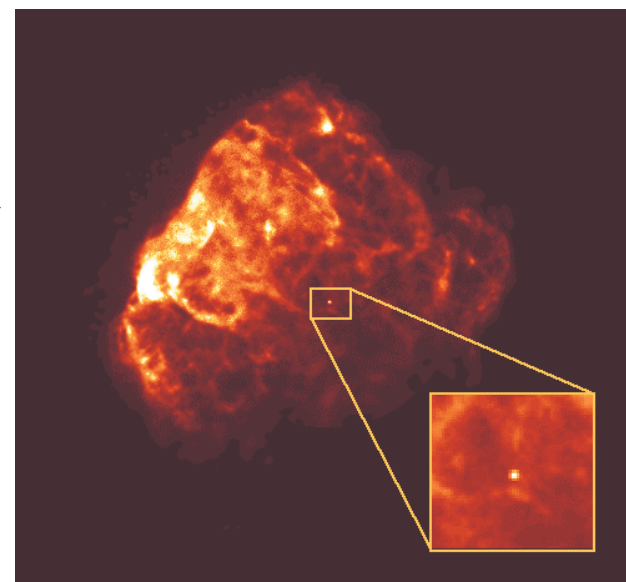
Aug 27, 2003

Astronomy 100 Fall 2003

Death of Stars



X-ray image of the death of a star— a supernova has blown this huge shell into space. At its center is the remnant— a neutron star.



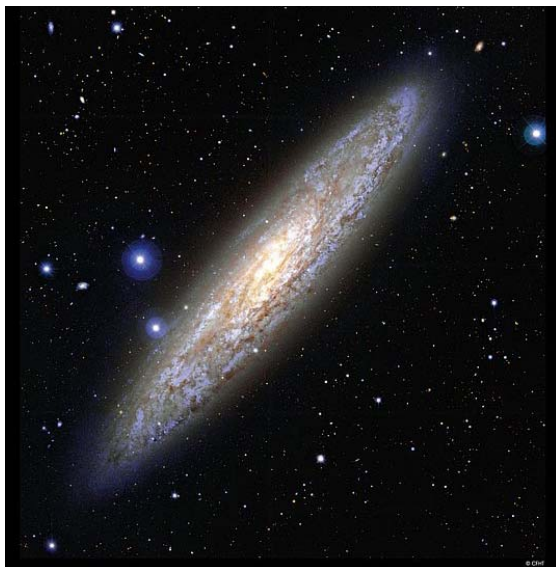
Aug 27, 2003

Astronomy 100 Fall 2003

Galaxies



Spiral Galaxy NGC 253, almost sideways. About 10 million light years away. NGC 253 is considered a starburst galaxy because of high star formation rates and dense dust clouds in its nucleus. The energetic nuclear region is seen to glow in X-ray and gamma-ray light.



Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap030525.html>

More Galaxies



M74: The Perfect Spiral. More than just another pretty face, this galaxy has about 100 billion stars and is 30 million light years away. Taken by the state of the art telescope, the Gemini North on Mauna Kea in Hawaii.



Aug 27, 2003

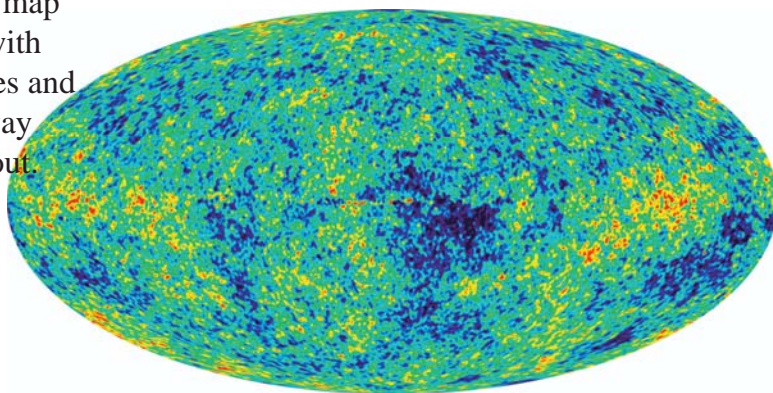
Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap030524.html>

Leftovers of the Big Bang



Microwave map of the sky with point sources and our Milkyway subtracted out.



The small variations allow the dating of the age of the universe-- 13.7 billion years old! And good to 1%.

Aug 27, 2003

Astronomy 100 Fall 2003

<http://antwrp.gsfc.nasa.gov/apod/ap030212.html>

Grades



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
Total		100%	1000

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

Aug 27, 2003

Astronomy 100 Fall 2003

Class Participation



Class Participation

- You should attend lectures
- 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.

Aug 27, 2003

Astronomy 100 Fall 2003

Homework



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

Aug 27, 2003

Astronomy 100 Fall 2003

Observing



Observing

3 observing assignments. You are *required* to do at least **one** of the 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 a chance to meet the instructor and TA more informally.

Aug 27, 2003

Astronomy 100 Fall 2003

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 class webpage.
- At the session there will be 4 stations which 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, 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.

Aug 27, 2003

Astronomy 100 Fall 2003

Solar Observing



- Daytime sessions to observe the sun are held at the Campus Observatory. Dates and times for the observing sessions posted on website.
- 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 be available, 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.

Aug 27, 2003

Astronomy 100 Fall 2003

"Virtual" Observing: Planetarium



- Special presentations designed for Astronomy 100 students will be held at Staerke Planetarium at Parkland College at 2400 W. Bradley Avenue in Champaign.
- **Show dates:** Shows will be held on XXX Seating is limited, so go early. Sessions start at 6:35pm and run for about an hour.
- **Admission Charge:** A **\$3 charge** is required and must be paid *in cash at the planetarium*. You **MUST** reserve a seat in advance on the webpage:
<http://www.astro.uiuc.edu/classes/planetarium/reservation.php>.
- **Transportation and Location:** You are responsible for your own transportation. Maps and bus schedules are available online.
- **Report:** A form is available 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.

Aug 27, 2003

Astronomy 100 Fall 2003

Yuck-- Exams



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: Friday, October 10th
- Hour Exam 2: Friday, November 17th
- Final Exam:

7:00-10:00 pm, Wednesday December 17

Aug 27, 2003

Astronomy 100 Fall 2003