Astronomy 210

Section 1– MWF 1500-1550

134 Astronomy Building

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

This Class (Lecture 1):

Introductions

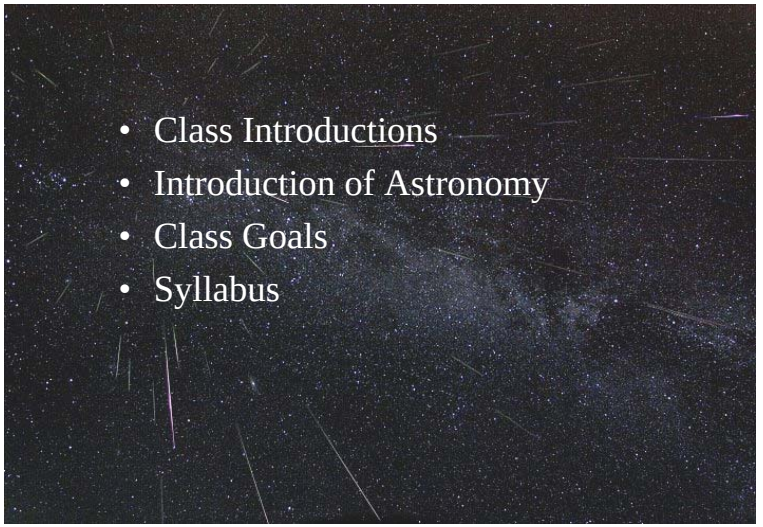
Next Class:

The Night Sky

http://eeyore.astro.uiuc.edu/~lwl/classes/astro210/spring05/

Music: *Pets* – Porno for Pyros

Outline



- Class Introductions
- Introduction of Astronomy
- Class Goals
- Syllabus

Welcome to Astro 210

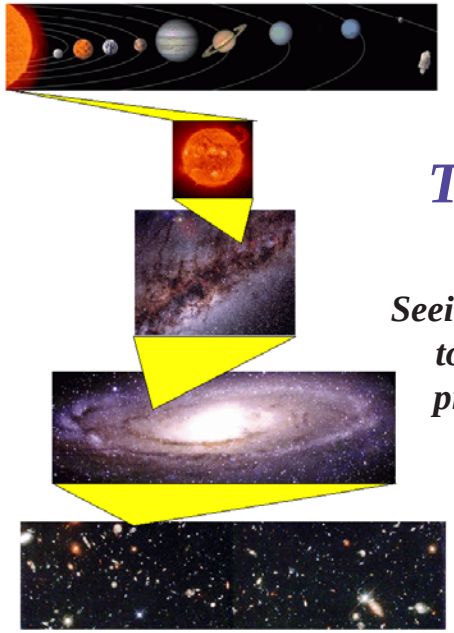
- It's a great time to take this course! Astronomy is in a golden age!
- In 1995, we knew of 9 planets. Now, in 2005, we know of about 200 planets around numerous suns.
- In the near future, NASA missions may find life on Titan or Europa, evidence of life of Mars, or image Earth-like planets around nearby stars.
- We will address the Universe with scientific methods, but also perhaps with some philosophy and science fiction thrown in too.
- In this course, you will get an understanding of the big astronomical picture.

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

Astronomy is not Astrology!

- In the ancient world, astronomy and astrology went hand-in-hand
- Many ancient astronomers were also astrologers
- Today, they are not connected
- Scientific tests of astrology show it's predictions are no more accurate than random chance
- Nevertheless, more people earn income casting horoscopes than doing astronomical research
- The zodiac signs were picked 2000 years ago, and since then the Earth has precessed, and someone born "in" Virgo is actually a Libra.



Astronomy: The Big Picture

Seeing how all these pieces fit together into a coherent picture of our Universe!

Type of Course

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

Feel free to interrupt me and ask questions, or pose new points, etc.

So….

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.
- Although the number of these are not set, often they come upon me on a whim, usually we will have 8-15 of these a semester, and 1-3 of them are dropped. This *usually* means that you can miss 1-3 surveys without penalty.

Type of Course

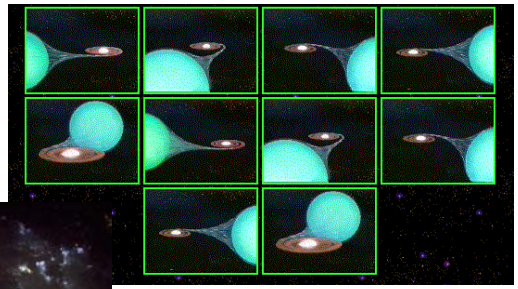
For example: What have you seen in the sky?

What is Astronomy?

- Quite simply, astronomy is the scientific study of the Universe beyond our Earth
- It is an ancient discipline, tracing back to the dawn of history
- It is a broad science, crossing the boundaries of physics, geology, chemistry, and biology

Some Key Questions

What happens when stars collide?

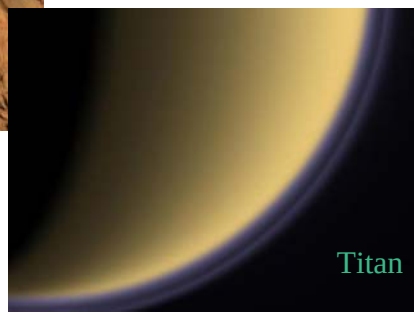


What happens when *galaxies* collide?

Is There Anyone Out There?

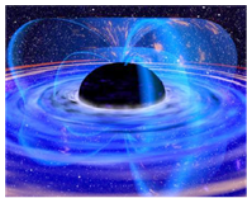
Could there be life in a place like this?

Or perhaps a place like this?

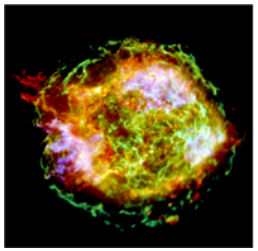


Should we be AFRAID?

- Will giant asteroids doom the earth?
- Will gamma-rays from an exploding star irradiate us?



- Will we be swallowed by a black hole?



Where Do We Come From?

- How can clouds of gas and dust form stars, worlds - and us?
- … and where are we going?

Power of Tens

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

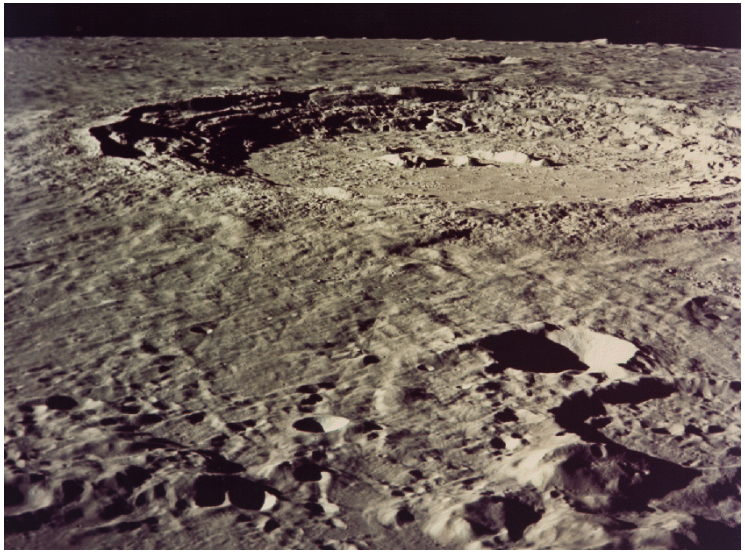
The Night Sky

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

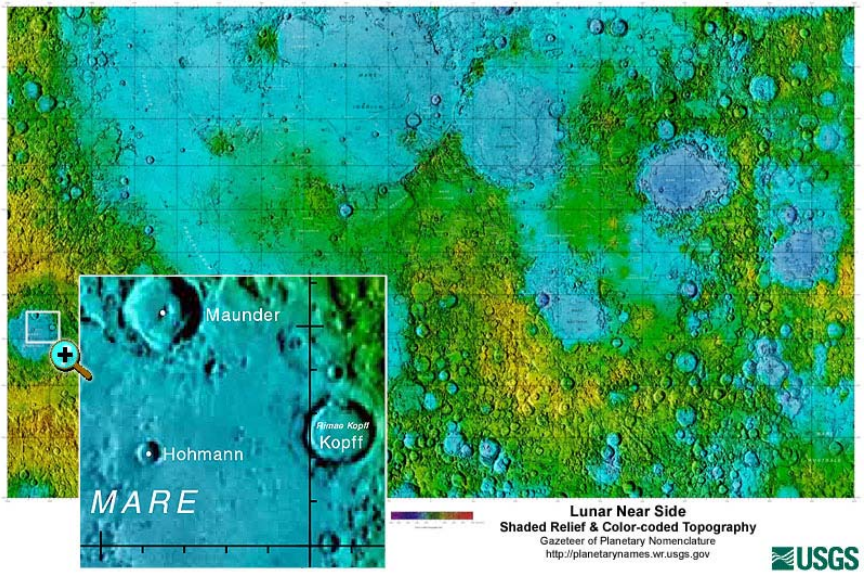
Our Earth

The Moon

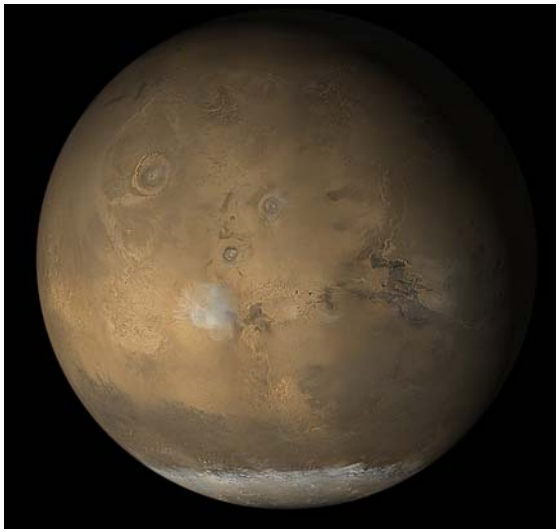
Craters (Copernicus)



Craters

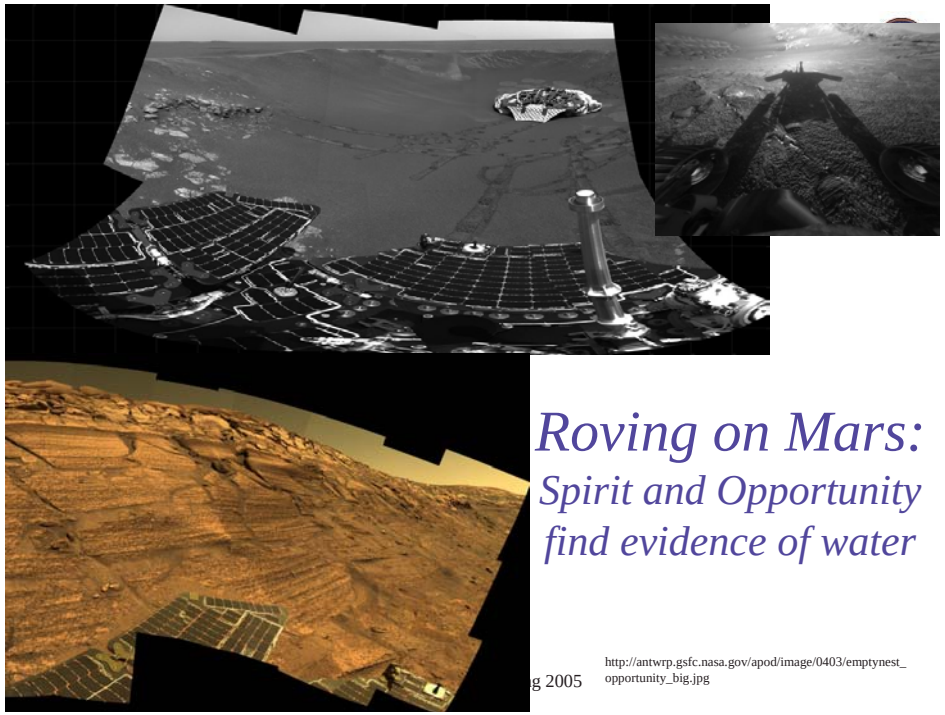


Mars



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

Roving on Mars

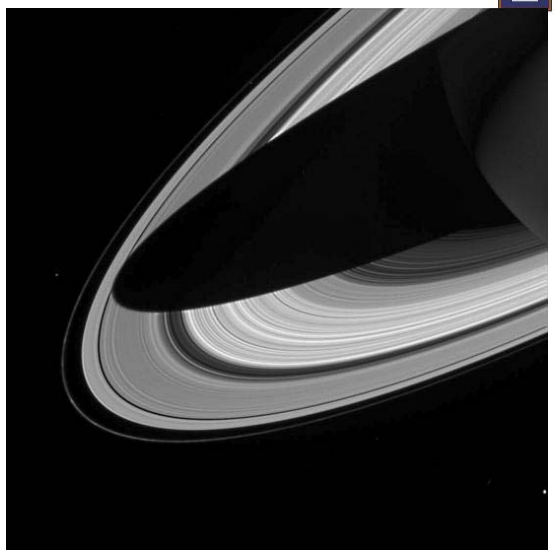


Roving on Mars:

Spirit and Opportunity find evidence of water

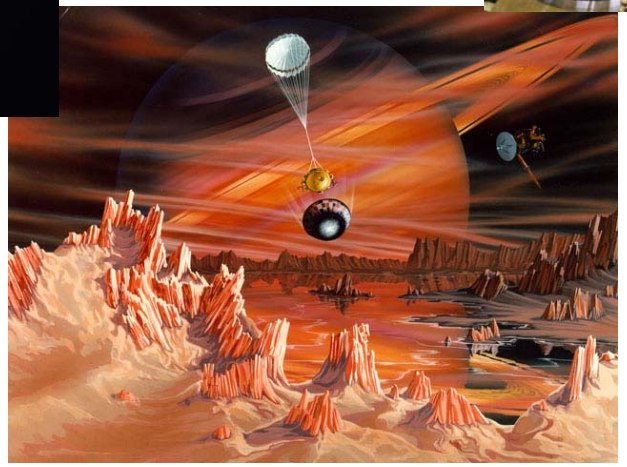
http://antwrp.gsfc.nasa.gov/apod/image/0403/emptynest_opportunity_big.jpg

Cassini Explores the Ring World



http://saturn.jpl.nasa.gov/cgi-bin/gs2.cgi?path=../multimedia/images/rings/images/PIA05417.jpg&type=image

Cassini:
Life on Titan?



The Huygens probe touched down on the 14th!

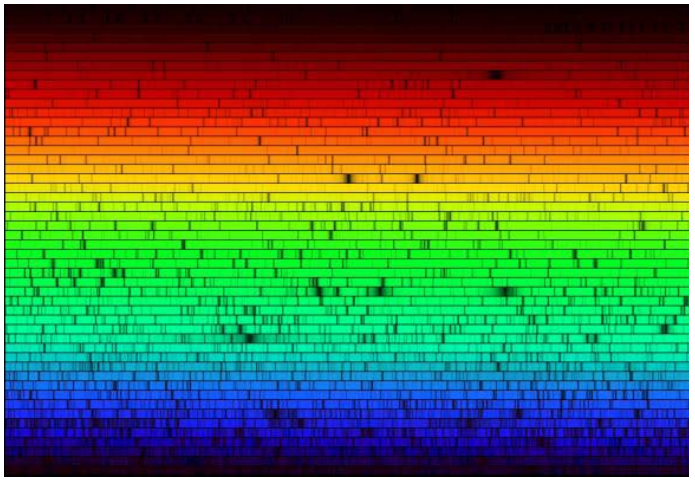
http://antwrp.gsfc.nasa.gov/apod/ap041220.html

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.



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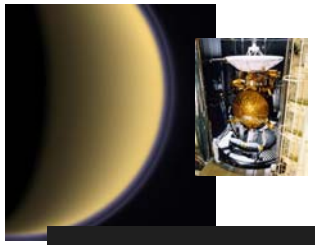
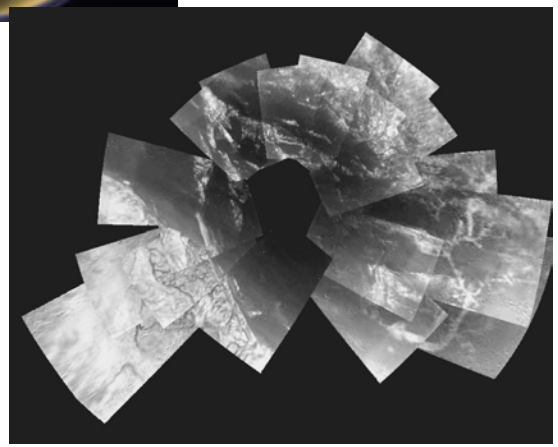


Cassini:
First Images

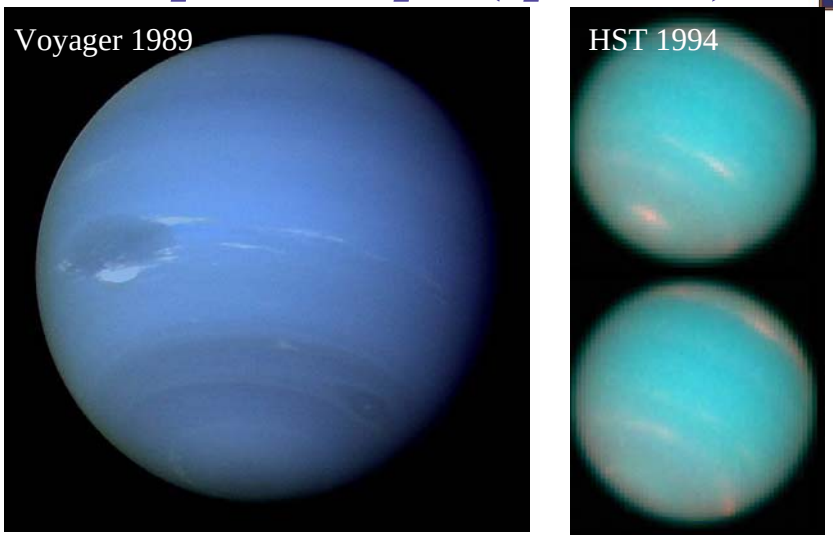


http://www.esa.int/SPECIALS/Cassini-Huygens/SEMC8Q71Y3E_0.html

Jupiter's Spot

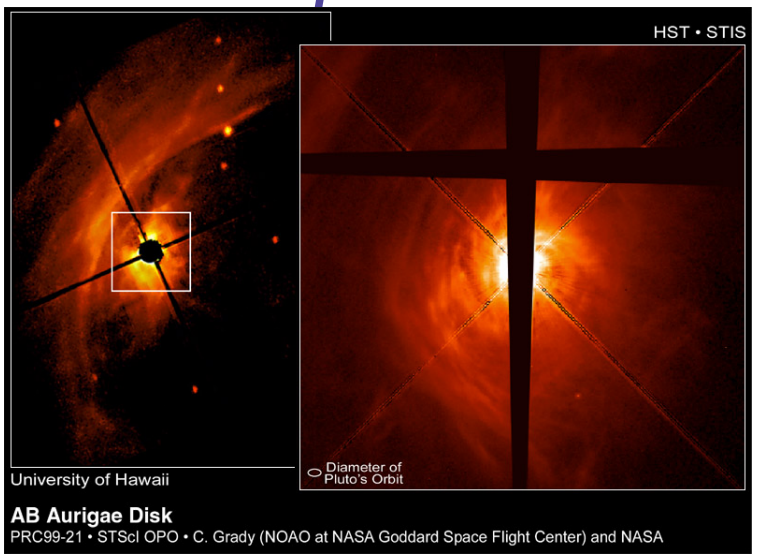
http://antwrp.gsfc.nasa.gov/apod/ap990718.html

Neptune's Spot (spotless?)

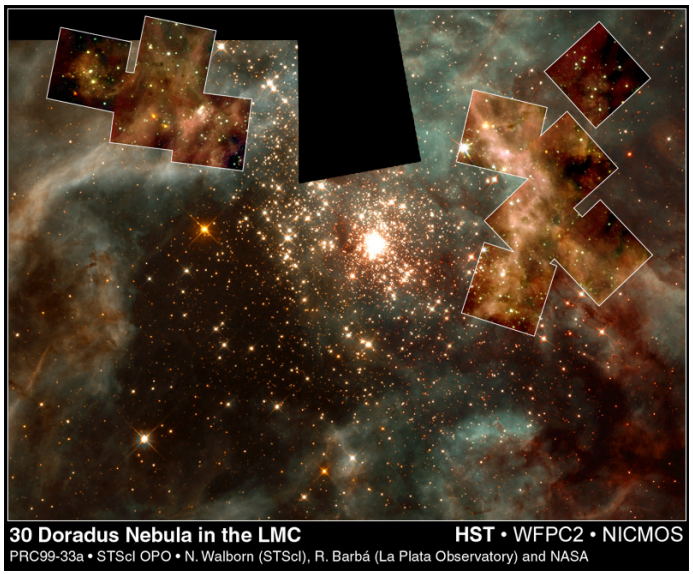


http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-neptune.html

Formation of Stars and Planets



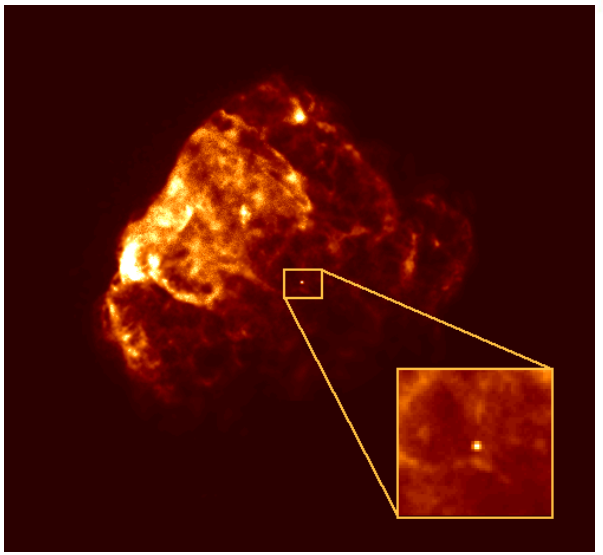
Young Massive Stars



Death of Stars

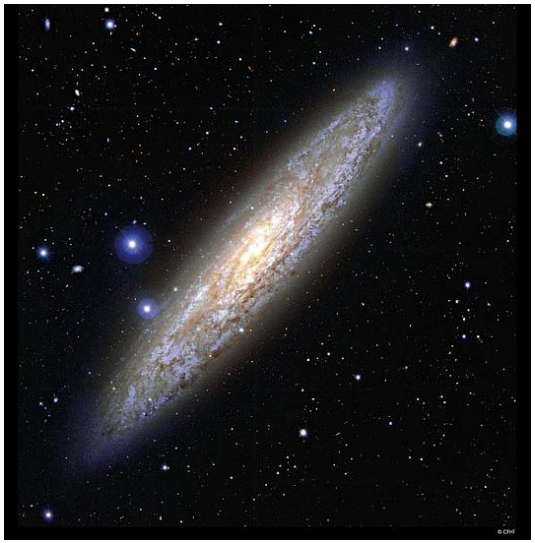
X-ray image of the death of a star!

A supernova has blown up, and made a shell of hot gas. At the center is the remnant– a neutron star.



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.



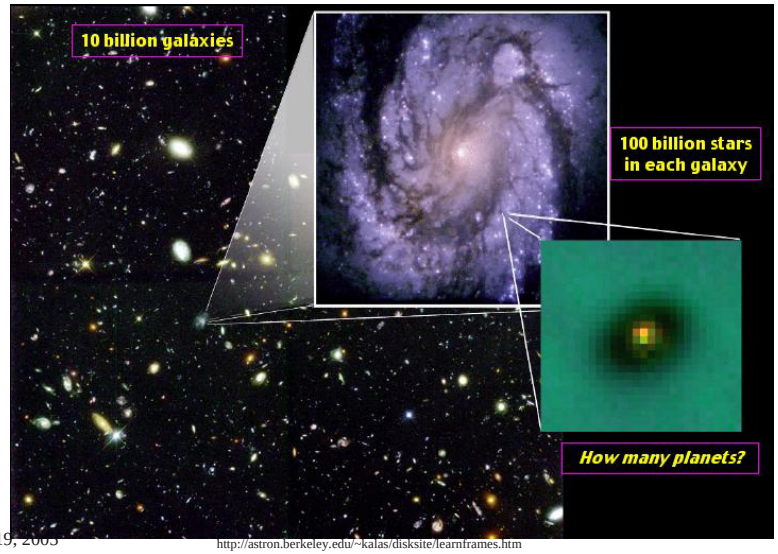
http://antwrp.gsfc.nasa.gov/apod/ap030525.html

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.

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

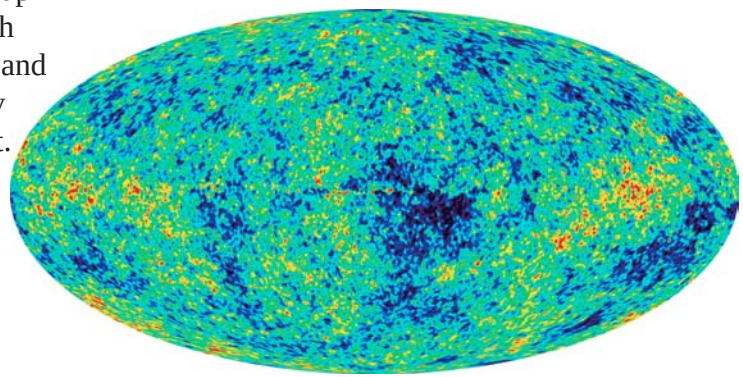
The Universe: Some Facts to Help you Live in it



http://astron.berkeley.edu/~kalas/disksite/learnframes.htm

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%.

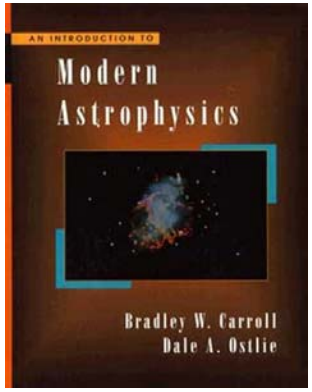
http://antwrp.gsfc.nasa.gov/apod/ap030212.html

Grades

Requirement	Percentage of Grade		Points
Class Participation Exercises (will drop 1 or 2 or 3)		7%	70
Homework Assignments (best 10 out of 11)	10 x 3% each	30%	300
Observing Reports (Night, Solar, Planetarium, and Stardials)	4 x 2% each	8%	80
One Hour Exams	2 x 15% each	30%	300
Final Exam		25%	250
Total		100%	1000

Texts

Recommended Text: *Introduction to Modern Astrophysics*, by Bradley W. Carroll & Dale A. Ostlie, Addison-Wesley, 1996.

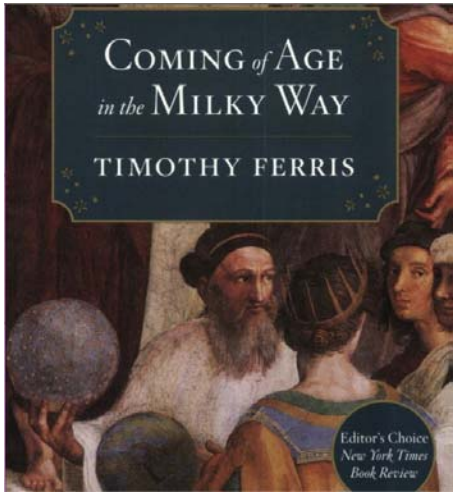


There are no good texts for this class. They are either too low level or too high level. This book represents the best compromise for this course. It is also often used in advanced astronomy courses (e.g., ASTR 404, 405, or 406). Unfortunately, either new or used, this text is very expensive: my apologies. A copy has been placed on reserve in the Physics and Astronomy Library in Loomis.

Texts

Required Text: *Coming of Age in the Milky Way*, by Timothy Ferris, Perennial, 2003

A nice general overview of most of the important topics in this class. Some homework and exam questions will be based from this book.



Homework

Homework

- There will be 11 homework assignments. The best 10 will be 30% of your final grade!
- These are meant to sharpen your thinking on the material covered in lecture, to develop physical intuition and quantitative skills, and to help prepare you for the exams.
- Homework is due at the beginning of class on almost every Friday, after which the answers will be made available. **No late homework will be accepted**.

Observing

Observing

3 observing assignments. You are *required* to do all three of the observing projects. Most students find that the observing sessions are fun, and a chance to meet the instructor and TA more informally.

Night and Day Observing

- Sessions will be held at the Campus Observatory
- **Night:** Check web for posted dates
  8-10pm (1 hr)
- **Solar:** Check web for posted dates
  10:30am-3:30pm (1/2 hr)
- **Report:** A PDF form is available on the class website
  - Print it out and bring it with you
- **Weather:** Some sessions may be cancelled if cloudy
  - Check the website for updates

"Virtual" Observing: Planetarium

- Sessions will be held at the Staerkel Planetarium at Parkland College - see website
- **Dates:** Posted on website, 6:35pm
- **Report:** A PDF form is available on the class website
  - Print it out and bring it with you
- **Sign-in:** You must sign up in advance through the website
  - http://www.astro.uiuc.edu/classes/planetarium

Yuck-- Exams

Exams

- Exams will consist of problem solving and essay questions. There will be two in-class hour exams. and a comprehensive final exam. Dates are as follows.
- Hour Exam 1: Friday, February 18th
- Hour Exam 2: Friday, April 1st
- Final Exam:
  1:30-4:30 pm, Tuesday May 10th