

# Astronomy 122

TR 1300-1350

112 Chemistry Annex

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**Office: Astro Building #218**

**Office Hours:**

**W 11:00 a.m. - Noon  
by appointment**

**<http://eeeyore.astro.uiuc.edu/~lwl/classes/astro122/spring08/>**

*Music: Astronomy – Metallica*

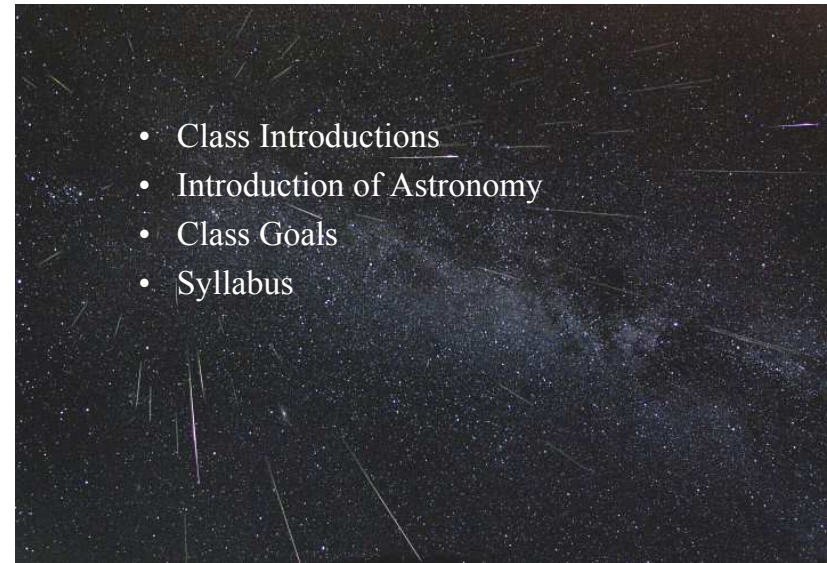
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## Outline

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

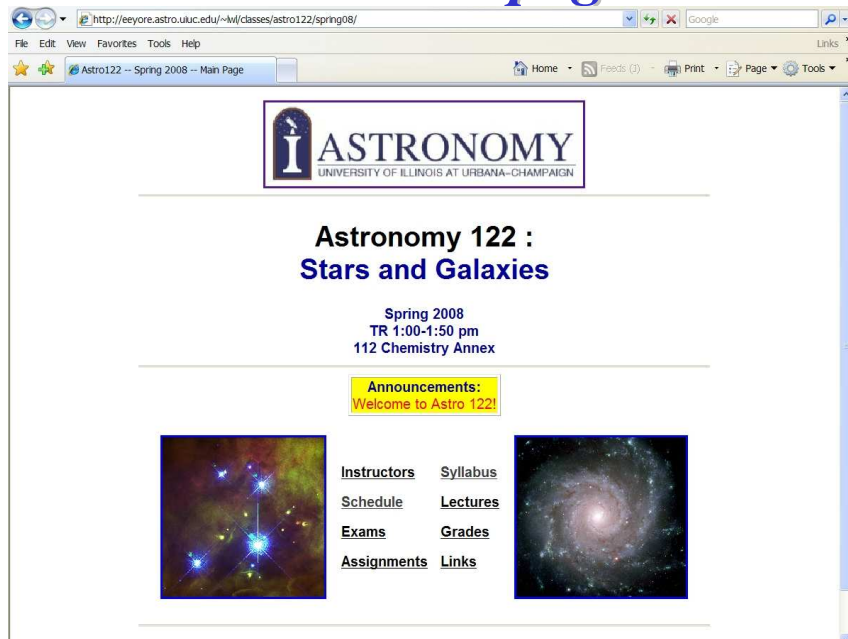


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## Class Webpage

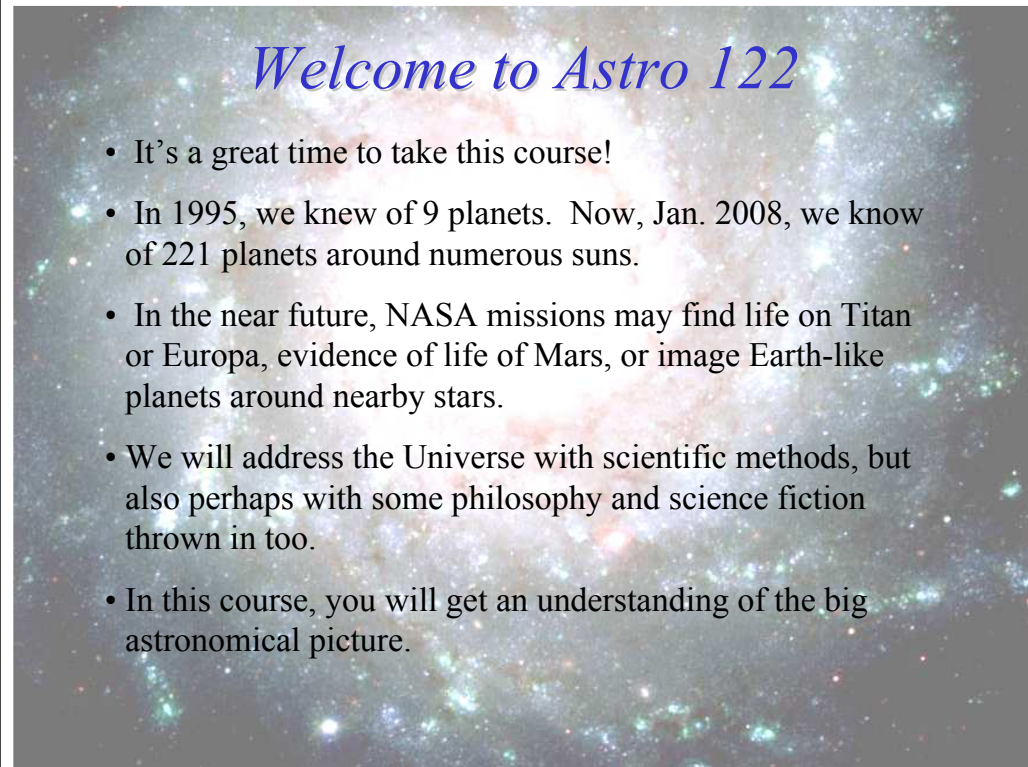


**<http://eeeyore.astro.uiuc.edu/~lwl/classes/astro122/spring08/>**



## Welcome to Astro 122

- It's a great time to take this course!
- In 1995, we knew of 9 planets. Now, Jan. 2008, we know of 221 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.



# 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.



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# Astronomy is not Astrology!



- 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
- Pseudo-science, not science
- And the zodiac signs were picked 2000 years ago.
- Since then the Earth has precessed, and someone born "in" Virgo is actually a Libra.



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## 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....

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## Class Participation



### Class Participation

- You should attend lectures and discussions.
- We will have random 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 often be asked to use an iClicker to register your response **(worth 22% of your grade!)**.
- Although the number of these are not set, often they come upon me on a whim, we probably have these for every class, so a handful will be dropped.
- **You must bring your iClicker to class every day!**

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## Type of Course



For example: What is Astronomy?

I said what it wasn't, but what is it?

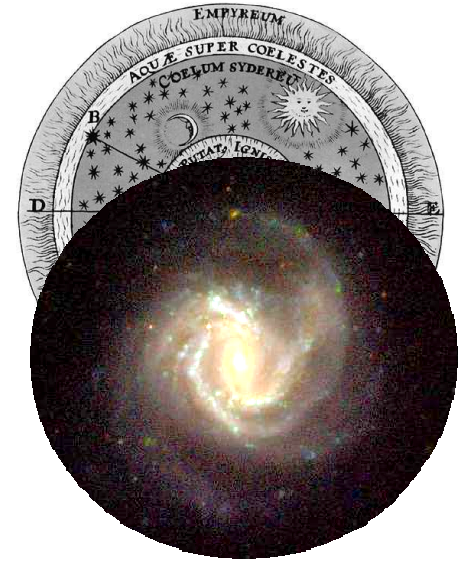
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## What is Astronomy?

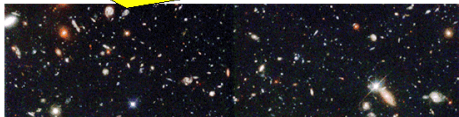
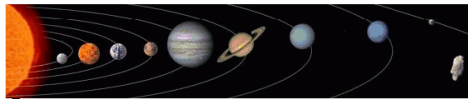


- Quite simply, astronomy is the scientific study of the Universe beyond our Earth
- It is an ancient discipline, tracing back to the dawn of history
- It is a broad science, crossing the boundaries of physics, geology, chemistry, and biology



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## Astronomy: The Big Picture

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



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## 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

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## And..



- This class is called Stars and Galaxies.
- So, we will spend a lot of time on guess what...
- But what are they? And why did you take this course? To learn about?

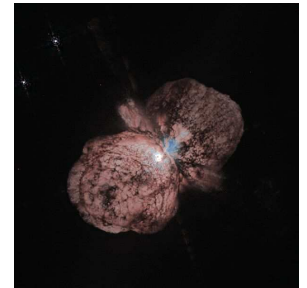
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## What is a Star?



- A huge ball of mostly hydrogen gas
- Mostly turning hydrogen into helium, which makes energy.
- Some stars can burn (thermonuclear speaking) for 10's of billions of years ( $<0.5$  solar masses), and some only burn for a few million years ( $>25$  solar masses)
- Our Sun is the closest star.

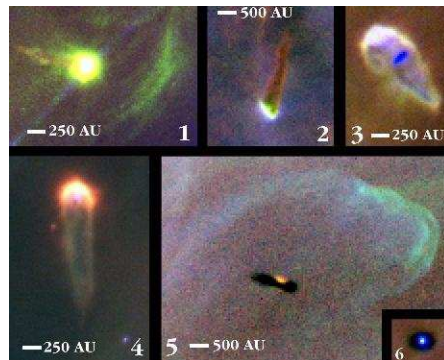
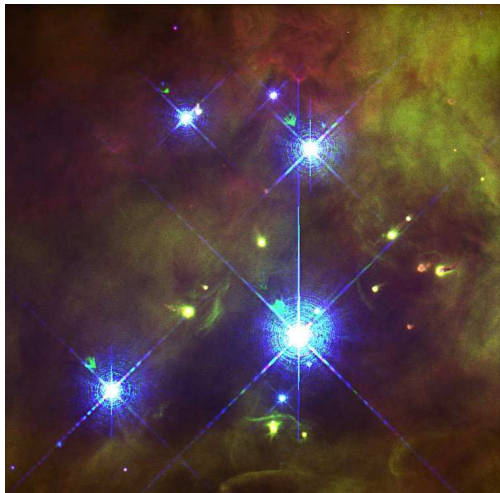


[http://www.daviddarling.info/images/red\\_dwarf\\_art.jpg](http://www.daviddarling.info/images/red_dwarf_art.jpg)  
HST of Eta Carinae

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## Formation of Stars and Planets

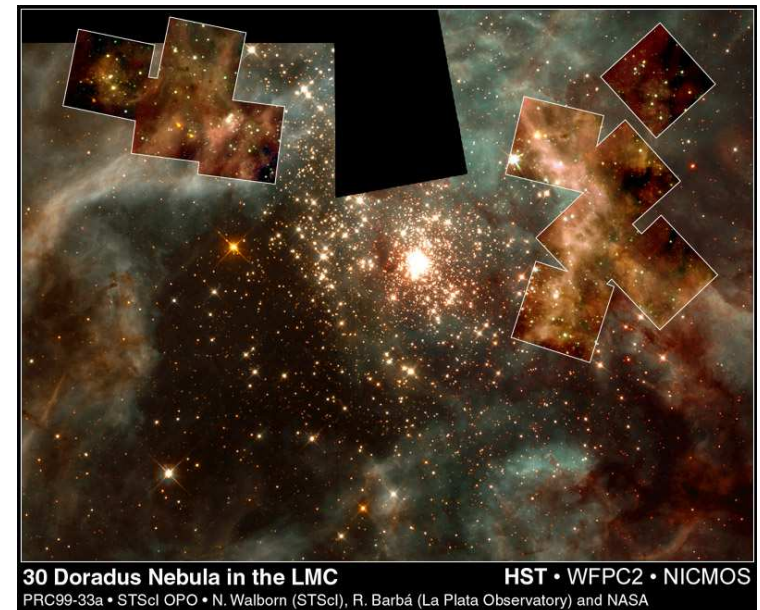


<http://www.merlin.ac.uk/biennial/fig02.jpg>  
[http://www.aip.de/~gallery/SF/proplyds\\_big.jpg](http://www.aip.de/~gallery/SF/proplyds_big.jpg)

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## Young Massive Stars



**30 Doradus Nebula in the LMC**  
HST • WFPC2 • NICMOS  
PRC99-33a • STScI OPO • N. Walborn (STScI), R. Barbá (La Plata Observatory) and NASA

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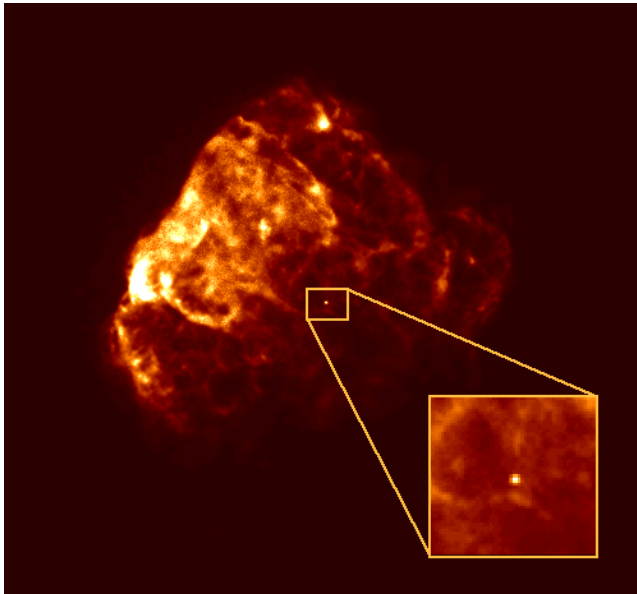
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## Death of Stars



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.



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## What is a Galaxy?



- Collection of stars (plus other dirt and gas).
- Island Universes
- Our Galaxy is called the Milky Way.



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## 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>

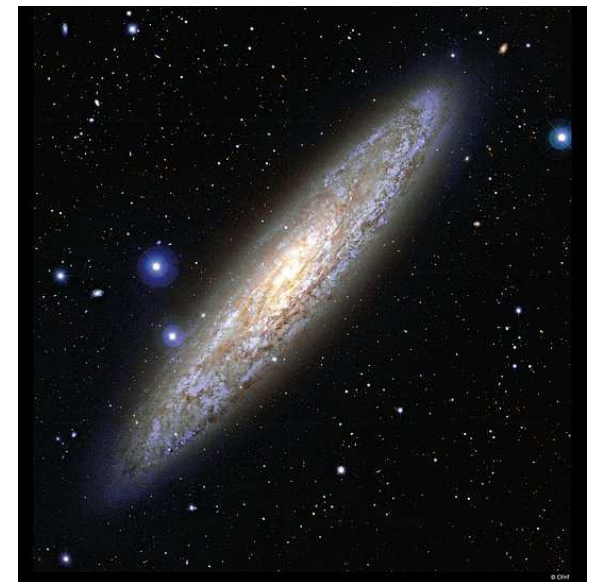
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## Galaxies



Spiral Galaxy NGC 253, almost sideways. About 10 million light years away. NGC 253 is considered a starburst galaxy.



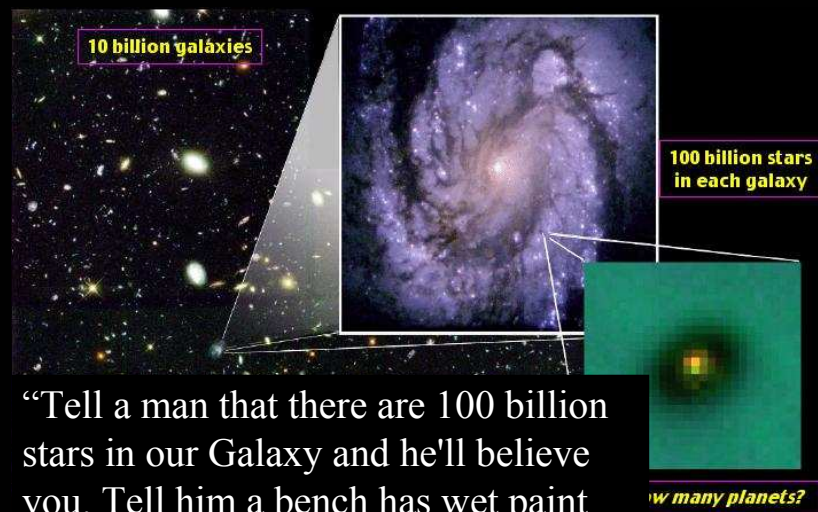
<http://antwrp.gsfc.nasa.gov/apod/ap030525.html>

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# The Universe: Some Facts to Help you Live in it



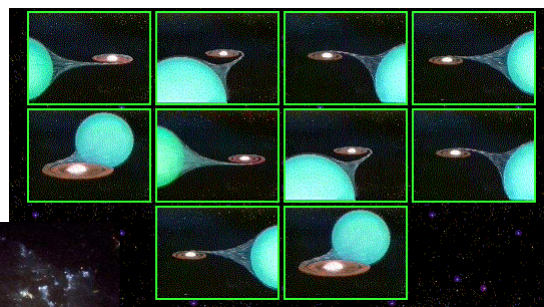
“Tell a man that there are 100 billion stars in our Galaxy and he'll believe you. Tell him a bench has wet paint and he has to touch it.”

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

## Some Key Questions



What happens when stars collide?



What happens when *galaxies* collide?

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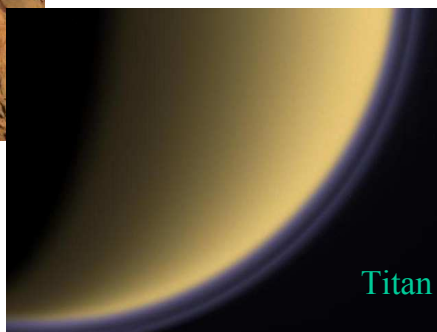
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## Is There Anyone Out There?



Mars

Could there be life in a place like this?



Titan

Or perhaps a place like this?

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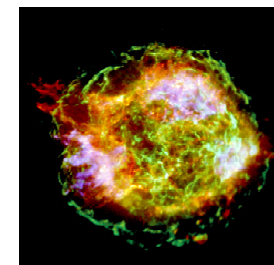
## Should we be AFRAID?



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



- Will we be swallowed by a black hole?

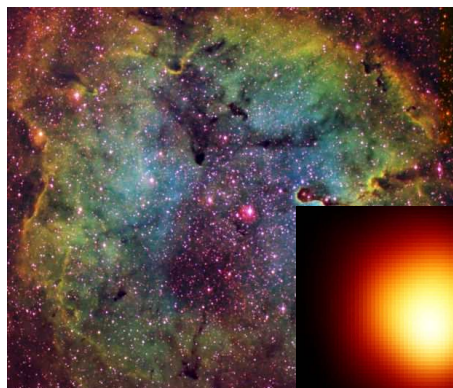


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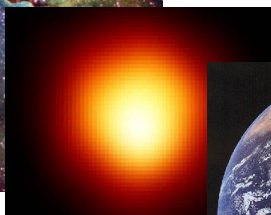
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## Where Do We Come From?



- How can clouds of gas and dust form stars, worlds - and us?



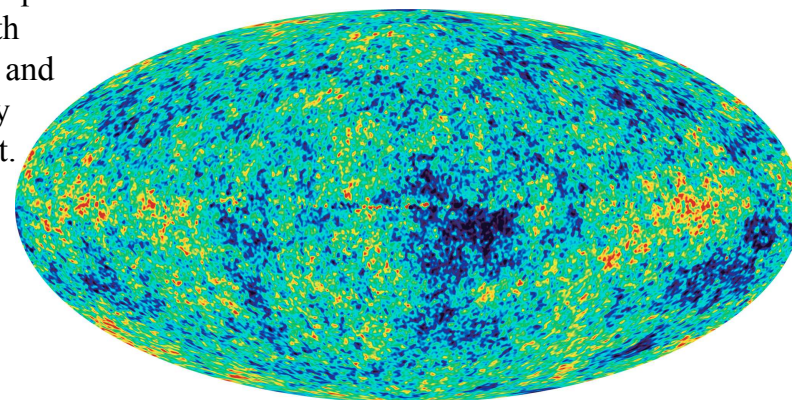
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## Leftovers of the Big Bang



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



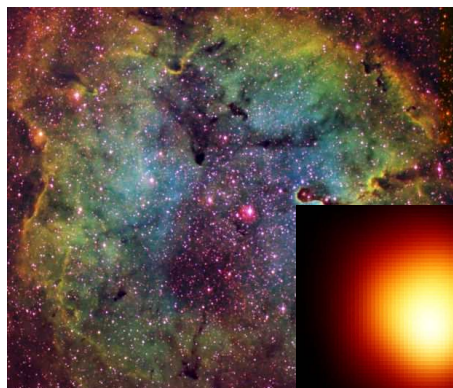
The small variations allow the dating of the age of the universe—13.7 billion years old! And good to 1%.

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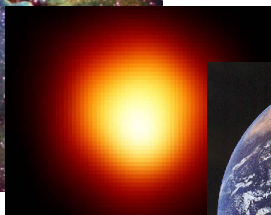
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<http://antwrp.gsfc.nasa.gov/apod/ap030212.html>

## Where Do We Come From?



- How can clouds of gas and dust form stars, worlds - and us?



- ... and where are we going?

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## The Night Sky



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



## *Our Earth*

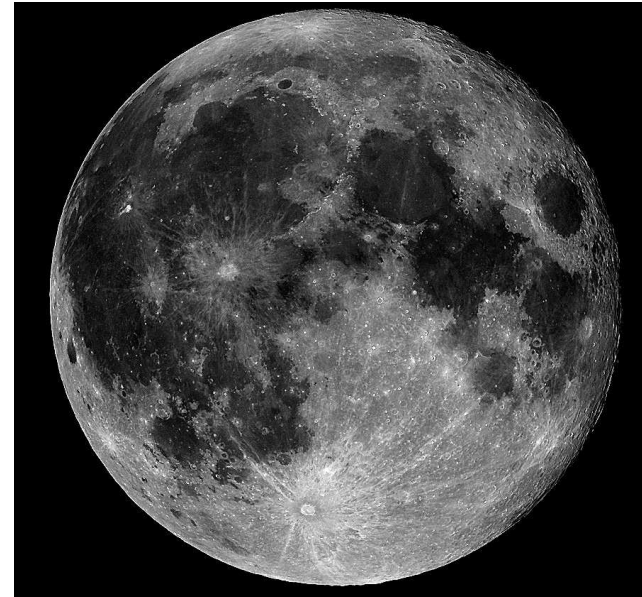


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<http://antwrp.gsfc.nasa.gov/apod/ap010204.html>

## *The Moon*

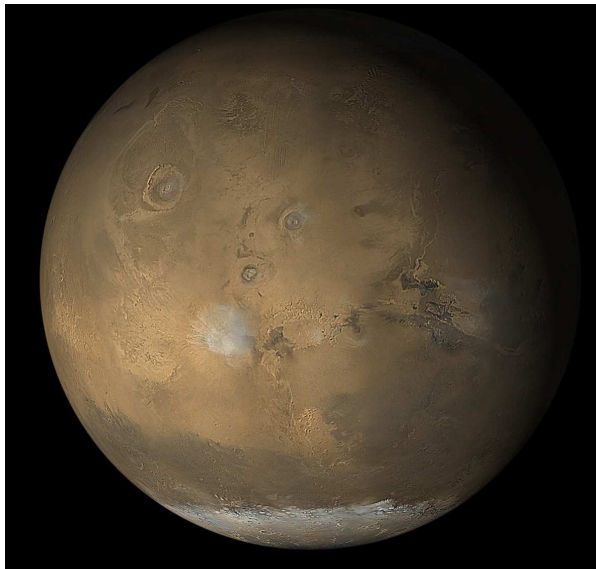


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<http://antwrp.gsfc.nasa.gov/apod/ap000113.html>

## *Mars*



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[http://www2.jpl.nasa.gov/files/images/hires/6\\_10\\_tharsis\\_high.jpg](http://www2.jpl.nasa.gov/files/images/hires/6_10_tharsis_high.jpg)

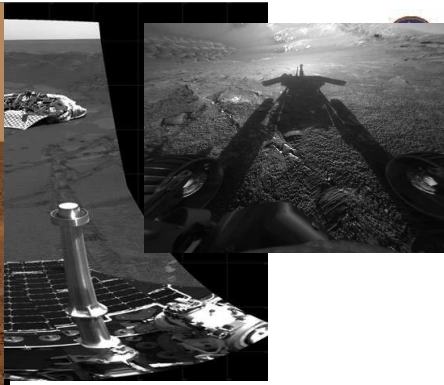
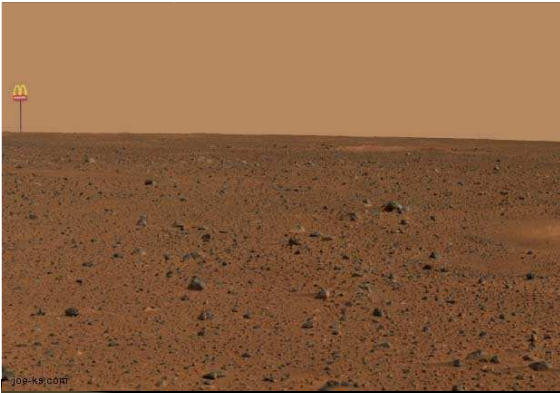
## *Roving on Mars*



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## *Roving on Mars: Spirit and Opportunity find evidence of water*

[http://antwrp.gsfc.nasa.gov/apod/image/0403/emptynest\\_opportunity\\_big.jpg](http://antwrp.gsfc.nasa.gov/apod/image/0403/emptynest_opportunity_big.jpg)

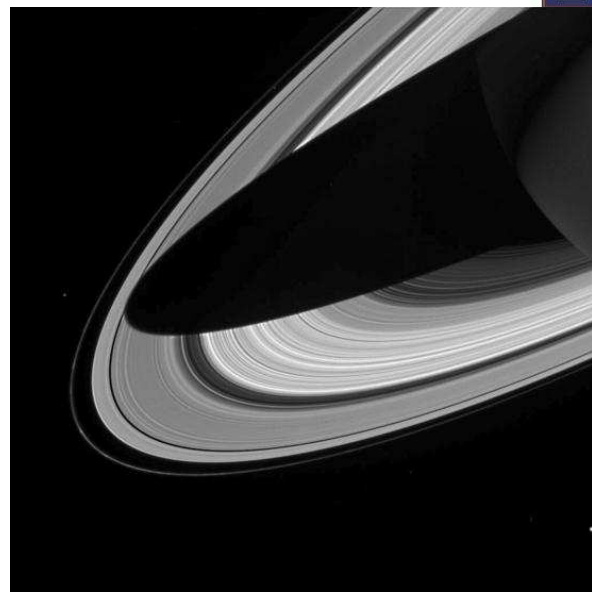
2008



## *Cassini Explores the Ring World*

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

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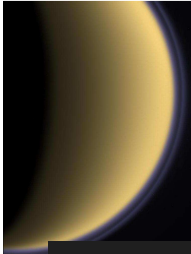
## *Cassini: Life on Titan?*



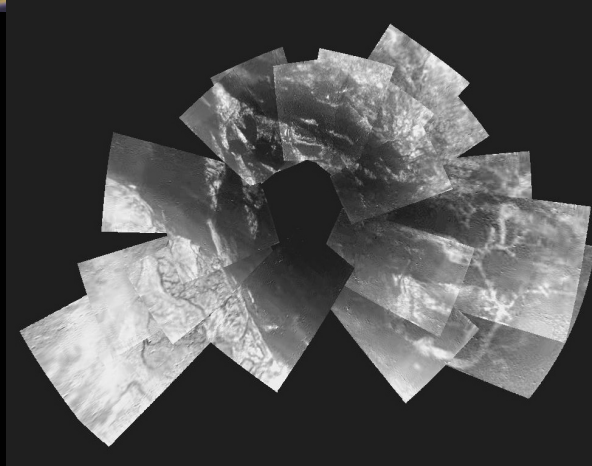
The Huygens probe touched down on Jan 14<sup>th</sup> 2005.

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

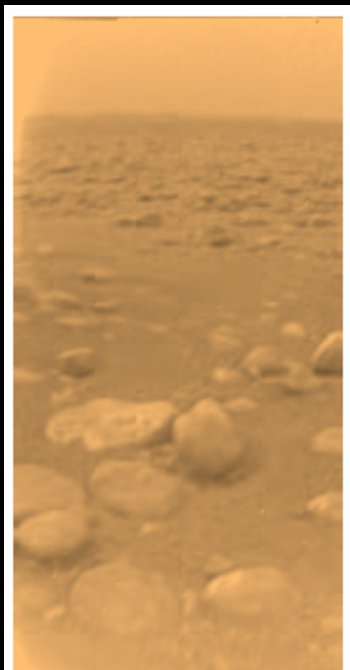
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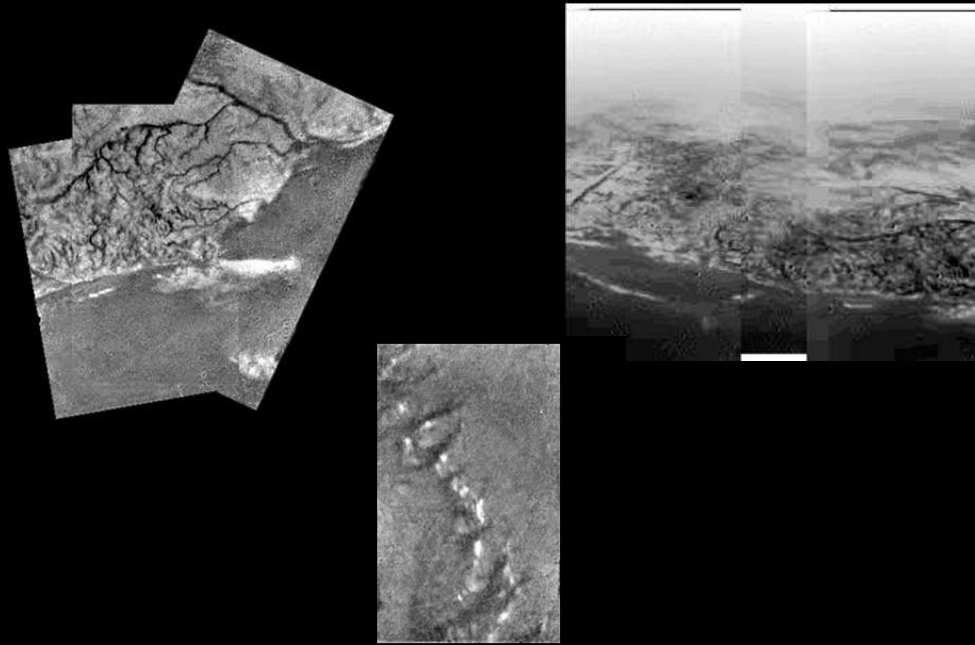
## *Cassini: Images*



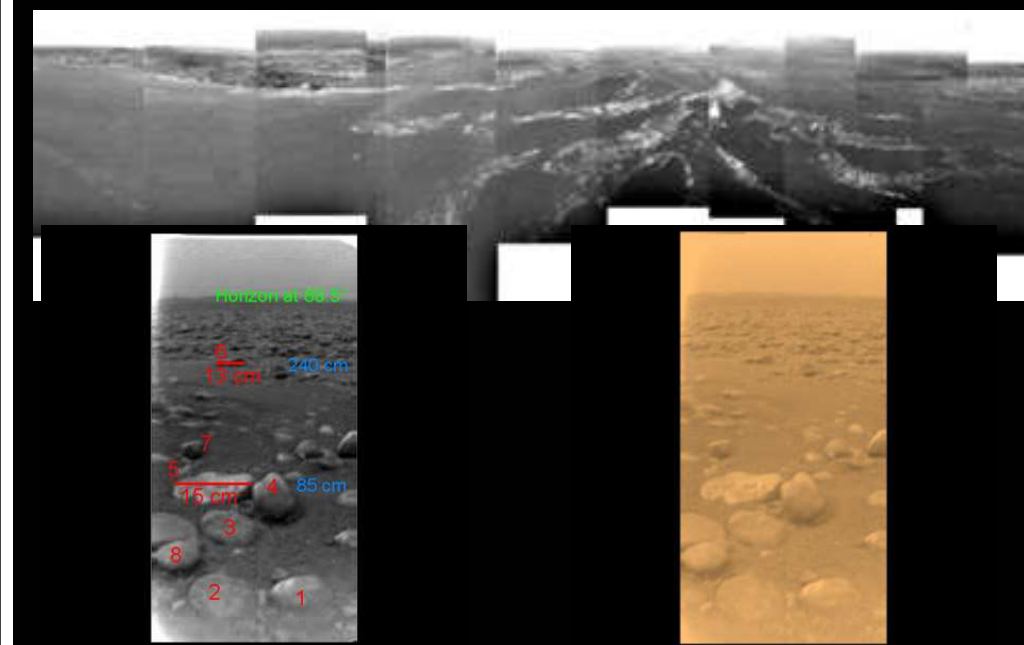
[http://www.esa.int/SPECIALS/Cassini-Huygens/SEMC8Q71V3E\\_0.html](http://www.esa.int/SPECIALS/Cassini-Huygens/SEMC8Q71V3E_0.html)



## Mapping Titan



## Mapping Titan



## Grades



Requirement	Percentage of Grade		Points
Class Participation Exercises (will drop handful)		22%	220
Homework Assignments (best 10 out of 11)	10 x 2% each	20%	200
Night Observing Report		5%	50
Midterm Hour Exam		20%	200
Final Exam		33%	330
<b>Total</b>		100%	1000

## Class Participation: iClicker + discussion section = 22% of Grade!



- I will be using the iClicker a lot in this course.
- Often will be used in class to gauge understanding.
- Your response will be recorded automatically.
- Get 75% credit for trying.
- Not really quizzes.
- Sometimes you will be asked to hand in short essay instead. Depends on point I am trying to make.

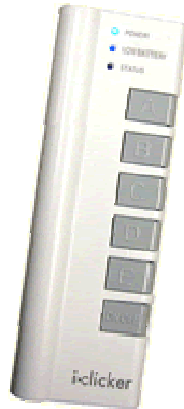




## *You need to Register Your Clicker*



- Go to link on syllabus to register your clicker.
- **Bring it to class every day.**



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## *Question*



Is this a brilliant idea?

- a) Yes, it will help gauge the class understanding of complex topics.
- b) No, it makes your class a pain.
- c) Whatever you want professor.. Whatever you want.... gimme an A, please.

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## *Question*



What is a star?

- a) A huge ball of mostly hydrogen gas.
- b) A collection of galaxies.
- c) An example: Johnny Depp.. 'nough said.
- d) A really bright object.
- e) By definition, bright hot objects with planets orbiting them.

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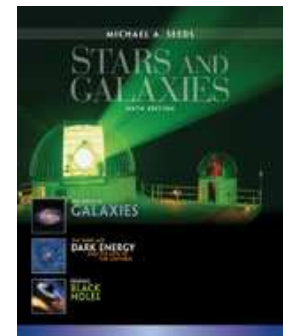
## *Text*



**Text:** *Stars and Galaxies*, 6<sup>th</sup> edition, by Michael A. Seeds, Thomson, Brooks/Cole, 2008.

A solid text and average priced.

It will be for supplemental readings and help with the homework questions.



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## Homework: 20% of Grade



- There will be 11 homework assignments. The best 10 will be used for 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 will be posted on Compass.
- Homework is due Saturday night (midnight). Check assignment and schedule for details. (<http://eeyore.astro.uiuc.edu/~lwl/classes/astro122/spring08/hw.html> )

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## Night Observing 5% of Grade



- Sessions will be held at the Campus Observatory
- **Night:** Check web for posted dates  
7:30-9:30 pm, requires about 40 mins to 1 hour to complete.
- **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



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## Yuck-- Exams



### Exams

- Exams will consist of problem solving and essay questions. There will be a single midterm and a comprehensive final exam. Dates are as follows.
- Midterm: **Thursday, March 6<sup>th</sup>**
- Final Exam:  
**1:30-4:30 pm, Tuesday May 6<sup>th</sup>**

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