

Lecture 2

# Exploring the Solar System

Getting to Know Our Neighborhood

- i. Clicker dry run #1

Lecture

1. The Solar System
2. The layout of the solar system
3. Key trends among planets
4. Our place in the universe

Notes:

- a. Extra copies of the syllabus up front
- b. Read Chapter 4.0-4.1 (pp. 75-79)



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Course website:  
<http://earthguide.ucsd.edu/planets>

You will be responsible for everything mentioned in the syllabus.  
Read ALL of it.

2010 - Spring 2007  
**The Planets**  
Instructor: M. Bruce Fenton and David C. Minton

**Prerequisites and Corequisites**  
Prerequisites: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100  
Corequisites: 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200

**Course Description**  
This course provides an overview of our solar system, including the planets and moons, and our place in the universe. The planets and their moons will be compared to gas giants and seen in perspective around our planet Earth.

**Required Course Materials**  
Text: The Planets (4th Edition)  
Authors: David Morrison and Robert Ramirez  
Publisher: Springer-Verlag, 2002  
• **Interactive Clicker**  
PRS (Personal Response System) Clicker (available at the UCSD bookstore)

**Grading**

|                      |      |
|----------------------|------|
| Pre-class (homework) | 20%  |
| Mid-term exam        | 20%  |
| Final exam           | 20%  |
| Final                | 20%  |
| Total                | 100% |

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PRS clicker



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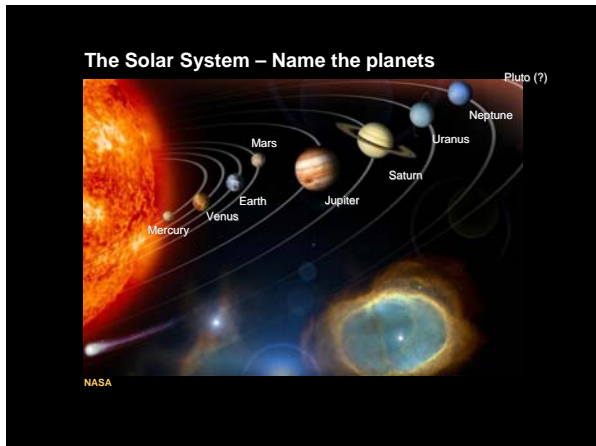
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### Distances across the solar system

**1 AU = Astronomical Unit**  
 = distance from Earth to the Sun  
 = ~150 million kilometers or 93 million miles

Sun      Earth      Jupiter

1 AU      2 AU      3 AU      4 AU      5 AU

1. Why use astronomical units rather than light-years?
2. How long does it take sunlight to reach the Earth?

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### Basic characteristics of planets

| Planet  | Distance from the Sun (AU) | Diameter (relative to Earth) | Density (g / cm <sup>3</sup> ) | Mass (relative to Earth) | Composition                  |
|---------|----------------------------|------------------------------|--------------------------------|--------------------------|------------------------------|
| Mercury | 0.4                        | 0.38                         | 5.4                            | 0.06                     | Iron, nickel, silicates      |
| Venus   | 0.7                        | 0.95                         | 5.3                            | 0.85                     | Silicates, iron, nickel      |
| Earth   | 1.0                        | 1.00                         | 5.5                            | 1.00                     | Silicates, iron, nickel      |
| Mars    | 1.4                        | 0.53                         | 4.0                            | 0.11                     | Silicates, iron, sulfur      |
| Jupiter | 5.2                        | 10.8                         | 1.3                            | 318                      | Hydrogen, helium             |
| Saturn  | 9.6                        | 8.9                          | 0.7                            | 95                       | Hydrogen, helium             |
| Uranus  | 19.2                       | 4.1                          | 1.3                            | 15                       | Ices, hydrogen, helium       |
| Neptune | 30.1                       | 3.8                          | 1.6                            | 17                       | Ices, hydrogen, helium       |
| Pluto   | 39.4                       | 0.2                          | 2.1                            | 0.002                    | Silicates, water, other ices |

1. Density vs. weight
2. Fractionation – chemical sorting

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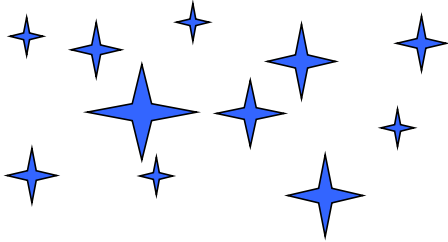
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**Parallax**



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**The Neighborhood Around the Solar System**

- Zooming out:**  
Solar system  
Galaxies  
Superclusters  
Known Universe

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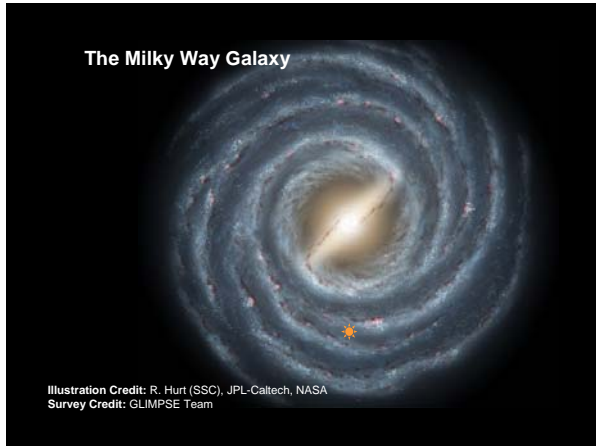
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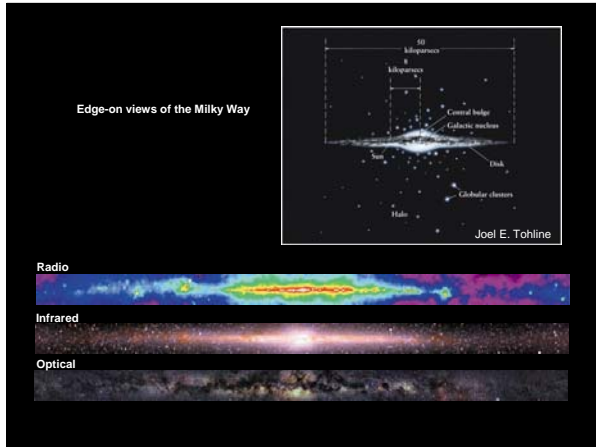
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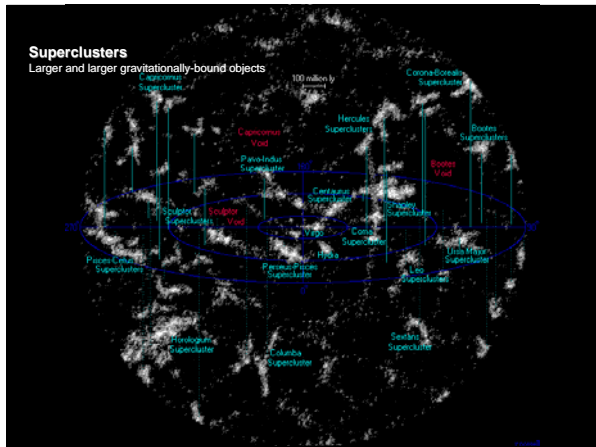
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**The condensed history of  
 The Solar System**

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Interstellar medium  
(filling the space  
between stars in a  
galaxy)

99% Gas  
1% Dust

Composed of mostly  
Hydrogen  
Helium

With little bits of the  
other elements

Herschel Telescope in Spain & the Milky Way  
Nik Szymanek and Ian King

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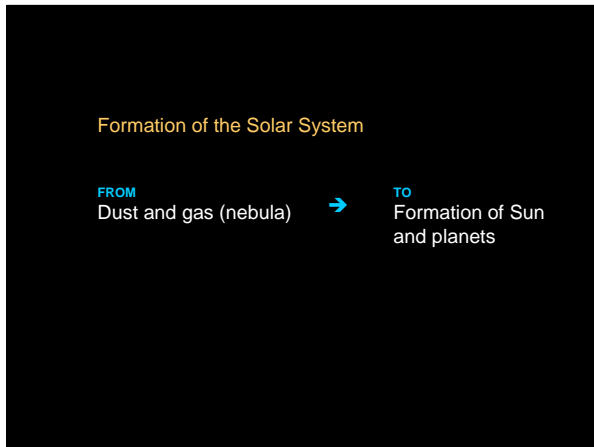
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### Formation of the Solar System

FROM  
Dust and gas (nebula) → TO  
Formation of Sun  
and planets

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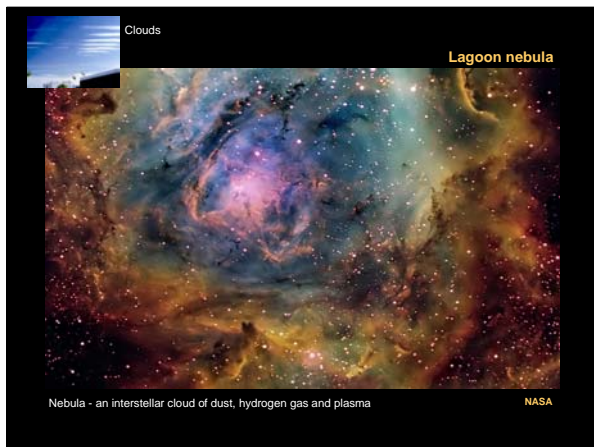
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Clouds

Lagoon nebula

Nebula - an interstellar cloud of dust, hydrogen gas and plasma

NASA

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Horsehead nebula



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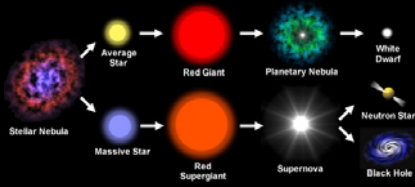
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Life cycle of stars



Accretion – gravitational accumulation of mass

The Sky

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Gravitational attraction



U.S. Army Women's Museum

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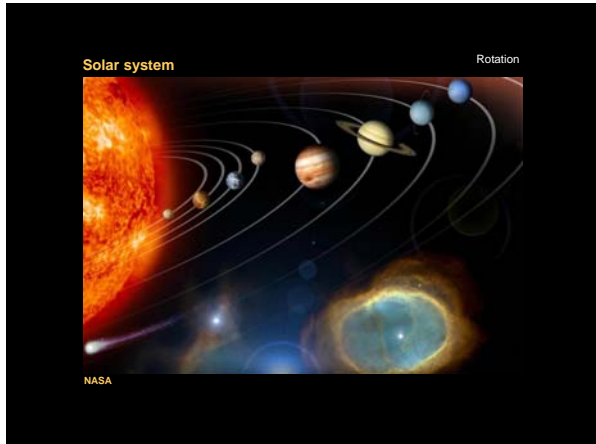
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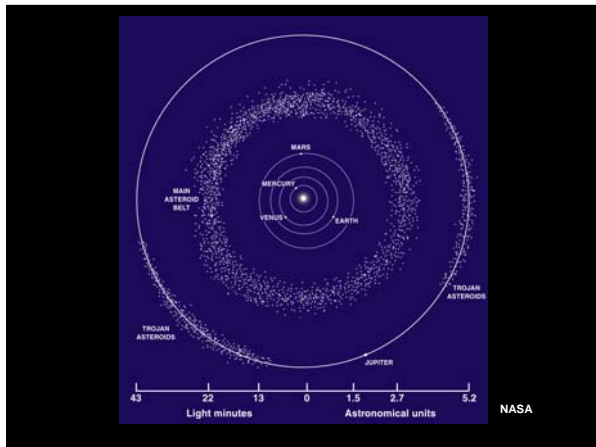
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**Basic characteristics of planets**

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1. How does density differ from weight?
2. How do we know the size of each planet?
3. How do we know the mass of each planet?

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Planetary accretion

FROM  
Dust and gas (nebula) → TO  
Planet

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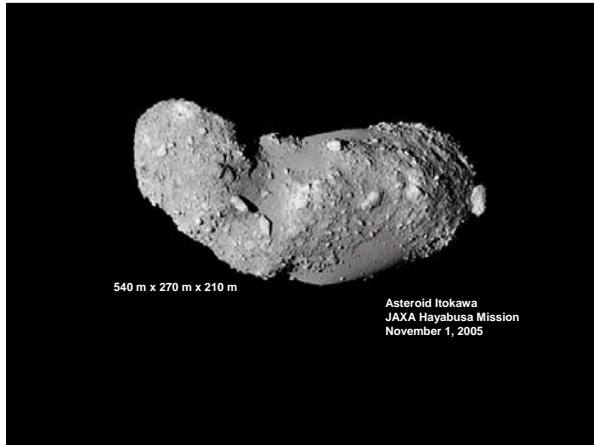
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Meteor Crater, 20 miles west of Winslow, Arizona.  
Photographer - Louis J. Maher, Jr.

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Ubehebe and Little Hebe Craters  
Death Valley, CA  
U.S. Geological Survey

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