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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You will be responsible for everything mentioned in the syllabus.

Read ALL of it.

Course website:

http://earthguide.ucsd.edu/planets


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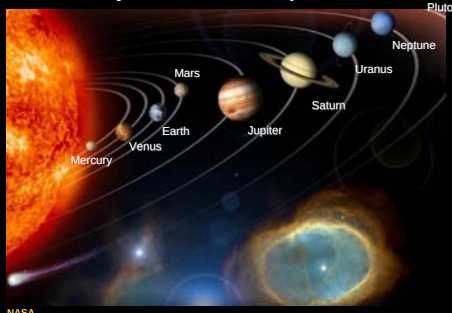
## PRS clicker

## The Solar System – Name the planets

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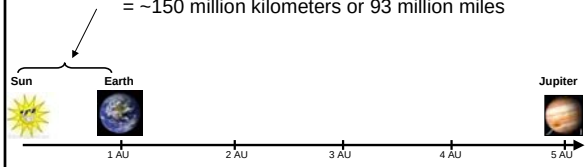
## Distances across the solar system

**1 AU = Astronomical Unit**

= distance from Earth to the Sun

= ~150 million kilometers or 93 million miles



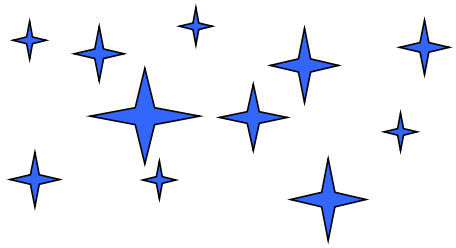

1. **Why use astronomical units rather than light-years?**
2. **How long does it take sunlight to reach the Earth?**

## Basic characteristics of planets

| Planet | Distance from the Sun (AU) | Diameter (relative to Earth) | Density (g / cm$^3$) | 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**

**Parallax**



**The Neighborhood Around the Solar System**

**Zooming out:**

- **Solar system**
- **Galaxies**
- **Superclusters**
- **Known Universe**

**Herschel Telescope in Spain & the Milky Way**

Nik Szymanek and Ian King

**The Milky Way**

~100 billion other stars

## The Milky Way Galaxy

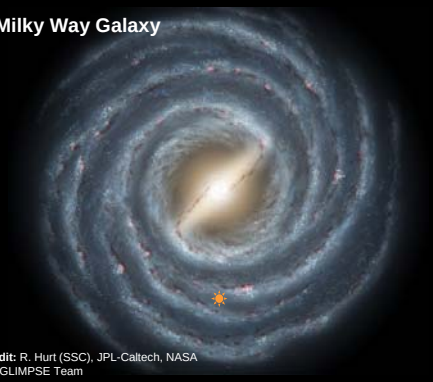
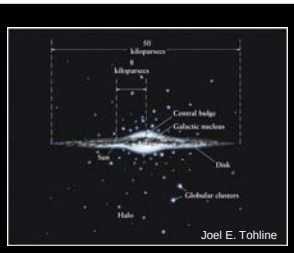


**Illustration Credit:** R. Hurt (SSC), JPL-Caltech, NASA
**Survey Credit:** GLIMPSE Team

## Edge-on views of the Milky Way




Joel E. Tohline

**Radio**

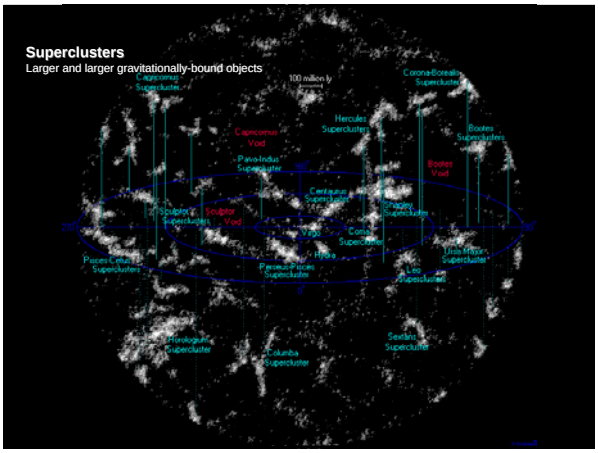
**Infrared**

**Optical**

## The Andromeda Galaxy

Messier 31
2.5 million ly away

Robert Gendler


**The condensed history of The Solar System**

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

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

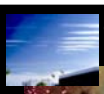
**99% Gas**
**1 % Dust**

**Composed of mostly**
**Hydrogen**
**Helium**

**With little bits of the other elements**

## Formation of the Solar System

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



Clouds

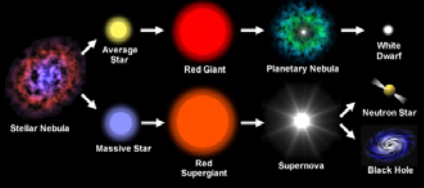
**Lagoon nebula**

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

NASA

Horsehead nebula

Life cycle of stars




Accretion – gravitational accumulation of mass

The Sky

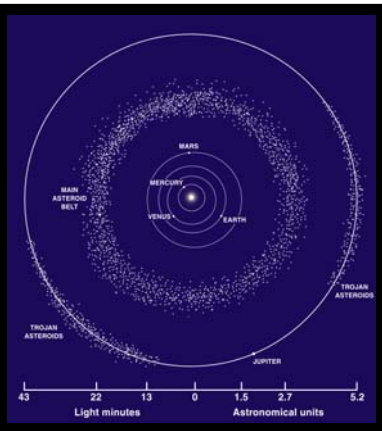
Gravitational attraction

U.S. Army Women's Museum

Solar system

Rotation

NASA




NASA

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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?**

Planetary accretion

FROM
Dust and gas (nebula) → TO
Planet

540 m x 270 m x 210 m

Asteroid Itokawa
JAXA Hayabusa Mission
November 1, 2005

Galileo mission
December 7, 1992

Craters of the Moon

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

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