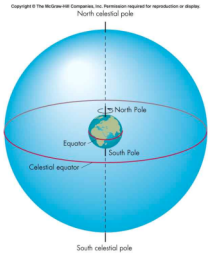
Lines on the sky



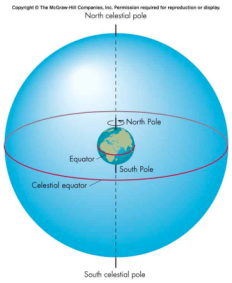
How the phenomena we see in the sky are linked to the "big picture" in the solar system

Some of the things we learned last week

- The horizon coordinate system
- Astronomical basis of the day
- Annual changes in the night sky
- Astronomical basis of the year
- Astronomical basis of the seasons

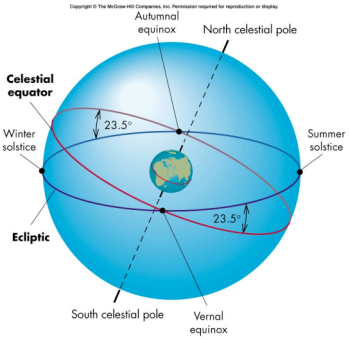
The celestial sphere, the celestial pole, and the celestial equator

Think about which people at the north pole and on the equator (and in between). Which stars do they see pass through the zenith?



Two Lines on the Sky

- The ecliptic
- The celestial equator



Using these ideas, let's consider a coordinate system which is fixed with respect to the stars (as opposed to our position)

Analogy: I am riding my bike on a dirt road near Lone Tree, and want to describe to someone in London the location of a radio tower I see in the distance.

Question: what system of coordinates do I use?

A New Coordinate System: Celestial Coordinates

- The stars "stick together" and define their own reference system. The planets move with respect to them
- Celestial coordinates are Right Ascension and Declination
- Right Ascension ….. Longitude ⇦
- Declination ….latitude ⇦
- http://sohowww.nascom.nasa.gov/

Let's see some star charts

http://www.memorybankinc.com/starmap/seti.htm

Astronomical Scientific Terms

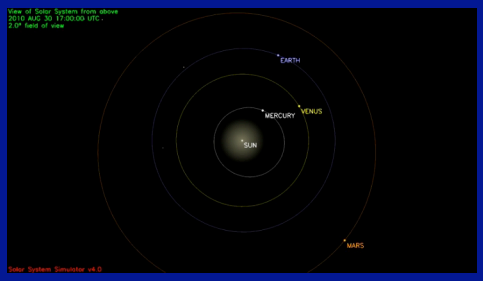
- Meridian
- Celestial sphere
- Zenith
- Azimuth and altitude
- Ecliptic
- Celestial equator
- Right ascension and declination

Let's have an illustration of the use of these coordinates

The first black hole discovered, Cygnus X-1, has coordinates of RA=19h 58m, dec=+35.2 d

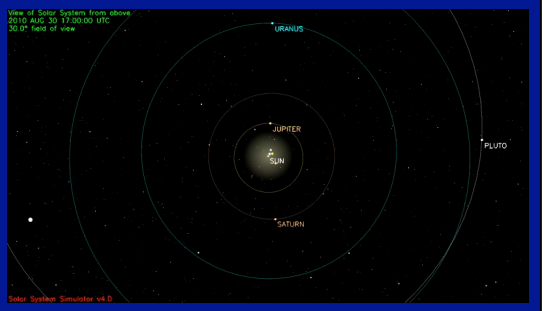
Where is it on the sky?

Next topic: the solar system in a stellar context



Why are we doing this?

Look further out into space



The Solar System in a Stellar Context

How can the study of the solar system help us better understand stars, galaxies, etc.

Size scales in the solar system

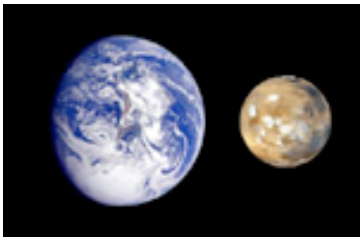
- Basic unit: 1 meter ⇒ **demo**
- 1 kilometer = 1000 meters = 0.6214 miles
- Diameter of Earth: 12756 kilometers (~ LA to Sydney)
- Closest object in space: Moon, 384,000 km *average* distance
- Most prominent object in astronomy: Sun, 149.6 million kilometers; 1 Astronomical Unit

The Earth and Moon in Space

The Terrestrial Planets

Planet	Distance (au)	Size
Mercury	0.387	0.38
Venus	0.723	0.95
Earth	1.00	1.00
Mars	1.523	0.53

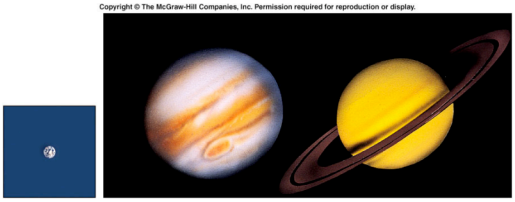
The Earth and Mars



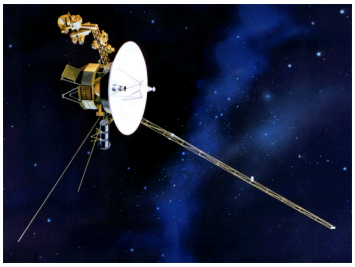
The Jovian Planets

Planet	Distance (au)	Diameter
Jupiter	5.2	11.2
Saturn	9.5	9.5
Uranus	19.2	4.0
Neptune	30.1	3.9

The Earth, Jupiter, and Saturn



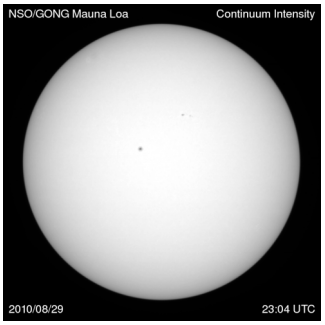
A piece of Iowa in the distant solar system: the Voyager spacecraft



Voyagers launched in 1977; V1 at 114.2 au from Sun, V2 at 92.8 au. Both spacecraft still functioning

Back to inner solar system: the dominant object in the solar system

The nearest star



Facts about the Sun

- Distance: 149.6 million kilometers = 1.496E+11 meters = **1 astronomical unit**
- Radius = 695,990 kilometers = 6.960E+08 meters (109 times radius of Earth)
- If Earth were scaled to 1 foot globe size, the Sun would extend from goal line to 30 yard line at Kinnick stadium

- The Sun, not the planets (including Earth) is the dominant object in the solar system