**Lines on the sky**

How the phenomena we see in the sky are linked to the “big picture” in the solar system.

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**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

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**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?

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**Two Lines on the Sky**

- The ecliptic
- The celestial equator

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**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?

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**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/](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
- 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 Terrestrial Planets

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<th>Planet</th>
<th>Distance (au)</th>
<th>Size</th>
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The Jovian Planets

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<tr>
<td>Neptune</td>
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</table>

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