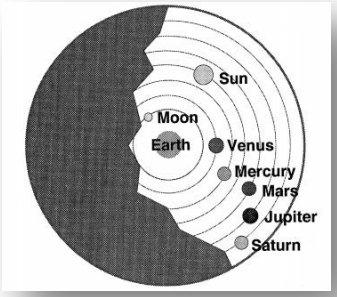
# Astronomy: Exploring the Universe

What are the celestial bodies that we have observed as part of our universe?

- Stars
- Moon
- Planets
- Black holes
- Nebulae
- Galaxies
- Asteroids
- Meteorites
- ...and more!

What were the two most significant models of the universe in Western science?

| Geocentric (earth-centered) | Heliocentric (sun-centered) |
|---|---|
| - Euxodus<br>- Aristotle<br>- Ptolemy<br>- Made sense to naked eye astronomers (see sun rise and set, see stars move around)<br>- Set of concentric spheres (earth in middle, planets and sun on spheres outwards in order of how often they repeat their patterns, outermost sphere is black with stars on it)<br>  | - **Aristarchus**<br>- Aryabhata<br>- Ja'far ibn Muhammad Abu Ma'shar al-Balkhi<br>- **Copernicus**<br>- **Galileo**<br>- Kepler<br>- Better way to explain certain phenomena (gravity, etc.)<br>- Astronomers began to use telescopes<br>- Model of the solar system that we use today with sun in center<br>  - Early proponents still used circular orbits, now we use elliptical (like ovals) |

What is your "sign"?

What does that tell you about the date you were born?

- On that date, the sun was between the earth and that constellation

Constellations don't just show up in our horoscopes. Some of the most important ones to us are the ones that we can see all the time. These are called the:

_____Northern Circumpolar Constellations_____

**Circumpolar** means __pole-circling (they appear to circle around the north star, Polaris)___.

A **constellation** is ___an officially recognized group of stars with defined borders____.

An **asterism** is ___a grouping of stars, can be part of one or many constellations____.

*Draw the asterisms that make up the nine Northern circumpolar constellations.*

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## Measuring Space

| The two most important measurements are **position** and **distance** | |
|---|---|
| Altitude<br>(position) | - Angular distance of a celestial body above the horizon<br>- Measured in degrees<br>- Always relative to the person measuring |
| Azimuth<br>(position) | - The bearing of a celestial body from your position (on a compass!)<br>- Measured in **degrees,** clockwise from due north<br>- "draw" line from star to horizon, measure that point with a compass |
| Astronomical Unit<br>(distance) | - Based on the distance from the earth to the sun<br>- Used to measure distances inside solar systems<br>- 1 au = 149 597 870 700 m (or $1.5 \times 10^{11}$ m) |
| Light Year<br>(distance) | - The amount of distance a beam of light will travel in a straight line in one year<br>- 1 LY = $9.4607 \times 10^{15}$ m |

An **astrolabe** is a simple tool used for measuring the altitude of a star. **Azimuth** can be determined using a compass (or a compass app). After constructing your astrolabe with a partner, choose 6 items outside (trees, poles, power lines, etc.) and measure their altitude and azimuth.

| Item | Alt, Azi | Item | Alt, Azi |
|---|---|---|---|
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1. a) Find the length of one light year in kilometers.

   b) Find the length of one light-year in AU's.

   c) A fuzzy green alien travels for three light years to arrive on Earth. How far did it travel, as measured in kilometers?

   d) A fuzzy green alien travels for 1/2 light years, after it leaves Earth again. How far did it travel, as measured in AU's?

*Pioneer 10 (also known as Pioneer F) is a 258-kilogram robotic space probe that completed the first interplanetary mission to Jupiter, and became the first spacecraft to achieve escape velocity from our Solar System.*

2. Pioneer 10's radio signals left Pluto in April 1983. They traveled at the speed of light ($3.00 \times 10^5$ km/s). How long did the radio signals take to reach Earth, a distance of $4.58 \times 10^9$ km?

3. Pioneer 10 traveled about 4.58 x 109 km between March 3, 1972 and April 25, 1983. Use an approximation of 11 years to determine the average speed of Pioneer 10 in km/h.