

Solar System Part 1



Can you name the planets?

Observations from Earth



Sun



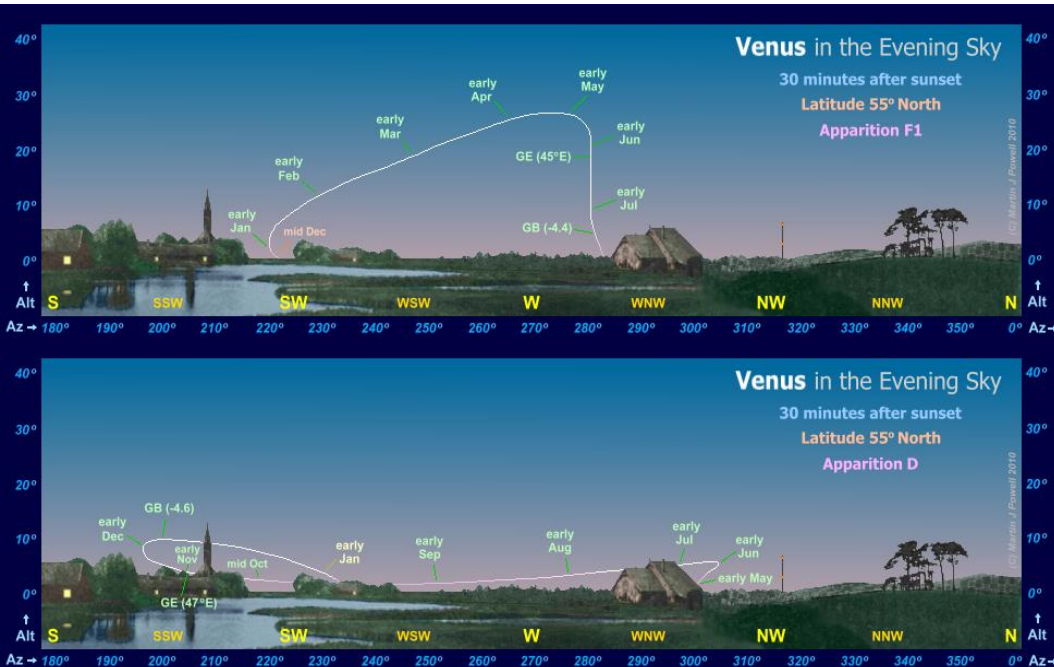
Ursa Major



Constellation Orion

- **All objects** in the heavens **rise in the east and set in the west.**
- The Sun and stars all move across the sky in a regular, predictable way. We can see **several thousand stars** easily!
 - The Sun travels around the sky in (about) 24 hours.
 - The stars travel around the sky slightly faster than the sun (23 hours and 56 minutes).
- Different stars are visible to different observers and the path they take is different. That would be the case for **an observer on a spherical surface** – this is a hint that the Earth is a sphere!

Observations from Earth



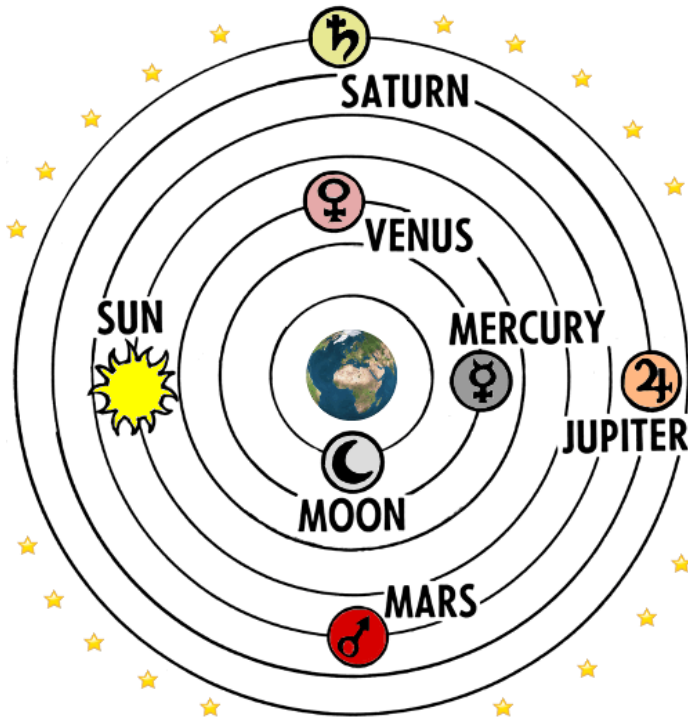
Planets (Anc. Greek: “wandering star”) move differently than the stars:

- **Mercury** and **Venus** can only be seen near **sunrise** or **sunset**.
- **Mars, Jupiter,** and **Saturn** usually move **slower** than the stars...
- ... but **sometimes** Mars, Jupiter, and Saturn **move faster** than the stars (so-called **retrograde** motion); retrograde motion varies slightly in when and how long it would last – this is a clue to the Solar System architecture and structure!

Solar System: historical models

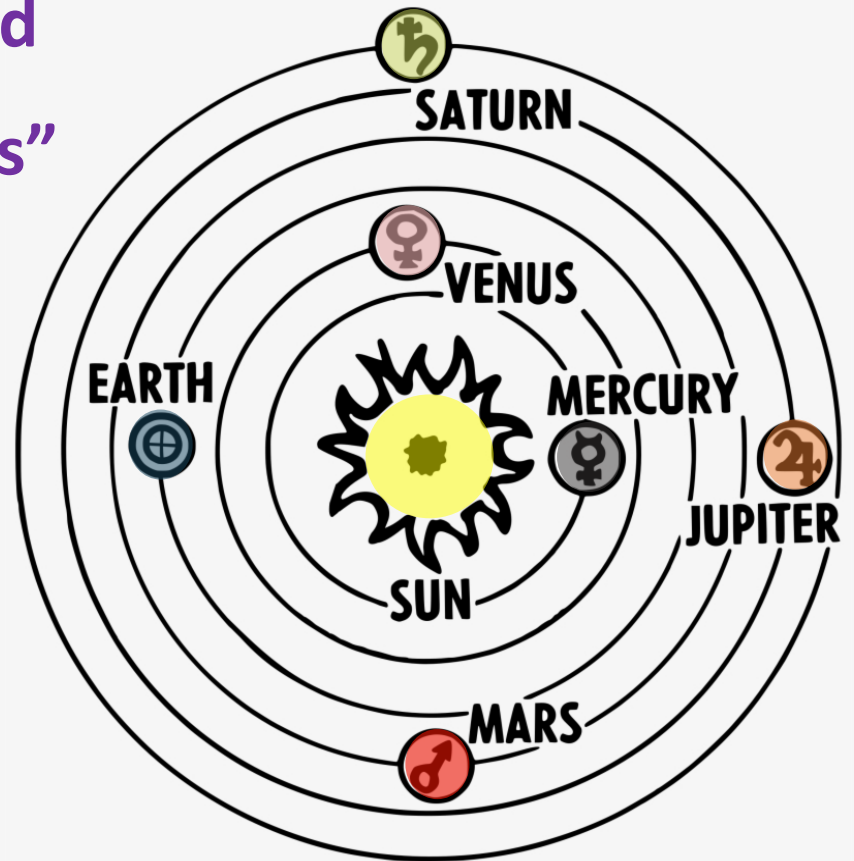
“naked
eye
planets”

VS



Geocentric

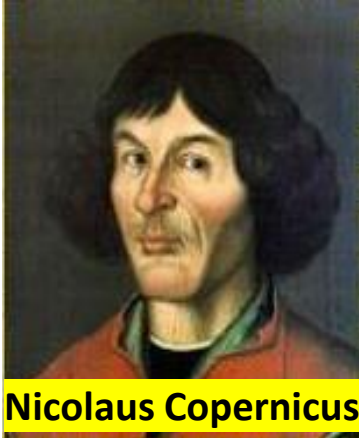
Aristotle (~350 BC),
Ptolemy (2nd century)



Heliocentric

Aristarchus (~350 BC), Nicolaus Copernicus
(15-16th century), Galileo Galilei, Johannes
Kepler, Isaac Newton (16-17th century)

Solar System: Renaissance



Nicolaus Copernicus

Heliocentrism



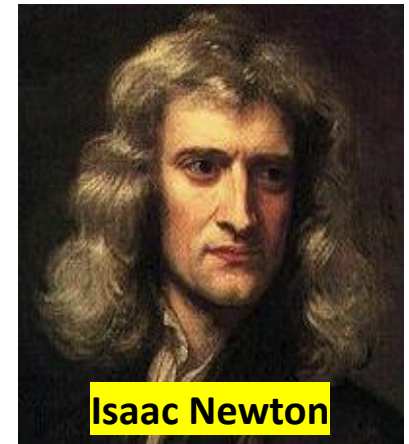
Tycho Brahe

Data!



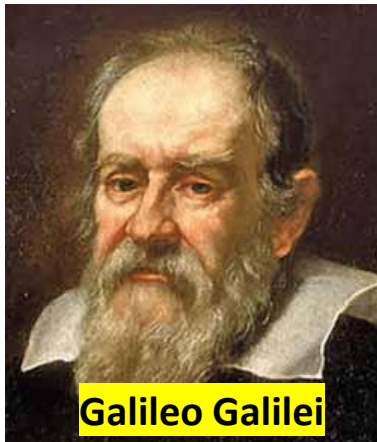
Johannes Kepler

Formulated three laws of planetary motion.



Isaac Newton

Formulated the laws of motion and universal gravitation.

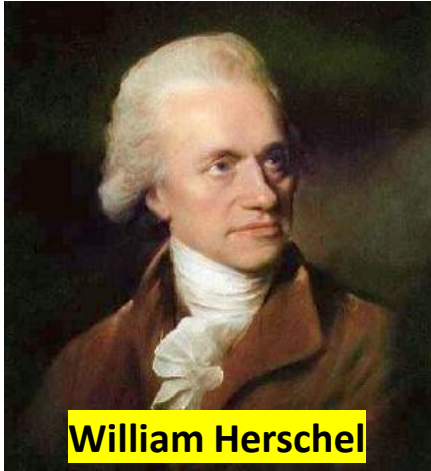


Galileo Galilei

- Discovered four large moons of Jupiter (*bodies that did not orbit Earth*).
- Observed all phases of Venus (*not possible in Geocentric model*) and rotation of the Sun.



Solar System: Modern Astronomy

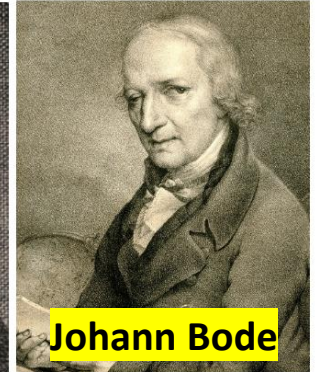


William Herschel

- Discovered *Uranus* and two of its moons.
- Created a catalog of over 2500 nebulae.
- Proposed theory of stellar evolution.
- Discovered IR light.

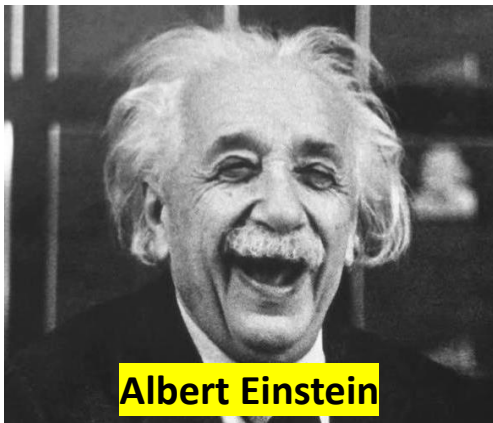


Johann Titius



Johann Bode

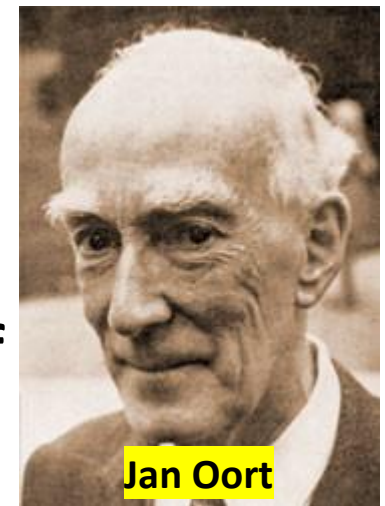
Empirical Bode-Titius Law helped discover the asteroid belt.



Albert Einstein

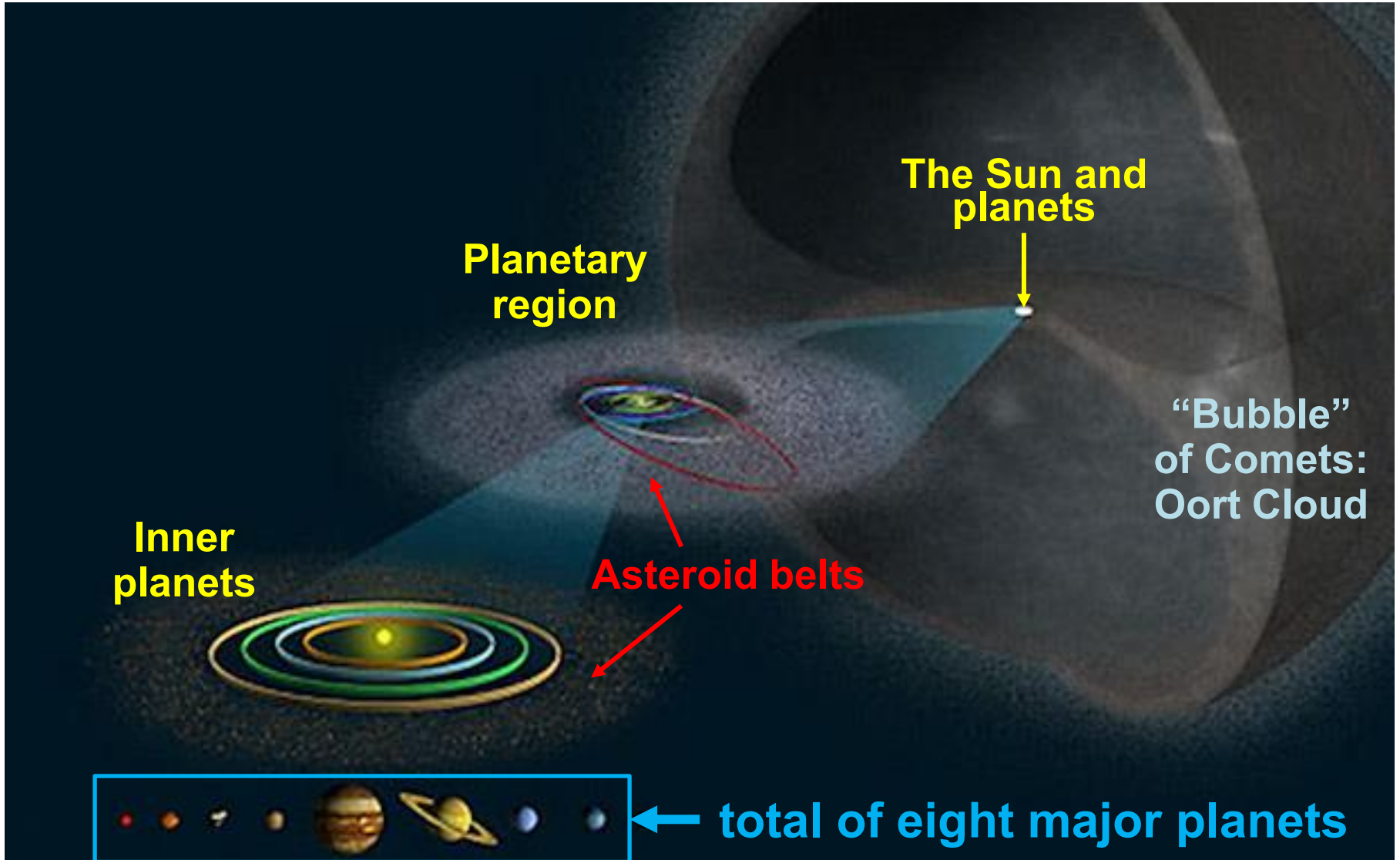
General Theory of Relativity helped explain the peculiar orbit of Mercury.

Theorized the existence of a vast *cloud of comets* at the Solar System's edge.



Jan Oort

Solar System: architecture



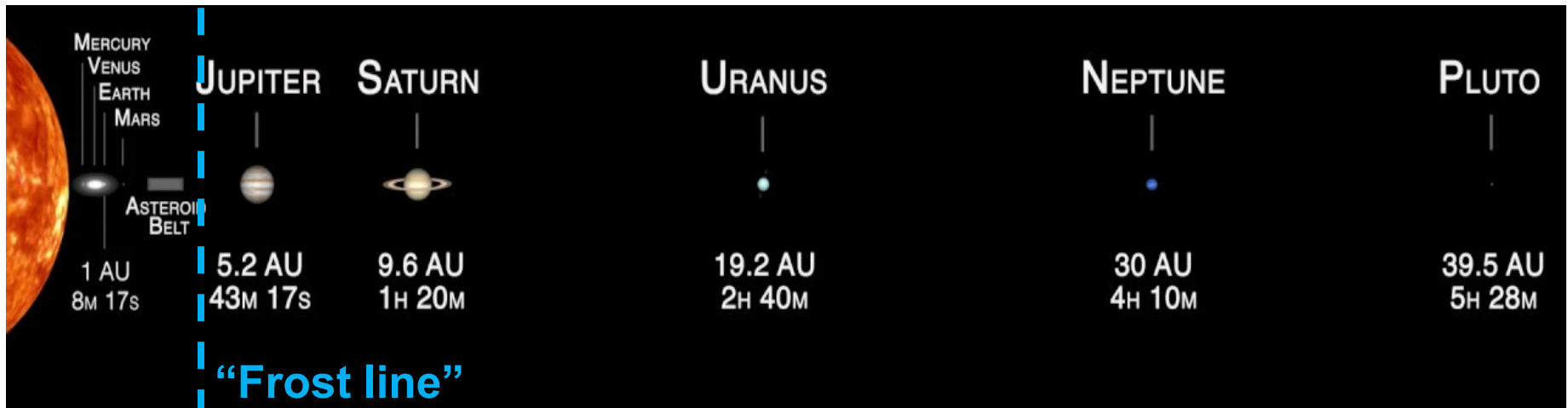
Solar System: inventory

- **Sun** **99.85%** by mass
- **Planets** **0.1 %** by mass
- **Satellites** (“moons”) and **Rings** of planets
- **Asteroids** (“minor planets”, small *rocky* bodies orbiting the Sun)
- **Comets** (small *icy* bodies orbiting the Sun)
- **Meteoroids** (rocky or metallic bodies smaller than 1 m)
- **Dust** (very small particles)
- **Solar Wind** (ionized gas escaping the Sun)

Solar System: distances

What units are used to measure distance in space?

- 1 Astronomical Unit (1 AU) = Average distance between the Earth and the Sun = 150 million km = 93 million miles
- 1 Light Minute (Hour, Second) = Distance *light* travels in 1 minute (hour, second) = 18 million km = 11 million miles



All distances shown to scale, all bodies x1000.