

TmARTSCIENCE YOUTUBE

ASTRONOMY

HISTORY OF SOLAR SYSTEM ASTRONOMY

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"...On the Shoulders of Giants"

Isaac Newton 1675

A brief history of solar system
Astronomy and Mathematics

Pythagoras 570-500 BCE

- Established that the Earth was spherical



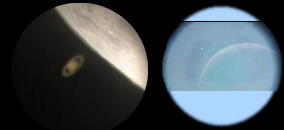
Aristotle 384-322 BCE



- Explained Moon phases



- Explained that planets are more distant than the Moon.

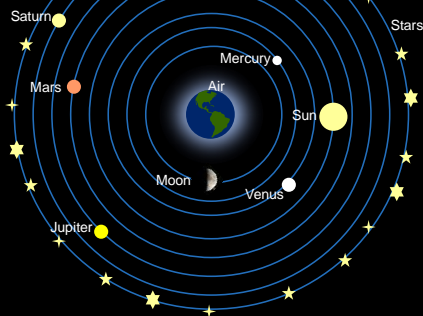


- Geocentric System

11/30/2001

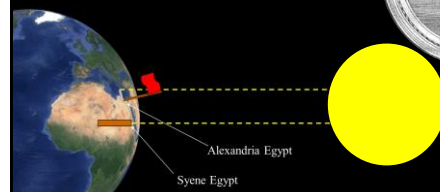
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Crystal Spheres



Eratosthenes 273-195 BCE

- Measured the circumference of the Earth



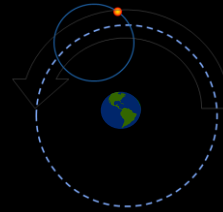
Hipparchus 190-120 BCE

- Developed observing and measuring tools
- Created good astronomical star catalog (map)
- Discovered precession



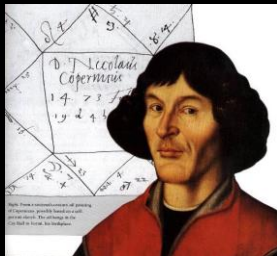
Ptolemy ~150

- Epicycles to account for Retrograde Motion



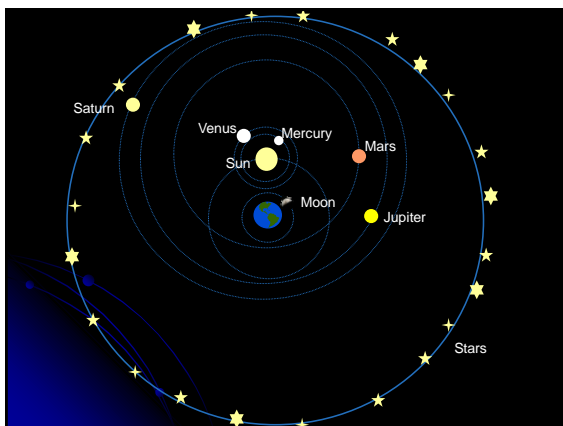
Copernicus 1473-1543

- Proposed the heliocentric model for the solar system.



Tycho Brahe 1546-1601

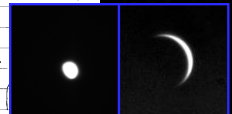
- Possibly the best observational astronomer... ever
- Measured stellar and planetary positions with outstanding precision!



Galileo Galilei 1564-1642

- First recorded telescopic observations of the sky.
- Discovered:
 - Moons of Jupiter
 - Phases of Venus
 - Changing apparent size of Venus and Mars

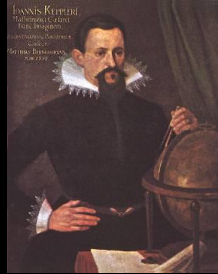
Observation	Sketch
Full Moon	○
Waning Gibbous	◐
First Quarter	◑
Waxing Crescent	◓
New Moon	○



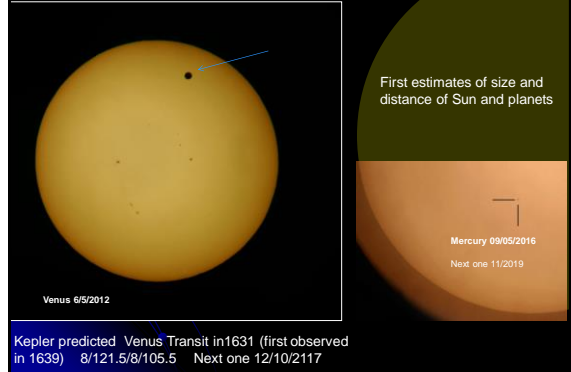
These observations **DISPROVED** the Geocentric model of the Solar System

Johannes Kepler 1571-1630

- Employed by Tycho
- Explained heliocentric planetary motions using Tycho's observations.
- Developed 3 Laws of Planetary Motion

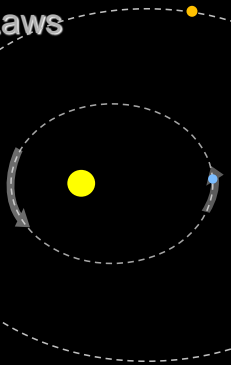


Planet Transits



Kepler's Laws

1. Planets travel around the Sun in an ellipse.
2. When close to the Sun (perihelion), planets move fast.
3. The inner planets orbit the Sun in less time than the distant ones.



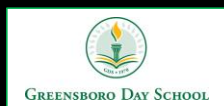
Sir Isaac Newton 1600's

- Developed laws of gravity after studying Kepler's work
- He knew **inertia** - An object at rest will stay at rest, an object in motion will stay in motion unless acted on by another force.
- By studying Kepler's work, Newton formulated the idea and theory of attractive force, **Gravity**, which kept planets in orbit around Sun.



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Kepler's Laws

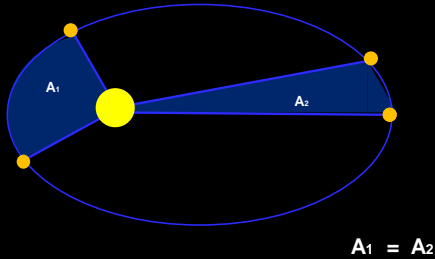
• 1st Law "Law of Ellipses"



- All objects orbiting the Sun travel in an ellipse. The Sun is one of the foci of the ellipse.

Kepler's Laws

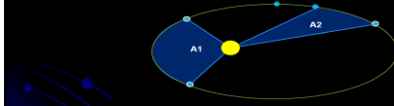
2nd Law "Law of Equal Areas"



Kepler's Laws

• 2nd Law "Law of Equal Areas"

- A line segment connecting the Sun and a planet will sweep sectors of equal areas in equal time.



- A planet within its orbit will travel faster when it is at perigee and more slowly when at apogee.
- Because of this in the N. hemisphere, summer is 2 days longer than winter.

Kepler's Laws

• 3rd Law "Law of Periods"

- $R^3 = P^2$

- $\text{Orbital Radius}^3 = \text{Orbital Period}^2$

Planet	P (yr)	a (AU)	T ²	R ³
Mercury	0.24	0.39	0.06	0.06
Venus	0.62	0.72	0.39	0.37
Earth	1.00	1.00	1.00	1.00
Mars	1.88	1.52	3.53	3.51
Jupiter	11.9	5.20	142	141
Saturn	29.5	9.54	870	868

- Planets that are close to the Sun will orbit faster than planets that are further from the Sun.