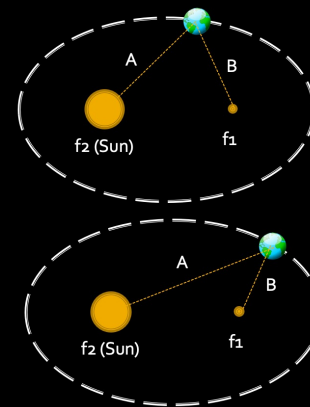
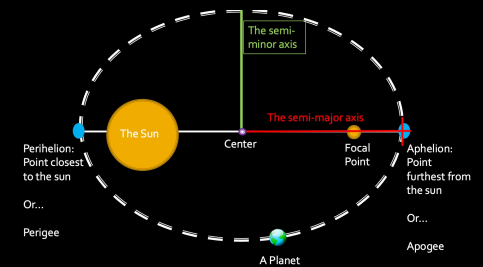
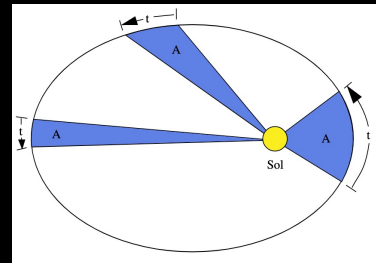
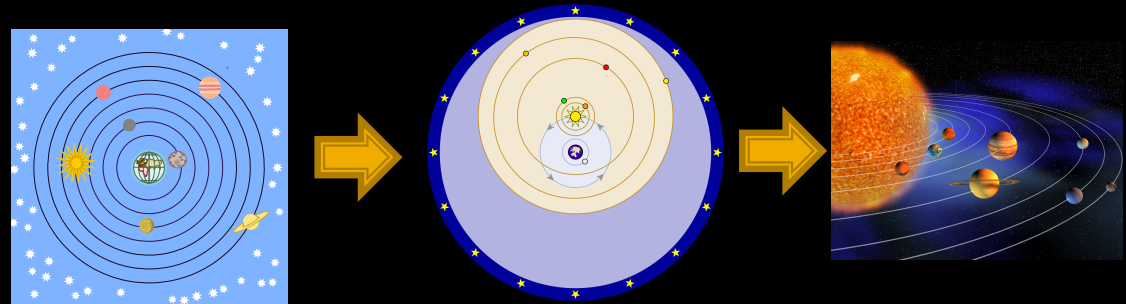


Kepler's Laws of Planetary Motion

- History
- Geocentric Model
- The Heliocentric Model
- Geo-Heliocentric Model
- Kepler's First Law
- Kepler's Second Law
- Kepler's Third Law



Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

The paid full version of your resource includes both Google Slides and PowerPoint and is Google Classroom Ready



History

- Throughout history there have been certain roadblocks to scientific advancement
- _____
- _____
- The thinking of the time was that everything had to revolve around the Earth



History



1

- Based on his finding he advocated for a _____
- He was tried by the Inquisition in 1615 and found "vehemently suspect of heresy" as heliocentrism "explicitly contradicts in many places the sense of Holy Scripture"
- As a result, he spent the rest of his life under house arrest

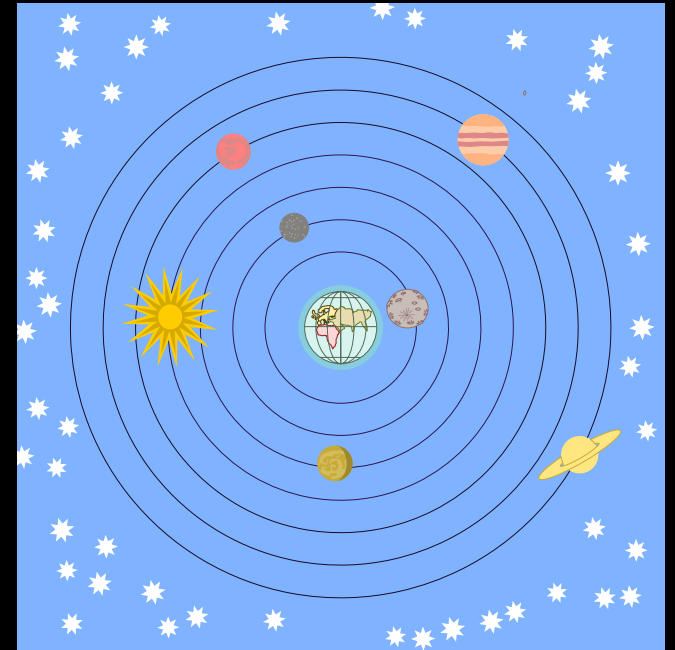


Heliocentric Solar System

It wasn't until 1992 (400 years after he used the telescope to see the planets) that the Pope officially admitted that they were wrong in how they treated Galileo.

Geocentric Model

- _____
- Lasted from approximately 1000 B.C. to the 1700's
- _____
- Ptolemy and Aristotle put the Earth at the centre because it was clear that the Sun and stars went around us each day in large circular motions



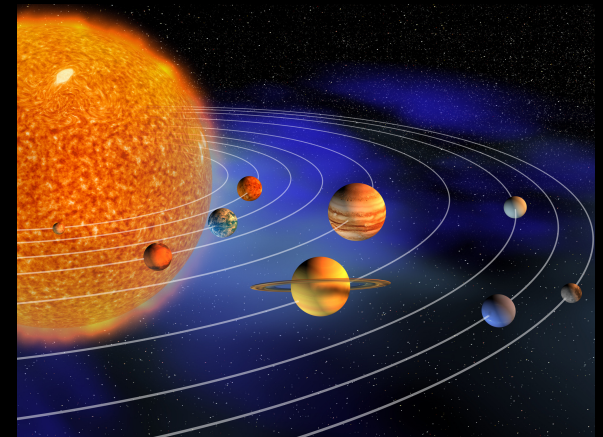
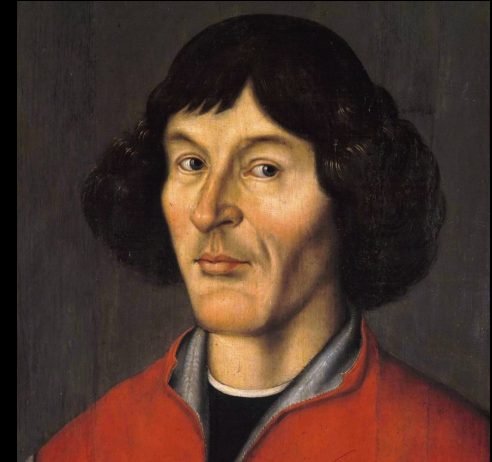
THIS SLIDE HAS BEEN REMOVED

The Heliocentric Model



2

- Nicolaus Copernicus (1473 – 1543) proposed a Heliocentric model of the solar system prior to Galileo
- _____
- *His book, De revolutionibus orbium coelestium (On the Revolutions of the Celestial Spheres), published just before his death in 1543, is often regarded as the starting point of modern astronomy and the defining moment that began the scientific revolution*



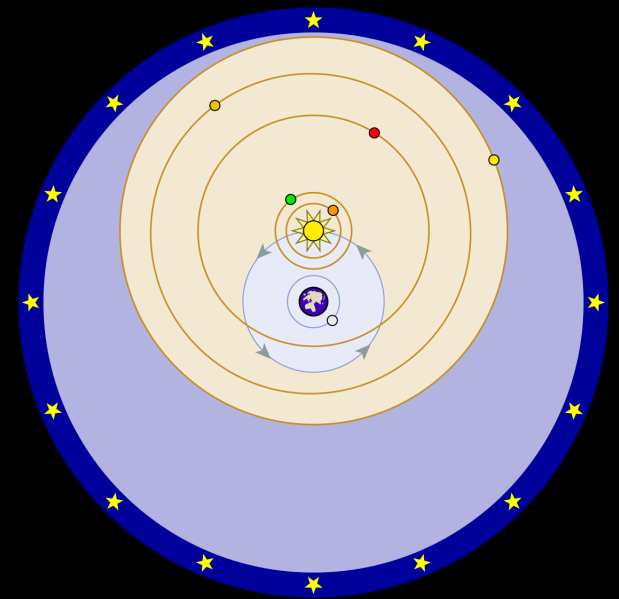
Copernicus

- But, most people did not /could not agree with Copernicus
- They accused him of making theories and then trying to fit the facts instead of doing proper science and using the data to create the theories



Geo-Heliocentric Model

- Brahe's Geo-Heliocentric model tried to combine both theories



THIS SLIDE HAS BEEN REMOVED

Johannes Kepler 1571 - 1630

- Kepler was Tycho Brahe's assistant and had access to all his data
- By carefully plotting and analyzing the data, Kepler produced three laws, now called Kepler's Laws of Planetary Motion



Kepler's Laws

1. _____

2. _____

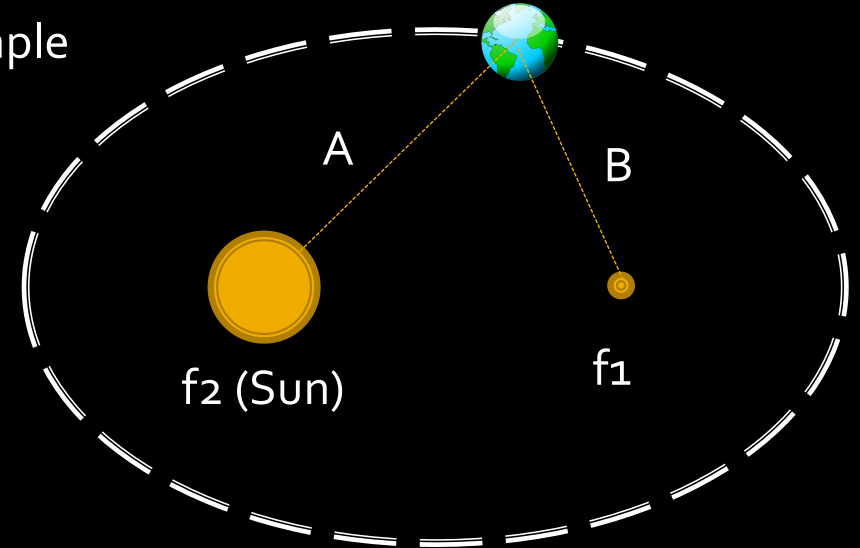
3. _____

Kepler's First Law

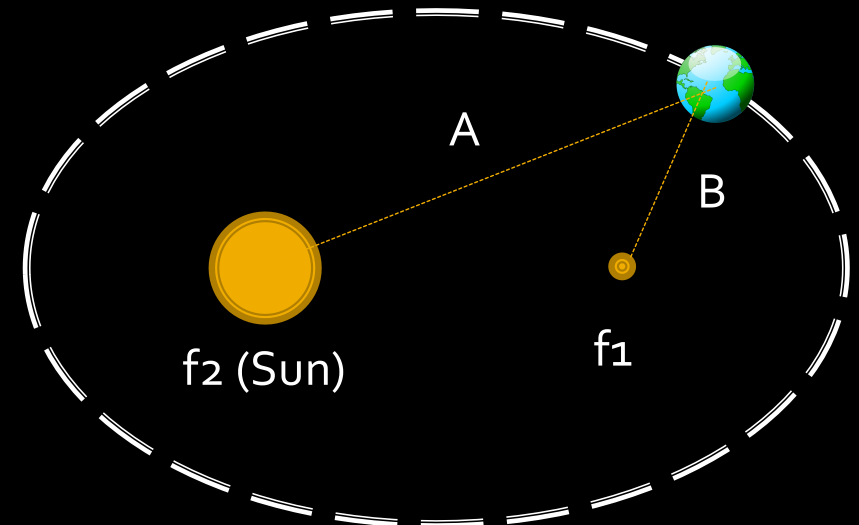


3

The video has been removed from this sample

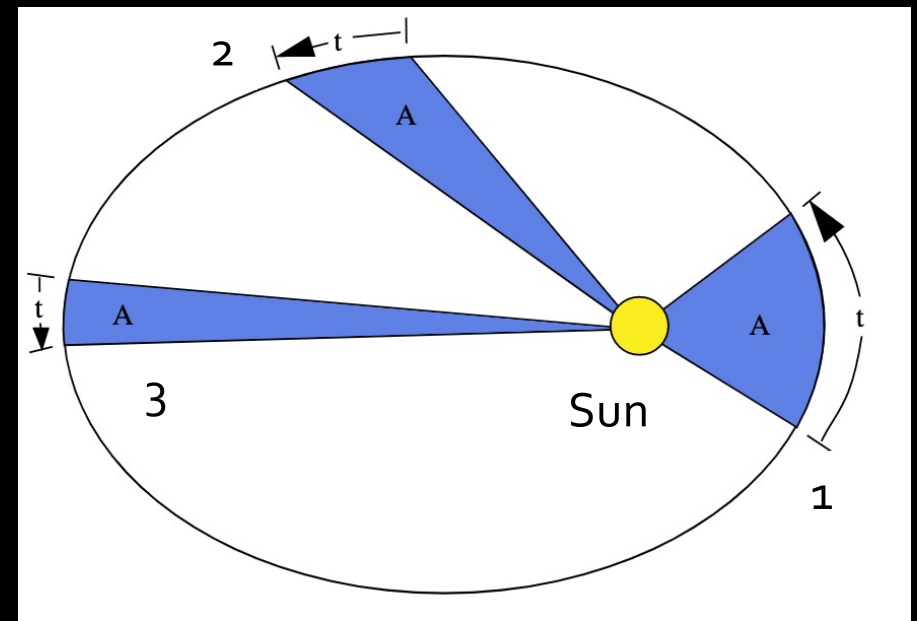


- For any point on the ellipse, the sum of the point's distances to the two foci ($A + B$) remain the same



THIS SLIDE HAS BEEN REMOVED

- If the planet is closer to the Sun (1), it needs to move farther around the orbit to create an area equal to when it is at a greater distance (2,3)



To cover the same area over the same amount of time, the planet at location 1 will have to move faster than location 2 which will move faster than location 3.

Angular Momentum

- As a planet moves through its orbit, its angular momentum is conserved
- $L = mvr$
 - L = angular momentum, m = mass, v = velocity, r = radius (distance)
- Since angular momentum and mass are constant, as

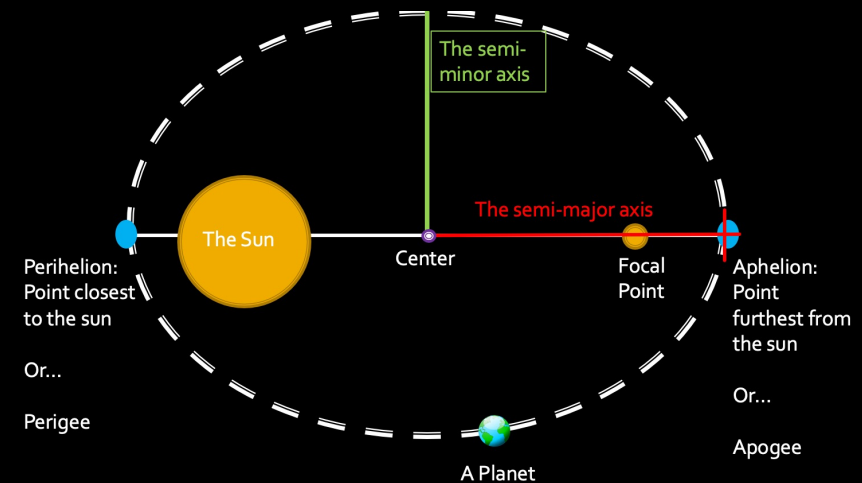
The video has
been removed
from this sample



THIS SLIDE HAS BEEN REMOVED

Terminology

- _____
- _____
- **The semi-major axis:** A line that runs from the centre, through a focal point and to the perimeter.
- **The semi-minor axis:** A line segment that is at right angles with the semi-major axis and has one end at the center of the conic section



Kepler's Third Law

- The square of the orbital period (time to complete one orbit - P) of a planet is directly proportional to the cube of the semi-major axis of its orbit (a)
 - P = Earth Years
 - a = Astronomical Units (A.U.)
- Or... $P^2 \propto a^3$
- _____



Planet	Radius of Orbit Relative to Earth's	Orbital Period (Length of Year) Relative to Earth's Year	Orbital Velocity Relative to That of Earth's
Mercury	0.387	0.2409	1.607
Venus	0.723	0.616	1.174
Earth	1.0	1.0	1.000
Mars	1.524	1.9	0.802
Jupiter	5.203	12.0	0.434
Saturn	9.539	29.5	0.323
Uranus	19.18	84	0.228
Neptune	30.06	165	0.182

Any object closer than Earth (i.e. Mercury) will move faster and have a shorter orbital

- Clearly, Kepler's third law is vital in determining how far away a planet is from its star since distance and speed are directly related

- _____

$$P^2 = \left[\frac{4\pi^2}{G(M + m)} \right] a^3$$