Astronomy

Fall 2025

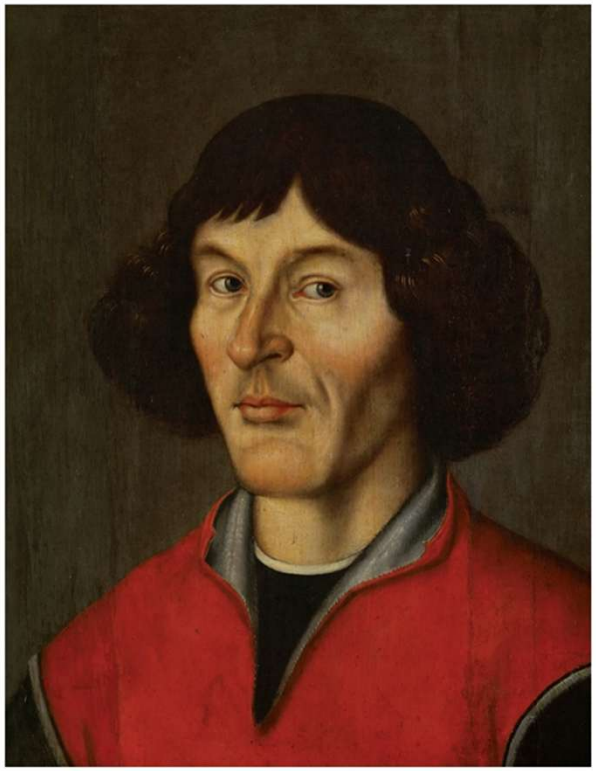
Weeks 7 - 8

Monday / Tuesday (September 22 – 23)

- T:**5B** research and evaluate the contributions of scientists, including Ptolemy, Copernicus, Tycho Brahe, Kepler, Galileo, and Newton, as astronomy progressed from a geocentric model to a heliocentric model; and
  6D understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation.
- O: I will be able to compare and contrast the models created by ancient astronomers
- D: by discussing similarities in my groups, completing a Stellarium project, taking notes, and taking a quiz.
- A: Copernicus, wondering stars
- Y: What concepts from ancient astronomers were correct? Which were incorrect?

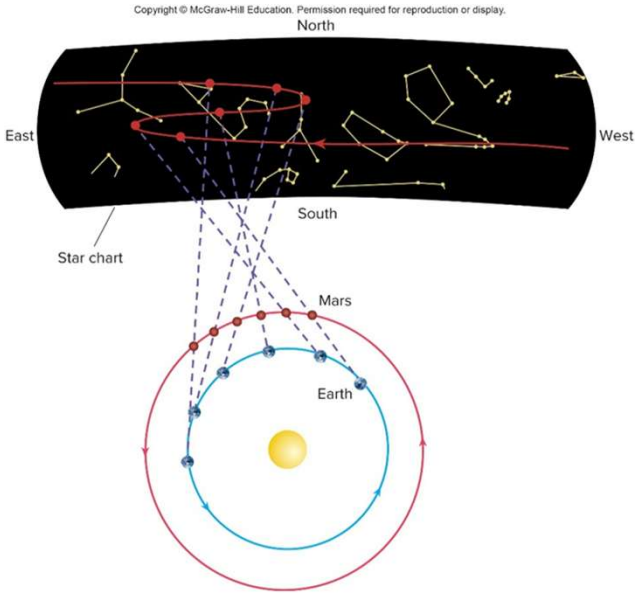
Astronomy in the Renaissance: Copernicus

- Nicolaus Copernicus (1473 to 1543)
- Could not reconcile centuries of data with Ptolemy's geocentric model.
- Consequently, Copernicus reconsidered Aristarchus's heliocentric model with the Sun at the center of the solar system.

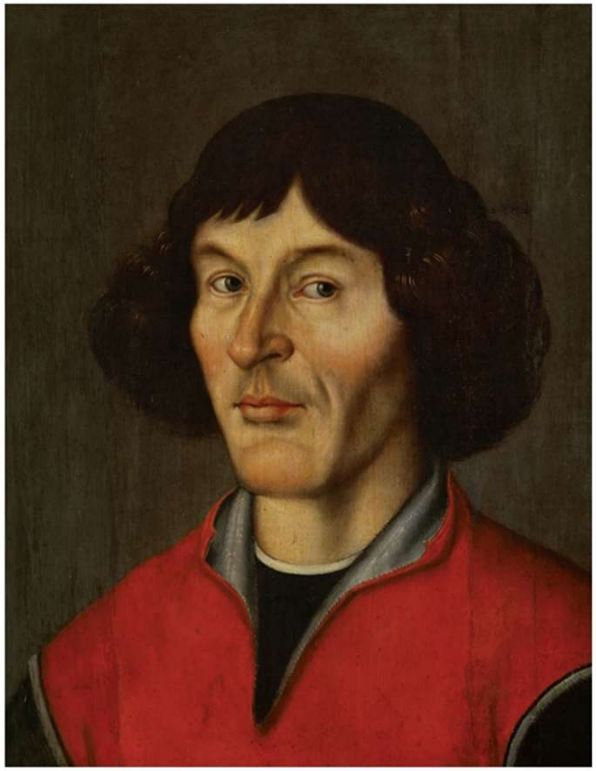


Copernicus's Success

- ***Heliocentric models*** explain retrograde motion as a natural consequence of two planets (one being Earth) passing each other.
- Copernicus could also derive the relative distances of the planets from the Sun, and explain why Venus and Mercury were always close to the Sun.



Copernicus's Failure



- However, problems remained:
- Could not predict planet positions any more accurately than the model of Ptolemy.
- Could not explain lack of parallax motion of stars.
- Conflicted with Aristotelian "common sense".

Wednesday / Thursday (September 24 – 25)

Journal 2.1

- What was my grade for the first 6-weeks? Am I happy with it? What will I do this six-weeks as compared to the 1st six-weeks?

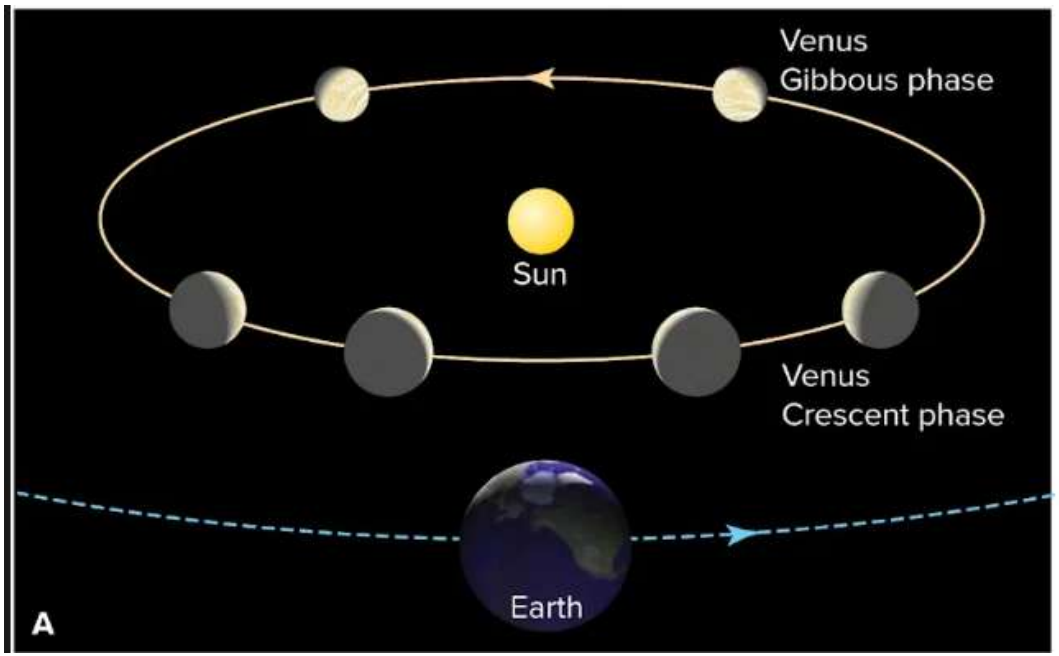
- T:**(5) Science concepts. The student understands how astronomy influenced and advanced civilizations. The student is expected to:**
- **5B** research and evaluate the contributions of scientists, including Ptolemy, Copernicus, Tycho Brahe, Kepler, Galileo, and Newton, as astronomy progressed from a geocentric model to a heliocentric model; and

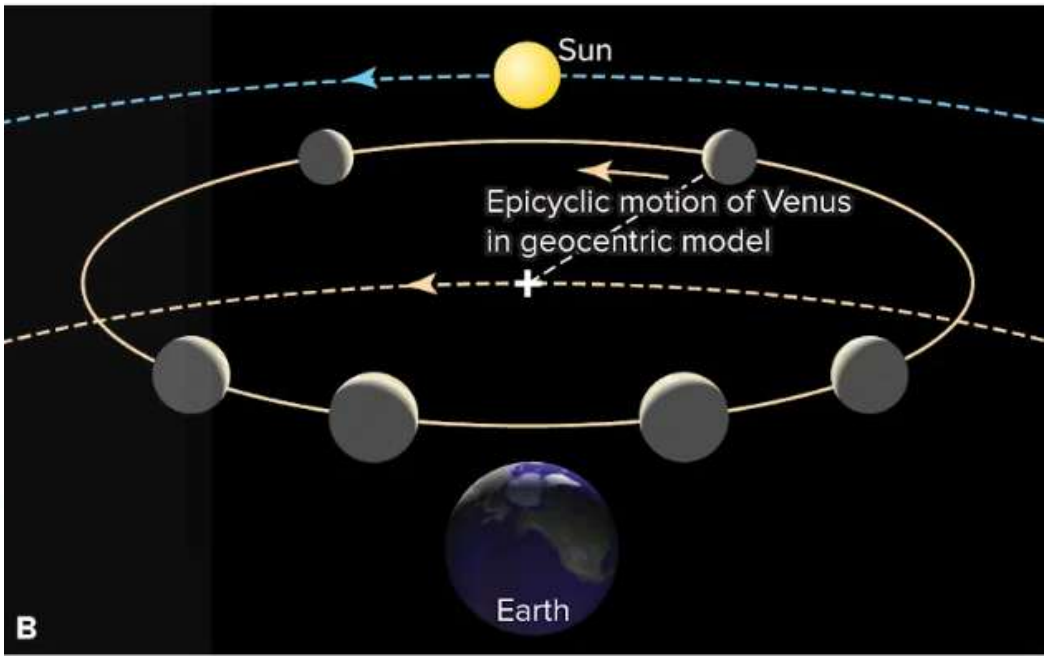
(6) Science concepts. The student conducts and explains astronomical observations made from the point of reference of Earth. The student is expected to:

- **6D** understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation.

- O: I will be able to explain the astronomical ideas presented by Galileo
- D: after watching a video, discussing with my peers, completing a Stellarium project, and conducting a close-read.
- A: Galileo, geocentric, heliocentric
- Y: What observations did Galileo use to determine that the Sun was the center of the universe?

According to geographic calculations, what shapes of Venus would we see in a geocentric Universe?
What about in a heliocentric Universe?





According to Galileo’s observations, which model of the Universe does he have evidence for?
Is this enough evidence to prove a heliocentric Universe?

Friday (September 26)

- C-day

Monday / Tuesday (September 29 – 30)

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(6) Science concepts. The student conducts and explains astronomical observations made from the point of reference of Earth. The student is expected to:

- **6D** understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation.

- O: I will be able to explain Kepler's Law of planetary motion
- D: by discussing data with my group, completing a stellarium assignment, taking notes, and reading an Actively Learn.
- A: Kepler's laws
- Y: How do Kepler's laws provide proof that the Sun is the center of our solar system?

Astronomy in the Renaissance: Tycho Brahe

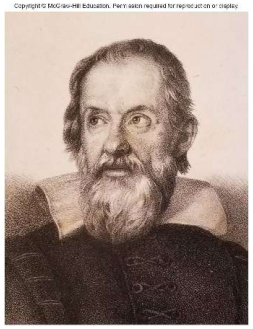
- Tycho Brahe (1546 to 1601)
- Made meticulous measurements of the planets.

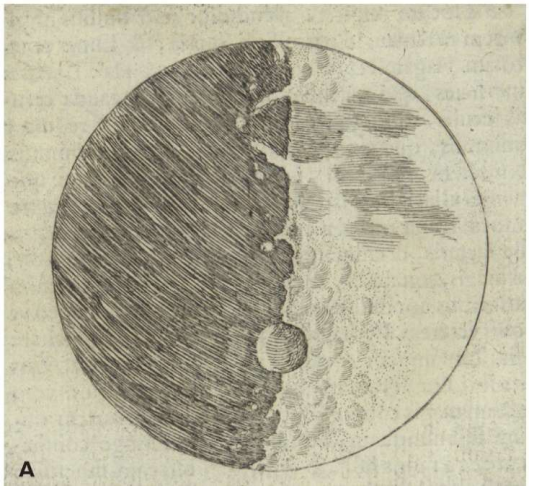
Tycho Brahe's Observations

- Observed supernova and comet
  - suggested that the heavens were both changeable &complex
  - Proposed compromise geocentric model,
  - observed no parallax

Astronomy in the Renaissance: Galileo

- Galileo (1564 to 1642)
- First person to use the telescope for astronomy
  - The Moon is a ball of rock.

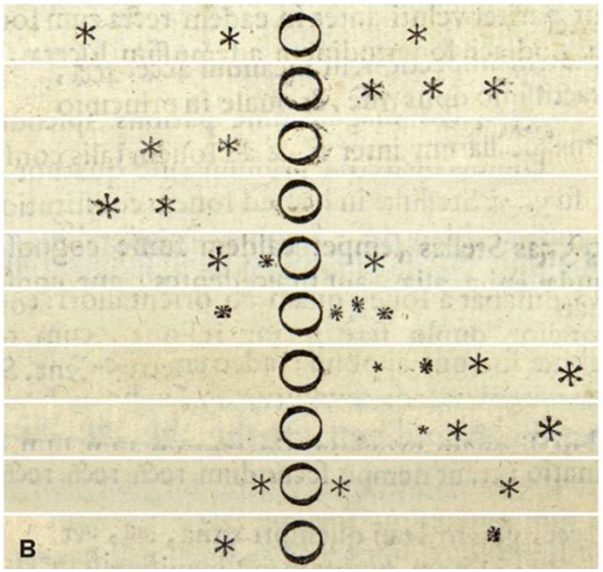




- Leopere di Galileo Galilei: Opere astronomiche. 1842-1853/ a. Galilei, Galileo, 1564-1642. Sidereus Nuncius. [1610] Library of Congress. Rare Books and Special Collections Division

Galileo’s Observations

- The Sun has spots: it’s imperfect, changes its appearance, and rotates.
- Jupiter has four moons orbiting it:
- Milky Way uncountable number of stars: Earth-centered universe is too simple.



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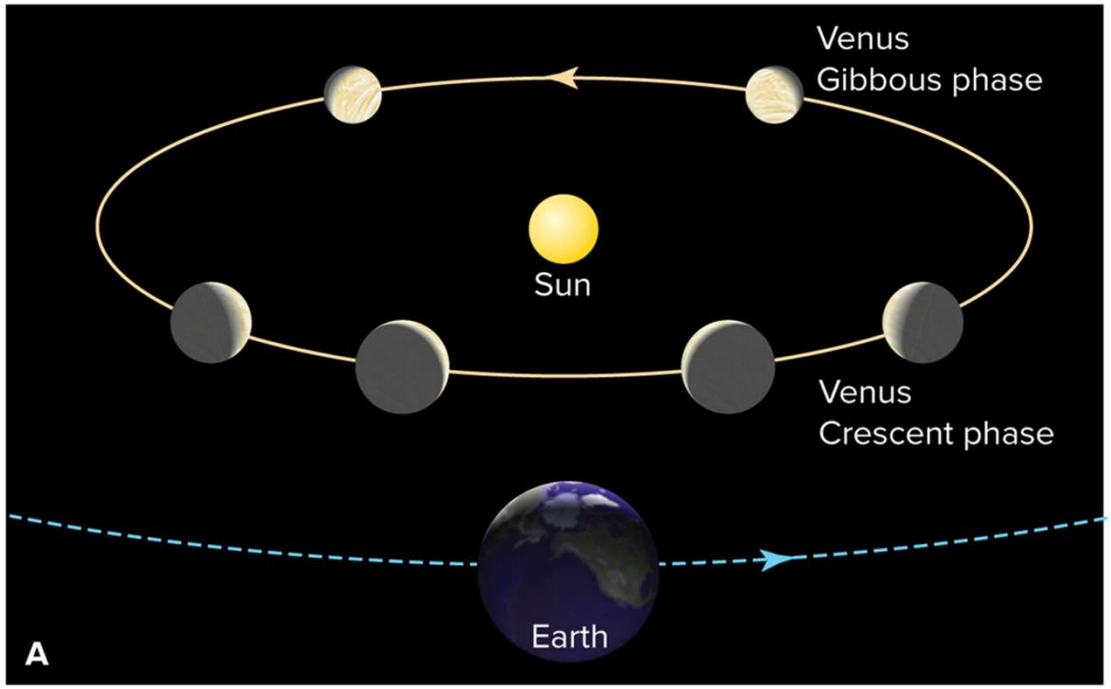
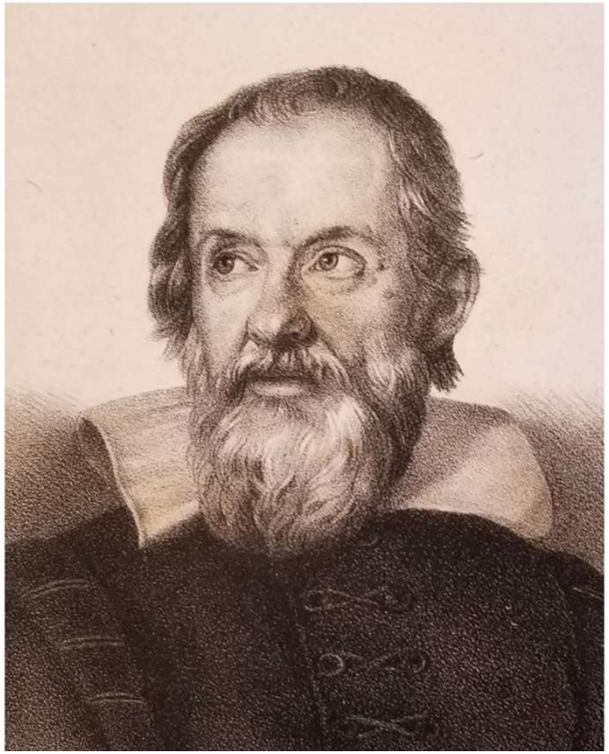
Evidence for the Heliocentric Model



- Venus undergoes full phase cycle: Venus must circle Sun.

One of the Founders of Modern Science

- Credited with originating the experimental method for studying scientific problems.
- Deduced the first correct “laws of motion.”
- Was brought before the Inquisition and put under house arrest for the remainder of his life.



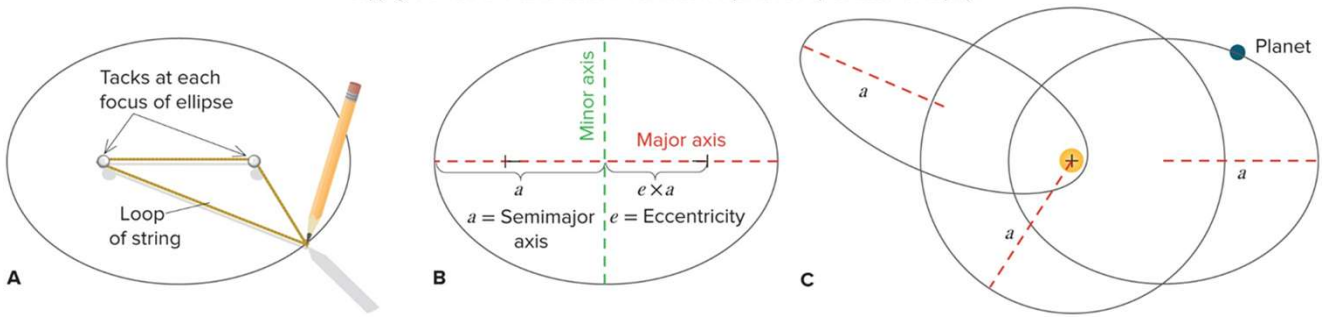
- Le opera di Galileo Galilei: Opere astronomiche 1842-1853

Johannes Kepler

- Johannes Kepler (1571 to 1630)
- Using the very precise Mars data, Kepler showed the orbit to be an ***ellipse.***

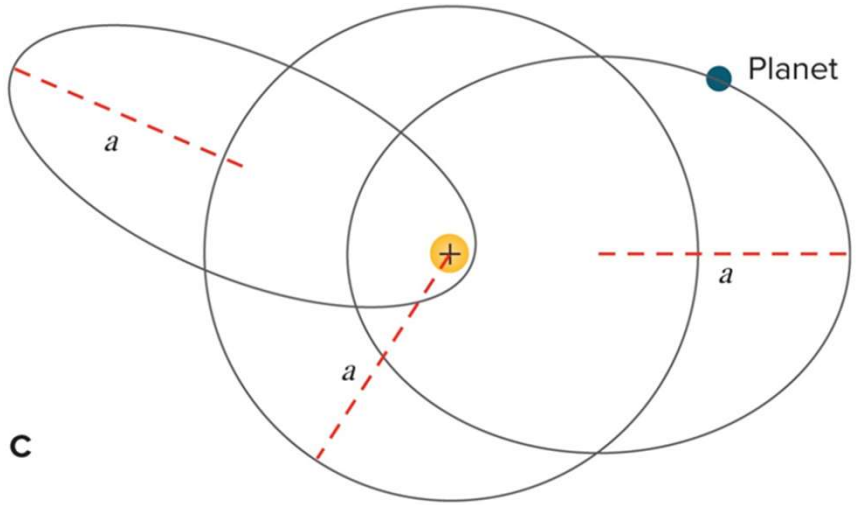
Kepler's Success

- Planets follow ellipses with the Sun located at one of the two foci



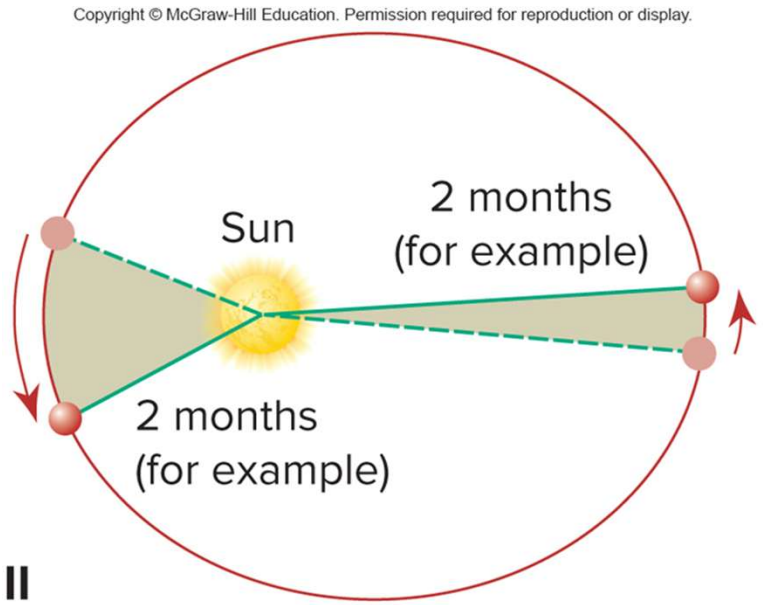
Kepler's 1st Law

- Planets move in elliptical orbits with the Sun at one ***focus*** of the ellipse.



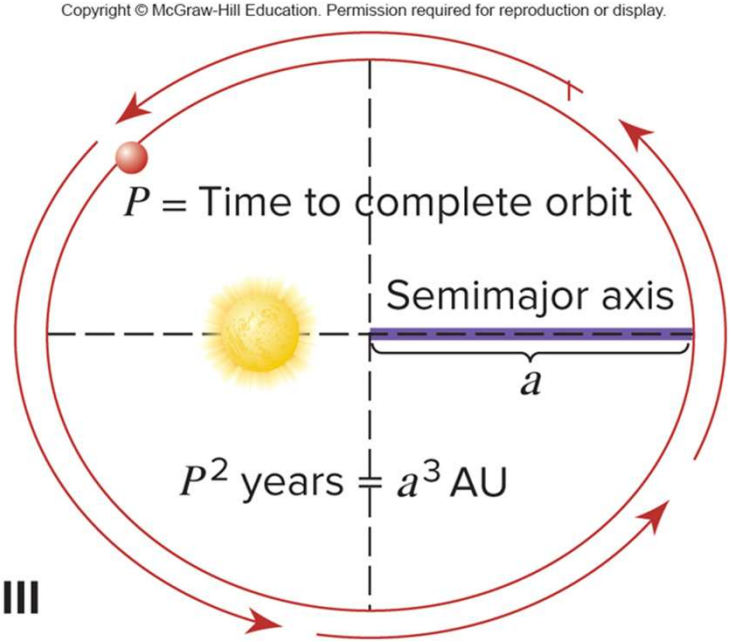
Kepler's 2nd Law

- The orbital speed of a planet varies so that a line joining the Sun and the planet will sweep out equal areas in equal time intervals.
- The closer a planet is to the Sun, the faster it moves.



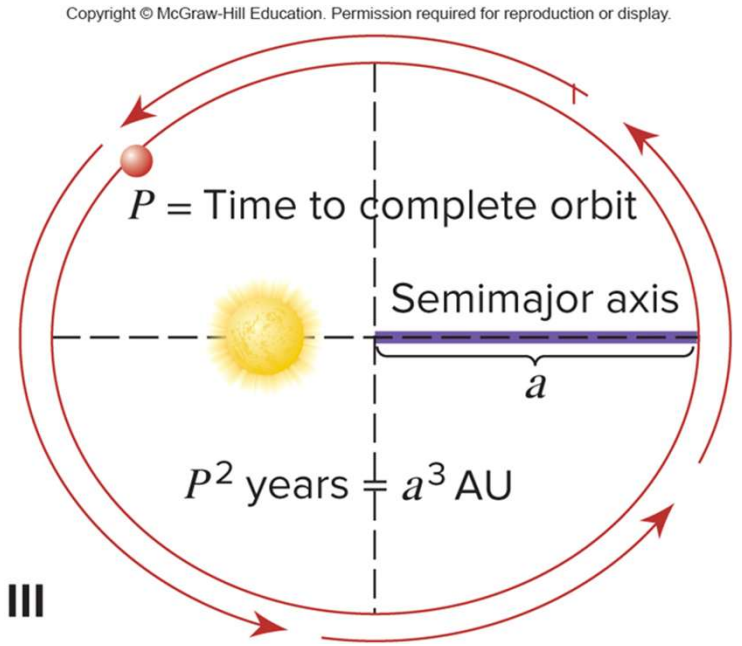
Kepler's 3rd Law

- The amount of time a planet takes to orbit the Sun is related to its orbit's size.
- The square of the period, P, is proportional to the cube of the ***semimajor axis,*** a.



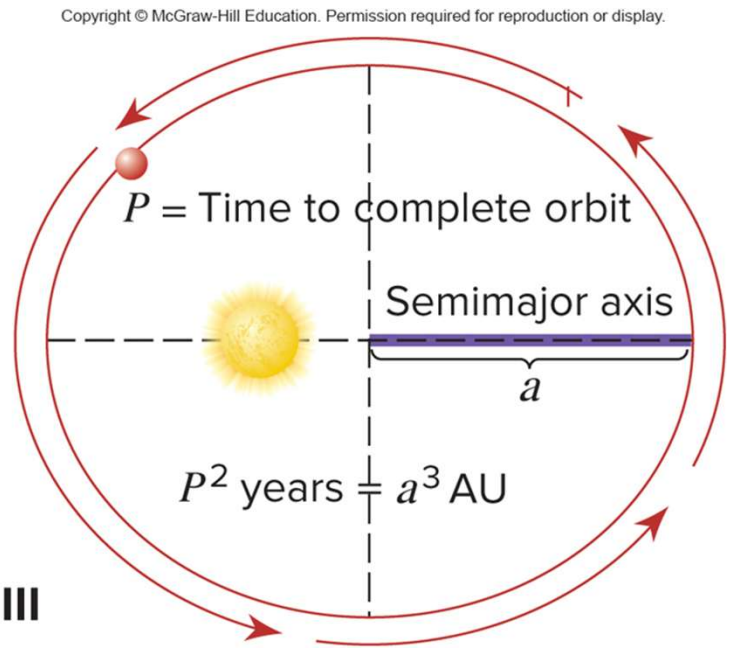
Kepler's 3rd Law: Period and Distance

- This law implies that a planet with a larger average distance from the Sun, which is the semimajor axis distance, will take longer to circle the Sun.
- Third law hints at the nature of the force holding the planets in orbit.



Kepler's 3rd Law: Still in Use Today!

- Third law can be used to determine the semimajor axis, a, if the period, P, is known, a measurement that is not difficult to make.



Wednesday / Thursday (October 1 – 2)

- Substitute on Thursday

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- **6D** understand the difference between astronomy and astrology, the reasons for their historical conflation, and their eventual separation.

- O: I will be able to explain the planets' orbits according to Kepler
- D: by completing 3 PhET simulations.
- A: Kepler's Laws
- Y: How can the orbits of the planets be proven by Kepler's laws?

Friday (October 3)

- C-day
- Substitute