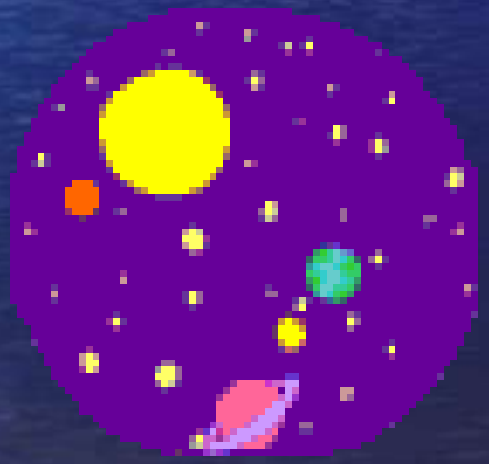
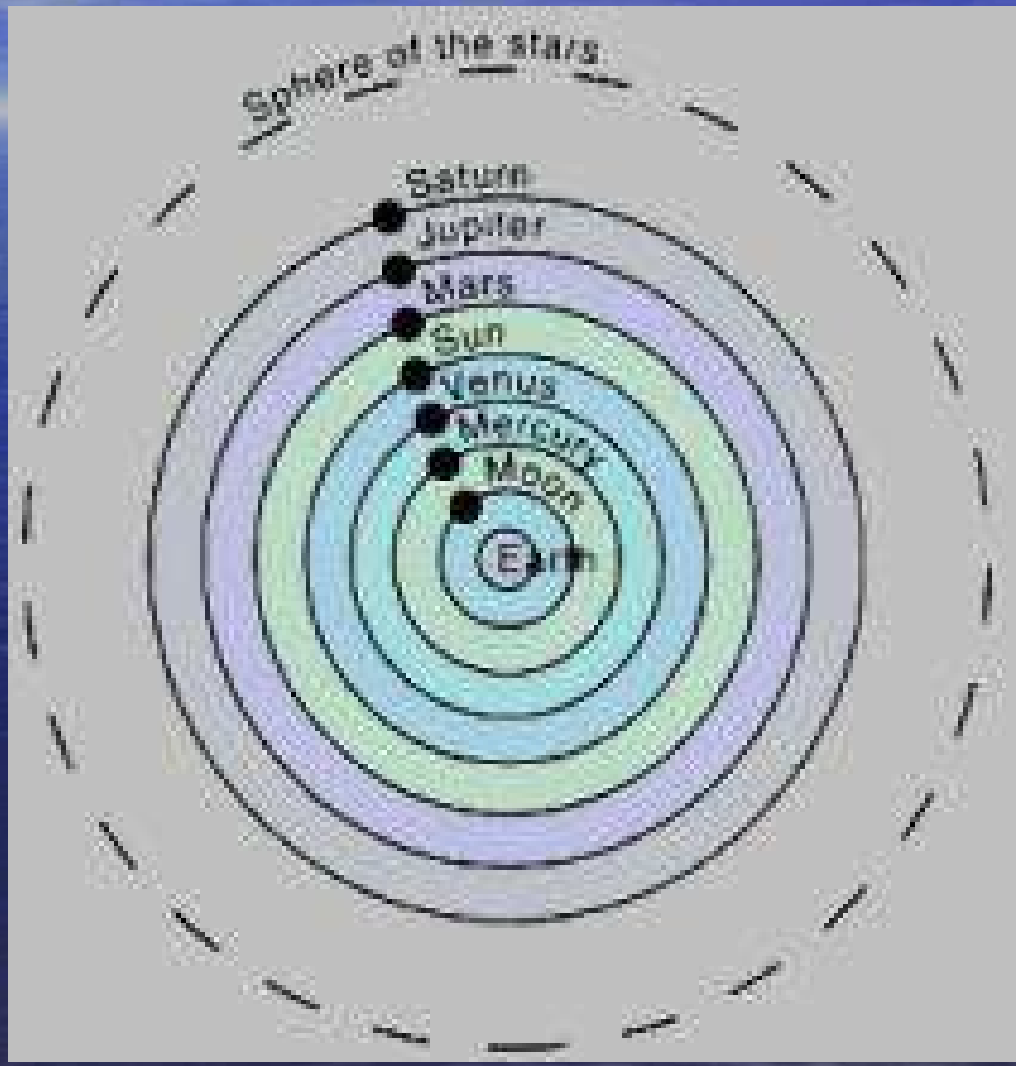
The Geocentric Theory vs. The Heliocentric Theory



The Geocentric Theory

- The earth is located at the center of the *universe* and all the planets revolve around the earth.



Geocentric Cont…..

- The Geocentric theory was believed by the Catholic church especially because the church taught that G-d put earth as the center of the universe which made earth special and powerful.
- The idea of the Earth actually *moving* was widely felt as a foolish suggestion because, as they saw it, if the Earth was moving they would be able to feel it.

Aristotle (384-322 B.C.)

- Developed an early model based on the concept of uniform circular motion. He placed the earth at the center of the universe and all of the planets, sun and stars around it.
- When Aristotle lived, if a person could "reason" out why something happened, then you didn't need to do any experiments to see what would happen.

- In the realm of change, the natural motion of earthy materials was to seek the center of the universe.
- This is why Aristotle placed the earth at the center of the cosmos. This is also his explanation for why objects fall when dropped. A dropped object is just following its natural tendency to seek the center of the universe.

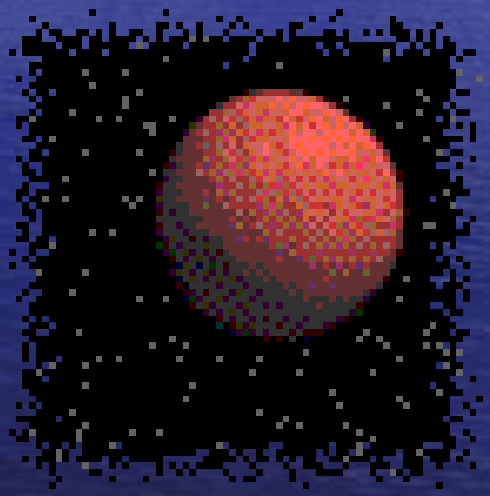
- Aristotle reasoned that if the earth rotated about its axis, we should fly off into space. Since we don't, the earth must be stationary.
- It would be almost 1900 years before Galileo introduced the concepts of gravity and inertia that explain why these effects are not observed even though the earth does move.

Ptolemy (140 A.D.)

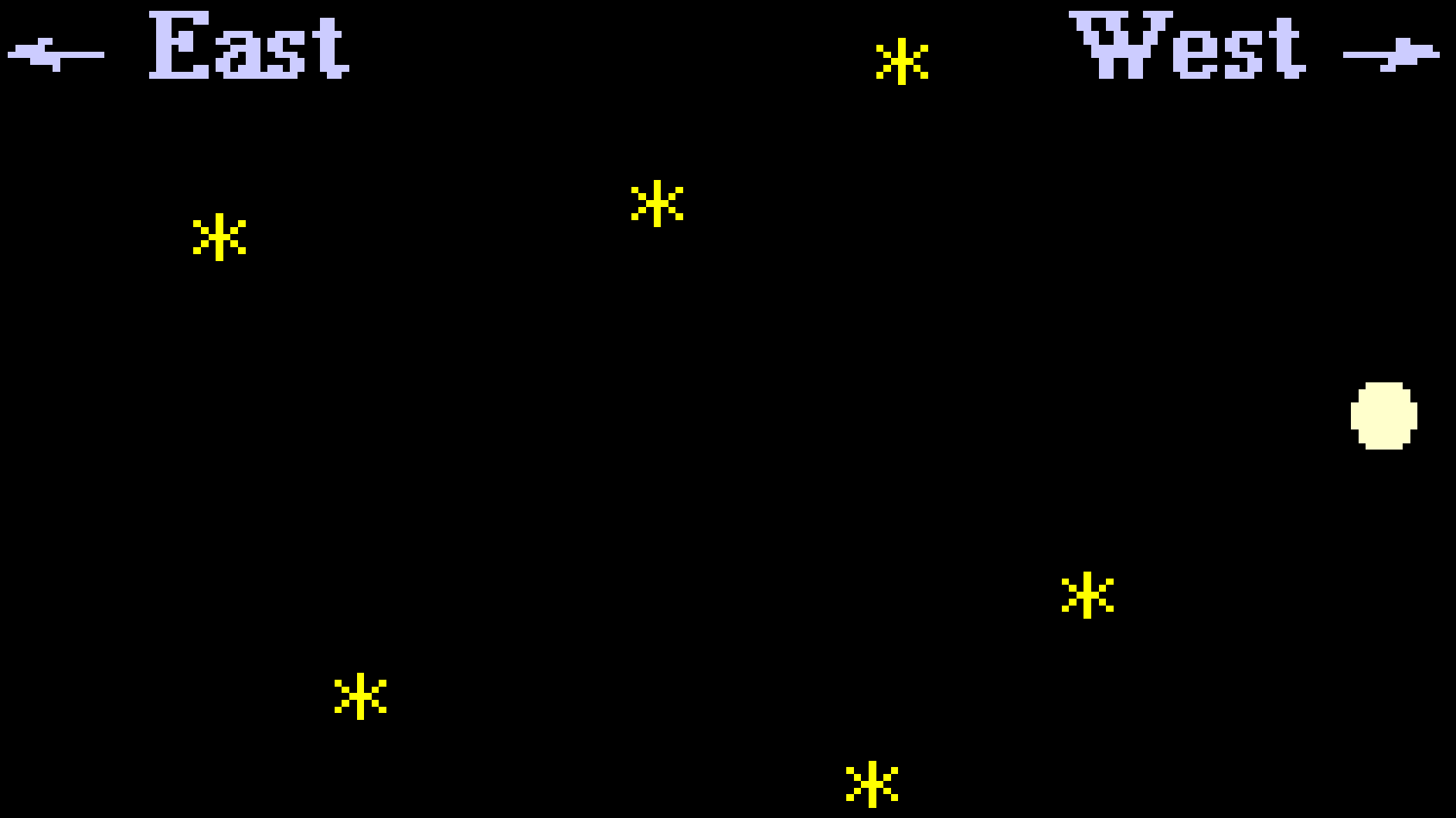
- Ptolemy advanced the geocentric theory in a form that prevailed for 1400 years.
- He added mathematics to support the theory

Ptolemy's Problem

- Many supporters of the geocentric theory had one piece of evidence they couldn't explain – the movement of MARS.
- Let's take a break and investigate this movement.



Mars' Motion

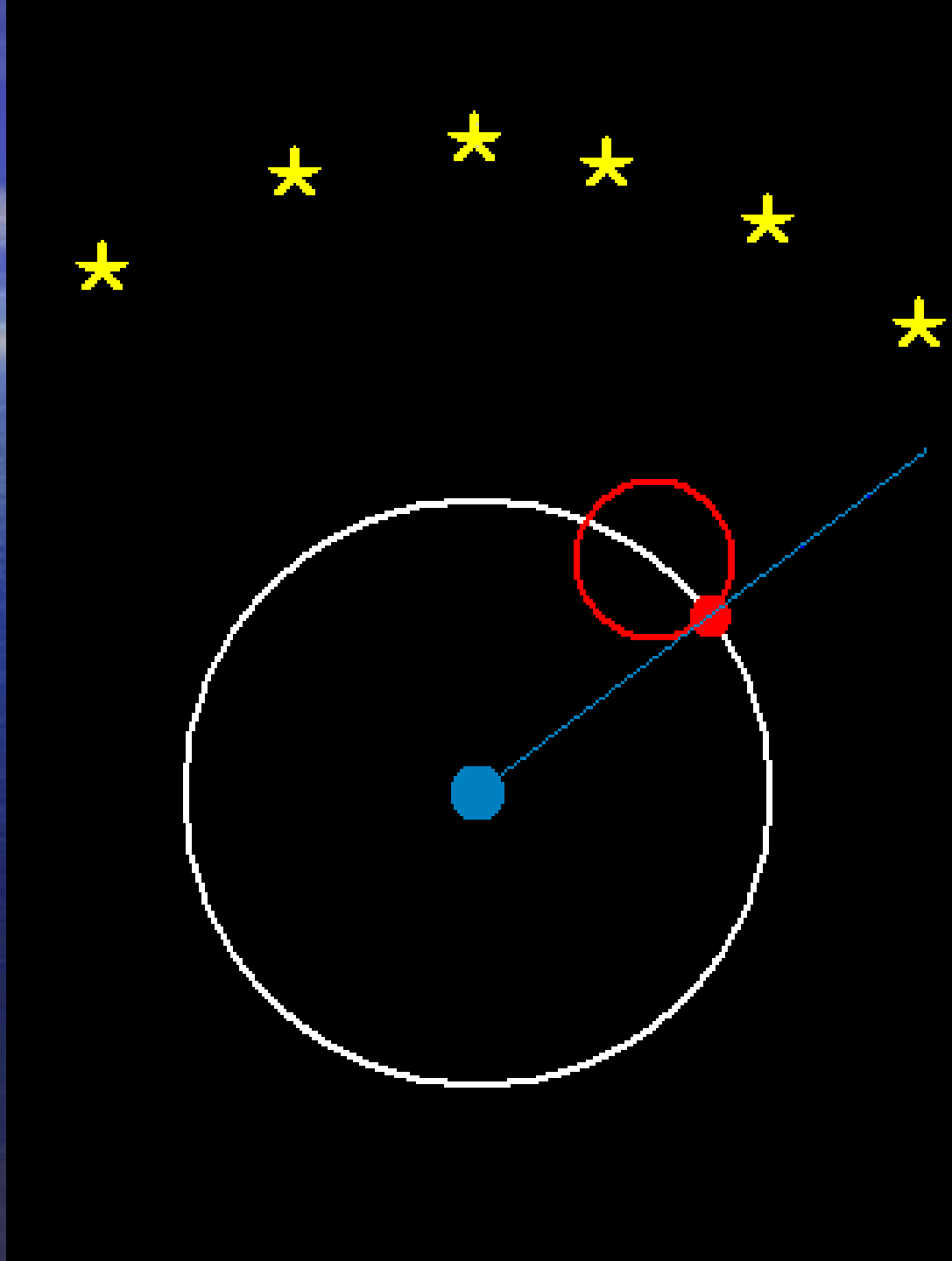


http://csep10.phys.utk.edu/astr161/lect/retrograde/retrograde.html

How did Ptolemy Explain this Problem?

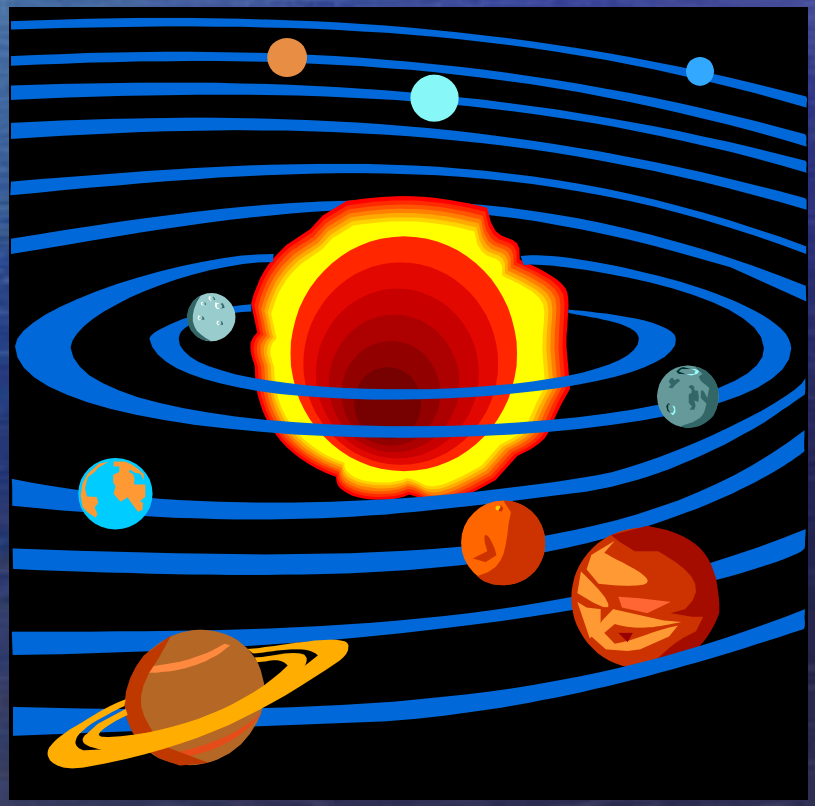
- Ptolemy used geometric models to predict the positions of the sun, moon, and planets, using combinations of circular motion known as epicycles.
- An epicycle is an orbit within an orbit
- Having set up this model, Ptolemy then went on to describe the mathematics which he needed in the rest of the work.

Ptolemy's Model – Epicycles Included



The Heliocentric Theory

- The Sun is the center of our *solar system*



Copernicus (1473-1543)

- Polish astronomer who advanced the theory that the Earth and other planets revolve around the Sun. This was highly controversial at the time.
- The Ptolemaic model had been widely accepted in Europe for 1000 years when Copernicus proposed his model.

Retrograde Motion in the Copernican System

http://alpha.lasalle.edu/~smithsc/Astronomy/retrograd.html

- Copernicus was told by many scholars that he should make his new findings accessible to others by publishing it. In 1543 the book called "On the Revolutions of the Heavenly Bodies" was released. Copernicus's book had a great impact that angered the Catholic and Protestant Church.
- The Church became so angry – the Geocentric theory made human beings seem closer to God and since earth was in the center that meant humans were more special. The heliocentric theory changed that perspective completely, making humans lose that position in the universe.

Galileo (1564-1642)

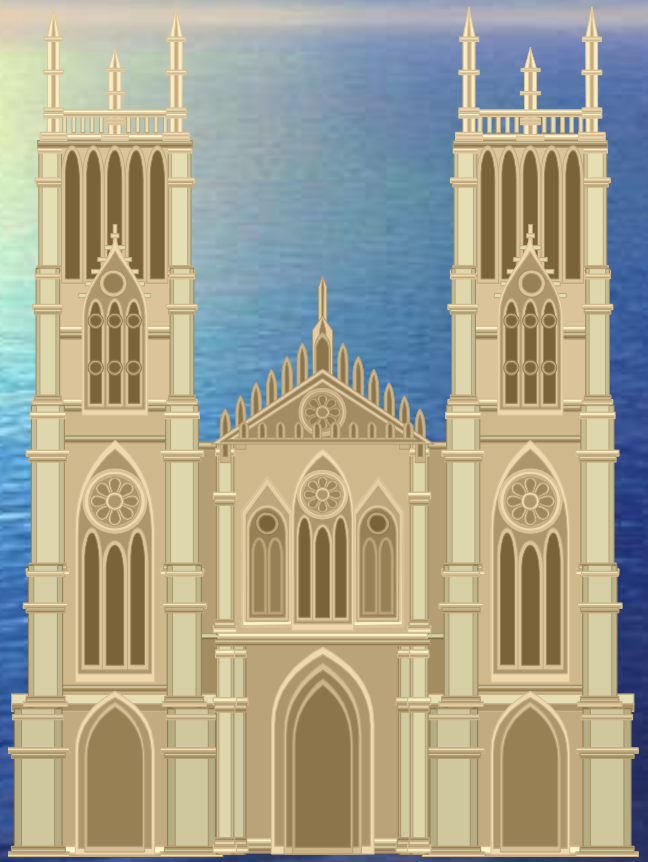
- An Italian scientist, Galileo was renowned for his contributions to physics, astronomy, and scientific philosophy. He is regarded as the chief founder of modern science.
- Galileo was condemned by the Catholic Church for his view of the cosmos based on the theory of Copernicus.

Galileo's Books

- Galileo published his discoveries and support for the Copernican model in two books published in 1616 and 1632.
- Galileo was unusual for the time because he wrote in Italian rather than Latin like most scholars.
- Galileo also took great pains to make his books interesting often writing them in the form of dialogues rather than dry, boring dissertations.
- After his first book, *"Starry Messenger"*, was published he was warned by the Church not to publicly support Copernicism again.

Trial Before the Inquisition

- Galileo abided by this edict until 1632 when he published *"A Dialogue on the Two Chief World Systems"*. This book's outright support for the Copernican model and its ridiculing of the Ptolemaic model earned Galileo a trial before the Inquisition.
- Galileo was accused of heresy and sentenced to house arrest for life. However, he got off easily compared to fellow Italian Giordano Bruno who was burned at the stake in 1600 for teaching Copernican ideas.



- In 1992, the Roman Catholic Church finally repealed the ruling of the Inquisition against Galileo. The Church gave a pardon to Galileo and admitted that the heliocentric theory was correct. This pardon came 360 years after Galileo's death.