History of Space Science to 1700s

Myths + Geocentric System + Heliocentric System

Qinghao Hu

September 29, 2025

Expectations

1. Describe how early cultures created myths to explain the universe.
2. Explain the differences between the Geocentric System and Heliocentric System.
3. Describe how humans' understanding of the universe developed in chronological order.
4. Describe how each scientist contributed to the Geocentric and Heliocentric systems.

The Start of Space Science: Myths

The origin of space science lies in myths and storytelling.

Myth

At the beginning of mankind, early civilizations did not understand modern science. They created stories and myths to explain the universe.

Examples

Two examples are taken from Grade 10 English.

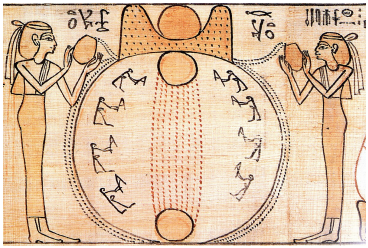

Figure: Ancient Egyptian Creation Myth

Example I: Pangu Creates the World

- From Chinese culture.
- Pangu used his hands and legs to break the chaos.
- His left eye became the **Sun**.
- His right eye became the **Moon**.
- His flesh became the **soil**.

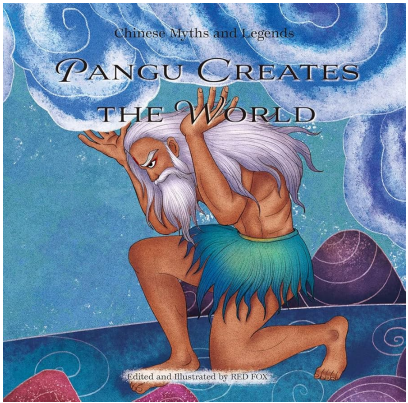

Figure: Pangu creates the Earth (from *Amazon*)

Example II: The Turtle Island Myth

- From Indigenous peoples of North America.
- The Earth was formed on the back of a giant turtle – "Turtle Island".
- A woman gave birth to **twins**.
- The Good Twin placed the **Sun** in the sky for warmth and daylight.
- The Bad Twin placed the **Moon** in the sky for cold and darkness.
- Such myths explained the cosmos before scientific astronomy.

Figure: From *Sequoia Proudly Indigenous*

Ancient Greek Space Science and the Geocentric Model

Eudosus (390–337 BCE): Concentric Spheres Geocentric System

- Mathematician and astronomer.
- Proposed the first geometric model of planetary motion.
- Used 27 concentric spheres with Earth at the center.
- The first to use mathematics and geometry to analyze the heavens.

Note

Spheres were primarily mathematical tools, not physical objects.

Figure: Eudosus (from Locklin on Science)

Search: Please go to the first Link

You should go to the google classroom. There is a tab post by me!

Aristotle (384–322 BCE): The Second Geocentric System

- Known as **The Father of Western Philosophy**.
- Ancient Greek philosopher.

Interesting Fact

He liked to bathe in olive oil and then sell it to others.

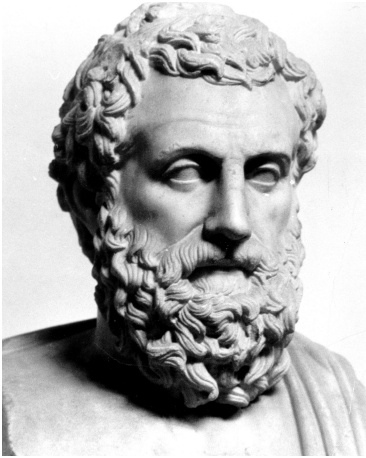

Figure: Aristotle (from *The New York Times*)

- "On the Heavens" is Aristotle's chief cosmological treatise.
- Expanded Eudosus's model using 55 concentric spheres.
- Earth is a sphere and stationary at the universe's center.
- Everything else travels in perfect circular orbits.
- Universe is spherical and finite.

ΠΕΡΙ ΟΥΡΑΝΟΥ Α.

Figure: Page one of *"On the Heavens"*

Ptolemy (100–170 AD): The Final Geocentric System

- Developed the **Geocentric Model**.
- Model dominated for over 1400 years.
- Mathematician, astronomer, geographer, and music theorist.

Figure: Ptolemy (from University of Toronto)

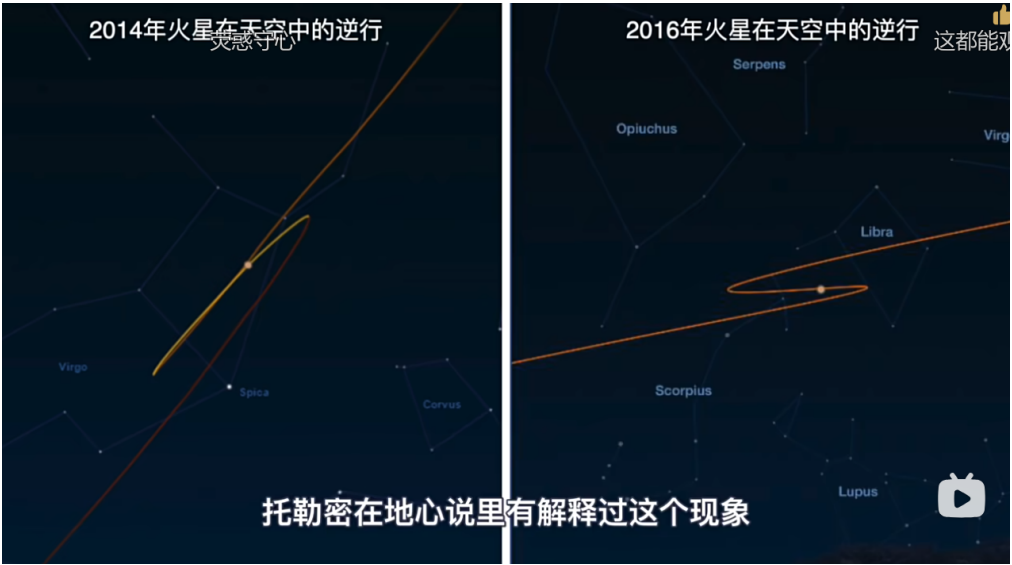

Figure: This is the Screenshot from Bilibili by me

- Most famous work by Ptolemy.
- Introduced epicycles to explain retrograde motion.
- Model accurately predicted planetary positions.
- Planetary orbits were circular, not spherical.

Google

Go to the second link in my tab!

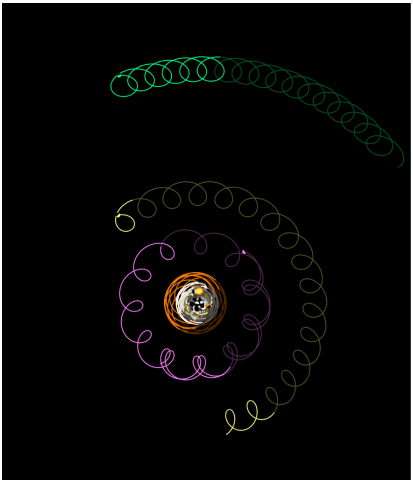

Figure: Screenshot from orbitsimulator.com by author

Student Activity I

According to the animation, try to summary the characteristics of "Geocentric System"
Is this model easy to use?
Is this model easy to understand?

The Sun-centered Universe

- Nicolaus Copernicus
- Born into a wealthy family
- Doctorate in Canon Law
- He read a lot of cosmic books from Ptolemy

Interesting Fact

He was a clergyman.

Figure: Nicolaus Copernicus (*Britannica*)

Copernicus' Heliocentric System

Based on the Ptolemy's geocentric system:

- Sun replaces Earth as the center.
- Planets arranged by distance from the Sun.
- Retrograde motion explained by Earth's motion, no epicycles needed.
- Small epicycles still used to refine circular orbits.
- He believed the Universe is still spherical and finite

Website

Visit: https://osp.berry.edu/CopernicanSystem.html

Fact

Initially, the heliocentric model was only a mathematical hypothesis.

- Built advanced observatories.
- Collected the most precise astronomical data.
- Proposed a hybrid model:
  - Sun orbits Earth
  - Other planets orbit Sun
- Data later allowed Kepler to formulate his laws.

Google

Go to the Third link in my tab!

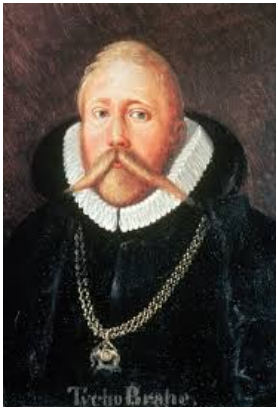

Figure: Tycho Brahe (*Britannica*)

Interesting fact

He died from a ruptured bladder after holding in his urine.

Johannes Kepler

- Student of Tycho Brahe.
- Used precise data to show planetary orbits are elliptical.
- Kepler's Three Laws of Planetary Motion:
  - Elliptical orbits with Sun at one focus.
  - Equal areas in equal times.
  - Square of orbital period $\propto$ cube of distance from Sun.
- Provided mathematical proof for heliocentrism.

Google

Go to the Fourth link in my tab!

Figure: Johannes Kepler (*space*)

Interesting fact

He was owed wages for 20 years and died on the way to get his wages.

- First to use a telescope to observe the universe.
- Discovered four moons orbiting Jupiter.
- Publicly challenged geocentric model.
- Faced opposition from the Catholic Church for contradicting the Bible.
- He suggested that our universe is not a dome

Interesting Fact

The Bible teaches how to go to heaven, not how the heavens go.

Figure: Galileo Galilei (*Britannica*)

- Pope Urban VIII supported Galileo to introduce both systems.
- Book compares Ptolemaic and Copernican systems.
- Written as a conversation between:
  - Salviati - defends heliocentrism.
  - Simplicio - supports geocentrism.
  - Sagredo - neutral observer.
- Written in Italian, accessible to general public.

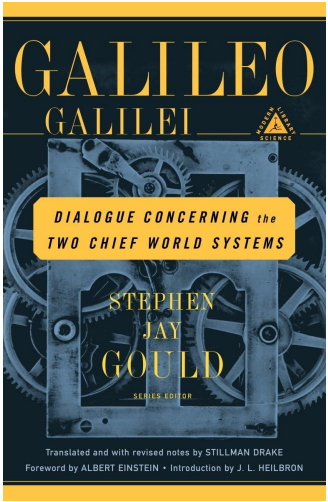

Figure: Dialogue Concerning the Two Chief World Systems by Galileo

After the Dialogue

- Book seen as an attack on the Pope and Catholic authority.
- Galileo forced to recant heliocentrism, condemned as "vehemently suspected of heresy".
- Sentenced to lifetime house arrest in Florence, but continued his studies.

Reference