

MODELS OF THE SOLAR SYSTEM



What does our Solar System really look like? If we were to somehow fly ourselves above the plane where the Sun and the planets are, what would we see in the center of the Solar System? The answer took a while for astronomers to figure out, leading to a debate between what is known as the geocentric (Earth-centered) model and the heliocentric (Sun-centered) model.

Our understanding of the universe has changed over time. Different civilizations have created different models to explain what the universe is and how the universe began. Ancient astronomers understood that bright points in the sky that appeared to move among the background stars were called planets. The ancient Greeks considered Mercury, Venus, Mars, Jupiter and Saturn- as well as the Moon and the Sun- to be planets. While who exactly discovered the “naked-eye” planets- the planets you can see without a telescope- has been lost in antiquity, we do know that civilizations all over the world spotted them and recorded their existence in historical records.



The Greek astronomer Ptolemy used measurements of the sky to create his model of the solar system, which placed the Earth at the center and the known planets orbiting around it. For centuries most people followed Ptolemy's teachings; during the Renaissance, European scholars relied on Greek sources for their education. But there were some things that didn't make sense. For example, Mars occasionally appeared to move backward with respect to the stars before moving forward again. Ptolemy and others explained this using a system called epicycles, which had the planets moving in little circles within their greater orbits. By the fifteen and sixteenth centuries, astronomers in Europe were facing other problems. Eclipse tables were becoming inaccurate and the calendar dating from the time of Julius Caesar, around 44 BCE, was no longer accurate in describing the equinox- a big problem for Church officials concerned with the timing of religious holidays, primarily Easter.

It wasn't until the mid-16th century that Nicolaus Copernicus came up with a different model. His theory of heliocentrism put the Sun at the center of the universe. Published in 1543, Copernicus' *On the Revolutions of the Heavenly Bodies* outlined the heliocentric universe similar to what we know today. Included among his ideas was that the planets' orbits should be plotted with a “fixed point”, e.g. the Sun; that the Earth itself is a planet that turns on an axis; and that when the axis changes directions with respect to the stars, this causes the North Pole star to change over time.



Putting the Sun at the center of our Solar System, other astronomers began to realize, simplified the orbits for the planets. The Italian astronomer Galileo Galilei, who made observations of the night sky using the newly invented telescope, discovered that Jupiter had four moons that were orbiting Jupiter itself, definitively concluding that everything did not orbit the Earth. Galileo's initial discoveries were met with opposition from the Catholic Church, who banned heliocentric books and ordered Galileo to refrain from teaching or defending heliocentric ideas. Galileo went on to propose a theory of tides in 1616, arguing that the tides were evidence for the motion

of the Earth. In response to mounting controversy over theology, astronomy and philosophy, the Roman Inquisition tried Galileo in 1633 and found him "vehemently suspect of heresy", sentencing him to indefinite imprisonment. Galileo was kept under house arrest until his death in 1642.