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## Unit 6.5: Copernicus

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Nicolaus Copernicus (1473—1543) is the Latin version of the famous Polish astronomer's name which he chose later in his life. The original form of his name was Mikolaj Kopernik or Nicolaus Koppernigk. Copernicus began to use this Latin version of his name while a student at Krakow University. There he studied Latin, mathematics, astronomy, geography and philosophy.

Around 1514 he distributed a little book, not printed but hand written, to a few of his friends who knew that he was the author even though no author is named on the title page. This book, usually called the Little Commentary, set out Copernicus's theory of a universe with the sun at its centre. It contains seven axioms which Copernicus gives, not in the sense that they are self evident, but in the sense that he will base his conclusions on these axioms and nothing else. His axioms stated:

1. There is no one center in the universe.
2. The Earth's center is not the center of the universe.
3. The center of the universe is near the sun.
4. The distance from the Earth to the sun is imperceptible compared with the distance to the stars.
5. The rotation of the Earth accounts for the apparent daily rotation of the stars.
6. The apparent annual cycle of movements of the sun is caused by the Earth revolving round it.
7. The apparent retrograde motion of the planets is caused by the motion of the Earth from which one observes.

This was the first outline of arguments eventually substantiated in *De revolutionibus orbium coelestium* (On the Revolutions of the Heavenly Spheres, 1543). This classic work challenged the geocentric cosmology that had been dogmatically accepted since the time of Aristotle. In direct opposition to Aristotle and to the 2d-century astronomer Ptolemy, who enunciated the details of the geocentric system based on the celestial phenomena, Copernicus proposed that a rotating Earth revolving with the other planets about a stationary central Sun could account in a simpler way for the same observed phenomena of the daily rotation of the heavens, the annual movement of the Sun through the ecliptic, and the periodic retrograde motion of the planets. He overturned the **geocentric** solar system with his **heliocentric** solar system.

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The early views of the solar system were guided by philosophy and religion more than mathematics. Most of the universe's structure was pondered upon philosophically through mysticism rather than logical derivation. Natural Philosophers (scientists) of the time began to explore how the solar system was structured and developed models to explain our universe. The idea that the sun is the center of the solar system was first postulated in 300 BC by Aristarchus of Samos, but was rejected until Copernicus provided the first proof 1800 years later. To the right is the Copernican model.

Religious authorities at first did not react to the book's publication. This was likely due, at least in part, to the addition of an anonymous preface, written by the publication's overseer Andreas Osiander (1498-1552), to the effect that Copernicus' planetary model should be treated as a **hypothesis** to facilitate the computation of planetary positions.

The issue came to a head 73 years after Copernicus' death. In 1616 a church **Inquisition** delivered an injunction to Galileo Galilei (1564—1642), an Italian nobleman famous for his studies of mathematics and physics, ordering him to stop defending the Copernican theory that the Earth revolves around the Sun. The Inquisition's panel of consultants had concluded that the heliocentric model was not only absurd, but heretical, and that the idea that Earth moves was at least erroneous, if not actually **blasphemous**. Galileo was ordered not to discuss the theory, in writing or in speech, and to cease either believing it or defending it. The Church placed Copernicus' work on the list of forbidden books until 1835.

Find the definitions for:

1. Geocentric: \_\_\_\_\_
2. Heliocentric: \_\_\_\_\_
3. Inquisition: \_\_\_\_\_
4. Hypothesis: \_\_\_\_\_
5. Blasphemy: \_\_\_\_\_