



The Scientific Revolution: Its Classical and Christian History with Dr. Ted Davis

Lecture 6.3: Saving the *Phenomena*, Aristotle

Outline:

Saving the *Phenomena*, Aristotle

- The history of Greek astronomy is a series of attempts to account for planetary motion, using circles that rotate with constant speeds – according to Plato's dictum. Next we consider the ideas of Plato's student Aristotle (c. 408 – 355).
- Aristotle accepting the cosmological theory of Callippus, who added 7 spheres to Eudoxus' model to improve its accuracy. However, Aristotle was much more interested in physical cosmology – the parts of the universe – than the mathematics of astronomical motions. He physicalized the purely mathematical ideas of Eudoxus and Callippus. In the process, he added 22 spheres, to counteract the motions of the spheres associated with the previous planets before starting the set of spheres for the next planet.
- He divided the universe into two regions: the heavens (celestial) and the earth (terrestrial), each with its own elements and “natural” motions.
- Aether in the celestial region; earth, air, fire, & water in the terrestrial region. This idea held sway for two millennia. Christians adopted it and integrated it easily into their theology (primarily by saying that the elect dwell beyond the edge of the physical universe).
- The four terrestrial elements each had their natural place (as still taught in the 17th century).
 - The five elements had different properties:
 - Earth and water had heaviness, while air and fire had levity. They moved straight down or straight up, until they reached their natural places.
 - “Aether” – a word meaning “runs always” – was neither heavy nor light. The pure “quintessence,” it made up the heavens and circled ceaselessly in its natural place.
- Aristotle thought that the heavenly ether spheres were fluid bodies, but his predecessors Anaxamenes and Empedocles believed they were hard or “crystalline.” No later Greek authors followed them, but they apparently influenced Josephus. In *Antiquities of the Jews*, he said that God placed a crystalline [firmament] round [the earth]” on the second day of creation.



- Centuries later, some Christian scholars also taught that God made “crystalline” heaven on the second day, apparently following Josephus.
 - In part, this resulted from speculation about the nature of the “waters above the firmament” in Genesis. Some believed that the waters “above the firmament” meant an ocean above the stars, including Basil of Caesarea and Martin Luther.
 - Others (Aquinas) held that the waters must be solid ice – water in “crystalline” form – and we cannot see them.
 - The idea of “crystalline spheres was common during the Renaissance.
 - John Milton, On the Morning of Christ’s Nativity, a hymn
 - The notion that spheres are crystalline and the music of sphere
- Aristotle gave two different causes for rotating spheres.
 - First explanation: The “Prime Mover” or Unmoved Mover is the ultimate good and the object of desire
 - It produces motion by being loved.” The sphere of fixed stars turns eternally to imitate the changeless perfection of the prime mover.
 - The immaterial mover assigned to each planetary sphere also has the same effect.
 - This led Moses Maimonides (13th century) to say, “Love makes the world go round.”
 - Some Christians later interpreted this as angels turning ears to move the planets and stars.
 - Second explanation of heavenly motion: The spheres don’t need separate movers; as spheres of ether, they turn naturally, on their own. (These two explanations obviously conflict.)
- Aristotle also taught that our universe is the only one that has ever existed. It is eternal (uncreated), but there are no others.
 - The one and only universe had a definite edge (finite).
- Aristotle also taught that the center of the earth corresponds to the center of the universe. Why? Because things made mostly of element earth, such as the earth itself, seek the center of the universe.
- Aristotle also taught that there are no empty spaces anywhere in the universe.
 - Why? If a vacuum (or void) really did exist, then he thought objects could move through it with an infinite speed – which is nonsense (he argued, among other reasons). Thus, the old expression, “Nature abhors a vacuum.”
- Although Aristotle’s cosmology had dozens of spheres, in practice, it was a much simpler version of Aristotle’s theory that captured the medieval imagination: a single sphere made of aether carries each planet around the earth.