

Ibn al-Haytham (Alhazen)

Mithra H. Pirooz, M.A.

Jonathan B. Santo, Ph.D.

University of Nebraska at Omaha

Abū ‘Alī al-Ḥasan ibn al-Ḥasan ibn al-Haytham was an Arab Muslim born around 965 CE and died circa 1040 CE in current-day Iraq. A scientist, astronomer, philosopher, and mathematician, he is particularly known for his work in astronomy, mathematics, visual perception, and optics. In medieval Europe, he was referred to as the “Second Ptolemy”. As the first to determine that vision results from light being reflected from an object to the eye, he is often referred to as “the father of optics”. He is also praised for being among the first theoretical physicists. He was one of the first scientists to support the notion that hypotheses must be evidenced by either mathematics or experiments designed with verifiable methods.

Ibn al-Haytham wrote *Kitab al-Manazir (Book of Optics)* from 1011 to 1021. Consisting of seven-volumes, this book on optics is his most famous work. It was influenced by Ptolemy’s *Optics* as well as Galen’s description of the structure and function of the eye. Its major contribution was that it combined Euclid’s arguments of the mathematical ray with Galen’s medical account and Aristotle’s theories of intromission. Among those influenced by this work was European Perspectivists.

Alhazen was a proponent of experimentation and controlled testing. He combined mathematics with classical physics, which supported many of his claims regarding optics. He

has been labeled as the systematically vary experimental conditions in constant ways in experiments with optics.

He is also credited with contributions to other areas of physics such as astronomy. In his work, *Epitome of Astronomy*, he examined the celestial physics. His encouragement of the use of mechanical models for Ptolemaic model contributed to the prevailing of the Ptolemaic system in the West. He believed that astronomy should be studied in terms of physical objects. This allowed astronomic hypotheses to be examined according to the laws of physics. In *On the Configuration of the World*, he described the earth as a sphere and the center of the earth as the center of the world. He also purported that the earth did not move.

A critic of Ptolemy, in *Al-Shukūk 'alā Batlamyūs (Doubts Concerning Ptolemy or Aporias Against Ptolemy)* he identified contradictions in Ptolemy works. Furthermore, it seems that he had planned to resolve such contradictions in a later writing. He claimed that Ptolemy did not understand the true configuration of the planets. These criticisms are an example of how science develops and grows.

After writing *Doubts on Ptolemy*, Alhazen provided a planetary model based on geometry in *The Model of the Motions of Each of the Seven Planets* around 1038. In this geocentric model, celestial movements were circular. Epicycles were used to explain the motion, but Ptolemy's equant was rejected. While he did not attempt to explain the movements, he gave a geometric description, which explained the observed movements while eliminating Ptolemy's contradictions.

Alhazen has also been noted for his work in mechanics. He disagreed with the Aristotelian perspective that nature abhors a void in his *Treatise on Place*. With geometry, he argued that place is the supposed three-dimensional space between a containing body's inner

surfaces. He is also known for his exploration of the Euclidean parallel postulate, as well as his work on perfect numbers and calculus.

Ibn al-Haytham is credited with a number of additional accomplishments. Among these is experience as a civil engineer when he designed a dam for the Nile River in Egypt. A practicing Muslim, he also wrote on theology, discussing prophethood.