

# Galileo Galilei

Intro: It has been my practice since beginning my pastorate to dedicate the last Sunday in October to the Reformation. Each year we examine one of the great men of God who stood against the powerful and perverted Roman Catholic Church of their day. The Reformation officially began on **Oct. 31, 1517**, when Martin Luther, an Augustinian university professor at Wittenberg, posted 95 theses on the door of the Wittenberg Church. Luther's 95 Thesis were actually 95 propositions challenging and denouncing Roman Catholic practices, which in his view were anti-scriptural perversions with no biblical basis. Key among these was the sale of papal indulgences, a document guaranteeing a person's admittance into heaven. Luther believed that salvation could not be purchased or earned, but was a free gift of God's grace available to any person who will acknowledge his sin and turn in faith to receive Jesus Christ as Savior.

QuickTime™ and a decompressor are needed to see this picture.

This year I would like to look, not at a religious reformer, but at an Italian physicist, astronomer, and mathematician named Galileo Galilei. Galileo was a devout Roman Catholic, who is recognized as the father of observational astronomy, modern physics, and the scientific method. Galileo's great genius lay in his ability to observe the world at hand, to understand the behavior of its parts, and to describe these in terms of mathematical proportions. While I have no official record to point to, I believe that Galileo's love of astronomy was perhaps based on **Psalm 19:1-2** "Day and night the created universe broadcasts its silent but eloquent symphony to the glory of the Creator."

Galileo's love for astronomy landed him in hot water with the authorities of the Roman Catholic Church. The majority of educated people of his day believed that the earth was the center of the universe, and that all heavenly bodies revolved around the Earth. This view was based on Aristotle's geocentric theory that the earth was the center of the universe. Galileo embraced the teaching of his predecessor Nicolaus Copernicus, the famed Polish astronomer, who around 1543 developed his celestial model advocating a heliocentric solar system, which named the sun, rather than the earth, as the center of the solar system. Galileo was a brilliant man, whose powers of observation supported and further advanced Copernicus' heliocentric solar system, which identified the sun, as the center of the solar system. Galileo defended his heliocentric

theory based on his own astronomical observations, which were greatly aided by his invention of the telescope. Galileo is called the “Father of Modern Science” because he was the first to combine the principles of observation, theory, experimentation, and mathematics together into a common framework.

Follow along as I briefly review Galileo’s early life and education, career as a teacher, scientist, and inventor, his controversy with the church, and his death.

### **Early Life And Education**

Galileo was born in Pisa, Italy, on 15 February 1564. He was the eldest of six children. His father was Vincenzo Galilei, a famous composer, lutenist, and music theorist. Following his eighth birthday, Galileo’s family moved from Pisa to Florence. Galileo was educated in the Camaldolese Monastery near Florence.

While his father wanted him to enter the priesthood, Galileo persuaded him to allow him to enroll at the University of Pisa to pursue a medical degree. He began his studies at the age of 17. While studying medicine Galileo reportedly accidentally attended a lecture on geometry. As it turns out he was much more interested in mathematics and physics than he was in medicine. Galileo once again persuaded his father to allow him to change his field of study from medicine to mathematics and natural philosophy. Galileo believed that mathematics was the language of the natural world all around us, and could be applied to the ordered behavior of planets and pendulums, or the fundamentals of music and mechanics.

### **His Academic Career**

In 1589, Galileo, who was only 25 years of age, was appointed to the chair in mathematics at the University of Pisa. It was during this time that Galileo was exposed to the Aristotelian geocentric view of the universe, that the earth was the center of the universe, and the sun and all other planets rotated around a stationary earth. Aristotle was the leading scientific authority and the only one sanctioned by the Roman Catholic Church. At first, Galileo supported this view, like any other intellectual of his time. However, as he continued his studies and teaching in the fields of mathematics, astronomy, and natural philosophy he came to embrace Nicolaus Copernicus’ celestial model advocating a heliocentric solar system, which named the sun, rather than the earth, as the center of the solar system. Galileo’s outspoken support of Copernicus’ sun centered universe resulted in his being dismissed from his professorship at the University of Pisa in 1592. Galileo quickly found a new teaching position at the University of

Padua, teaching geometry, mechanics, and astronomy. During his 18-year tenure at the University of Padua, near Venice, he gave entertaining lectures and attracted large crowds of followers, further increasing his fame and his sense of mission.

### **His Scientific Career**

During his formative years as a student at Pisa, Galileo embarked on his life-long course of discovery and invention. He was fascinated by the principles of motion and gravity. One of his earliest discoveries was based on his observations of a swinging chandelier, caused by wind currents sweeping through the building. As he watched the chandelier swing back and forth, he timed the arch of the chandelier's swings from side to side with his own heartbeat. He discovered that the chandelier took the same amount of time to swing back and forth, no matter how far it was swinging. He rushed home and set up two pendulums of equal length and swung one with a large sweep and the other with a small sweep and found that they kept time together. His discovery and experimentation with swinging pendulums came to be known as "the Law of the Pendulum." His discovery was used a hundred years later by Christian Huygens to create an accurate pendulum clock. Galileo's studies on objects in motion led to his publication of a manuscript entitled *The Little Balance*.

Galileo followed up this first publication with another entitled *On Motion*. This manuscript described the universal law of acceleration, which all objects in the universe obeyed. His findings were supported by field studies in which he purportedly dropped two large steel balls of different weights from the top of the Leaning Tower of Pisa. Both reached the ground at the same time. Once again he demonstrated that Aristotle's hypotheses was incorrect.

### **His Inventions**

Galileo invented one of the first thermometers. In 1604 he invented a compass that the military used to direct cannonballs. His most memorable invention was the telescope. He didn't actually invent the first telescope, but refined a spy-glass made by a Dutch eyeglass maker. Galileo designed and built his own telescope 32 times more powerful. In July 1609 Galileo demonstrated his telescope to some Venetian merchants. They saw its value for spotting enemy ships at greater distances and commissioned Galileo to manufacture several of them. It is said, that out of the 100 or so telescopes made by Galileo, he only considered 10 of them worthy instruments for the study of the heavens.

## His Astronomical Discoveries

Galileo's telescope enabled him to view the heavens. He discovered that Jupiter had 4 tiny lights that seemed to circle the planet. He eventually came to realize that these were 4 moons that rotated/orbited around Jupiter. He also observed that Venus had phases like the earth's moon, proving it rotated around the sun. These revolutionary discoveries supported Copernicus' heliocentric theory that celestial bodies rotated around the sun, and that the earth was not the center of the universe.

In March 1610, Galileo published a small booklet, *The Starry Messenger*, revealing his discoveries that the moon was not flat and smooth, but a sphere with mountains and craters. In 1613, he published his observations of sunspots, which further refuted Aristotelian doctrine that the sun was perfect. That same year, Galileo wrote a letter to a student to explain how Copernican theory did not contradict Biblical passages, stating that Scripture was written from an earthly perspective and implied that science provided a different, more accurate perspective. As you might imagine, Galileo's private letter was made public, and in 1616 church officials ordered him to appear at a Church Inquisition in Rome.

## His Inquisition

The Roman Catholic cardinals in charge of the inquisition denounced the Copernican theory advocating a heliocentric, sun centered universe, to be heretical. They upheld Aristotle's geocentric theory that the earth was the center of the universe, and the sun and all the planets revolved around the earth. Galileo responded to his inquisitioners, "**Holy Writ was intended to teach men how to go to Heaven, not how the heavens go.**" The cardinals were not impressed. They ordered Galileo to recant and agree with the official teaching of the Church or face torture and death. Since this was not a matter of denying his faith in God, Galileo recanted of his views supporting Copernicus' heliocentric sun centered universe. Galileo was ordered not to "hold, teach, or defend in any manner" the Copernican theory regarding the motion of the earth. He returned to Florence, where he continued his observations of the heavenly bodies.

Seven years later, a very close friend of Galileo's, Cardinal Barberini, became Pope Urban VIII. Galileo was summoned to Rome to visit his old friend. Pope Urban VIII allowed Galileo to pursue his work on astronomy and even encouraged him to publish it, on condition it be objective and not advocate the

Copernican heliocentric theory. In 1632, Galileo published the *Dialogue Concerning the Two Chief World Systems*, a satirical discussion among three people: one who supported Copernicus' heliocentric theory of the universe, one who argued against it, and one who is impartial. Though Galileo claimed *Dialogues* was neutral, it was clearly not. The advocate of Aristotelian belief comes across as the simpleton, getting caught in his own arguments. Various scholars in the church of Rome convinced Pope Urban VIII that he was the simpleton in Galileo's story that supported Aristotle's geocentric earth based theory.

Church reaction against Galileo's new book was swift. He was summoned to appear before the Catholic Inquisitors in Rome. The Inquisition proceedings lasted from September 1632 to July 1633. During most of this time, Galileo was treated with respect and never imprisoned. In order to save face, but also to spare his friend, Pope Urban VIII ordered Galileo to be confined to house arrest. Galileo returned to his villa outside Florence, where he continued observing and recording his findings. In 1638 he published his masterpiece: *Discourses and Mathematical Demonstrations Concerning the Two New Sciences*. The two new sciences he described were the science of materials and the science of motion. Following his death on January 8, 1642, his faithful servant smuggled his writings out of Italy to Holland. His final masterpiece, as well as his earlier works were published and preserved in Holland.

**Conclusion:** In the end, the ideas of Galileo and other scientists like Copernicus triumphed, because they were able to prove them to be true. Although his ideas triumphed, Galileo paid a high price for his science: he spent the last eight years of his life under house arrest, and the Catholic Church banned the publication of anything written by him.

As time past the Church eventually recognized Galileo and Copernicus' theory advocating a heliocentric universe to be true . In 1758, it lifted the ban on most works supporting Copernican theory, and by 1835 dropped its opposition to Copernicus' heliocentrism altogether.

In the 20th century, several popes acknowledged the great work of Galileo, and in 1992, three years after Galileo's namesake spacecraft was launched, Pope John Paul II expressed regret for how the Galileo affair was handled. Galileo's contribution to our understanding of the universe was significant not only in his discoveries, but in the methods he developed and the use of mathematics to

prove them. He played a major role in the scientific revolution and deservedly earned the title “The Father of Modern Science.”

**Einstein, one of Galileo’s biggest fans said this about him** “All knowledge of reality starts from experience and ends in it. “Propositions arrived at by purely logical means are completely empty as regards reality.”

Closing: Invitation and prayer

Closing Song: *All Creation Worships You*