

The Trial of Galileo Galilei 1633

2

In the 1633 trial of Galileo Galilei, two worlds come into cosmic conflict
Galileo's world of science collides with the world of the Catholic Church
The result is a tragedy that marks both the end of Galileo's liberty and the
end of the Italian Renaissance

3

Galileo Galilei

Galileo was born in Pisa, Italy in 1564--the same year that Michelangelo
died

In 1583 he entered the University of Pisa to study medicine

He soon lost interest in medicine and studied mathematics

At this time, while attending church, he developed his theory of pendulums

Due to financial difficulties, Galileo left the university before earning a degree

Galileo continued to study mathematics, supporting himself with minor teaching positions

By age twenty-five, Galileo assumed his first lectureship at the University of Pisa

4

At Pisa, Galileo conducted his fabled experiments with falling objects

These led to a departure from Aristotelian views about motion and falling objects

5

Galileo developed an arrogance about his work, and his strident criticisms of Aristotle left him isolated among his colleagues

In 1592, his contract with the University of Pisa was not renewed

Galileo quickly found a new position at the University of Padua, teaching geometry, mechanics and astronomy

During his 18-year tenure at Padua, he gave entertaining lectures and attracted large crowds of followers

This further increased his fame and his sense of mission

Within a few more years, Galileo earned a reputation throughout Europe as a scientist and superb lecturer

6

Eventually, he would be recognized as the father of experimental physics
At the University of Padua he developed a strong interest in the Copernican theory

In 1543, Copernicus had published *Revolutions of the Celestial Orbs* in which he presented his revolutionary idea that the Sun was the center of the universe

7

Nicholas Copernicus

He held that the Earth--rotating on an axis--orbited around the sun once a year

This challenged the natural philosophy of Aristotle, the astronomy of Ptolemy and the teachings of the Church

They all held that the sun and all the stars revolved around a stationary Earth

8

Early Christian Church View

While the understanding of nature by the church in the previous 1000 years had come a long way, there were still many who believe as St. Augustine did

Saint Augustine (354–430) stated that the idea that men on the opposite side of the earth whose “footsteps are higher than their heads“ is not credible

9

In the half-century since its publication, however, Copernicus' theory met mostly with skepticism

Skeptics held the belief that the earth they stood on did not move at all
Certainly not at the speed required to rotate every twenty-four hours and go around the sun once a year

But in the mid-1590s, Galileo concluded that Copernicus got it right

10

Galileo, however, continued to keep his thoughts to a few trusted friends
In a 1597 letter to Johannes Kepler, a German mathematician who had written about planetary systems:

"Like you, I accepted the Copernican position several years ago and discovered from thence the cause of many natural effects which are doubtless inexplicable by the current theories."

11

He was warned by the fortunes of Copernicus:

"I have not dared until now to bring my reasons and refutations into the open, being warned by the fortunes of Copernicus himself

In July 1609, Galileo learned about a simple telescope built by Dutch eyeglass makers, and he soon developed one of his own

Galileo's vast improvements to the telescope in 1609 enabled him to confirm his belief

12

Through his telescope Galileo saw the Milky Way, the valleys and mountains of the moon

He found Venus had phases like the moon, proving it rotated around the sun

He observed that Jupiter had revolving moons, which didn't revolve around the earth

Galileo began talking publically about his observations

Galileo expected the telescope to make everyone believers in the Copernican system

He decided to address his arguments to the enlightened public at large

He wrote in tracts, pamphlets, letters, and dialogues--simply and directly

He was mounting a body of evidence that put him at odds with the doctrines of Aristotle and the Catholic Church

13

Galileo became disappointed when it became clear that the Copernican theory had its enemies

In a 1610 letter to the famous German mathematician, Kepler, Galileo wrote:

"My dear Kepler, what would you say of the learned here, who have steadfastly refused to cast a glance through the telescope? What shall we make of this? Shall we laugh, or shall we cry?"

14

In 1612, he published his *Discourse on Bodies in Water*, refuting the Aristotle's explanation of why objects float in water

He said that it wasn't because of their flat shape, but instead the weight of the object in relation to the water it displaced

In 1613, he published his observations of sunspots, which further refuted Aristotle's doctrine that the sun was perfect

15

The first attack on Galileo's Copernican views came from a Dominican friar in Florence, Father Lorini

Lorini said that Copernican doctrine violated Scripture, which clearly places Earth, and not the Sun at the center of the universe

Pressured later to apologize for his attack on Galileo, Lorini said "the doctrine of Copernicus, or whatever his name is, was against Holy Scripture"

16

Galileo argued that the Scripture could not be interpreted literally in every case

"The hand of God" is not meant to be interpreted as referring to a five-fingered appendage

Galileo contended that the Bible was the true word of God, but not a good astronomy text book

Galileo's enemies accused him of attacking Scripture and meddling in theological affairs

Father Lorini send a letter to the Roman Inquisition questioning Galileo's remarks

He would stop at almost nothing to destroy the "Galileists"

For example, he purposely misquoted Galileo so that his words would appear more anti-church

17

Lorini wrote that Galileo asserted:

The language of Holy Scripture does not mean what it seems to mean

In discussions about natural phenomena the last and lowest place ought to be given the authority of the sacred text

Its commentators have very often erred in their interpretation

The Holy Scriptures should not be mixed up with anything except matters of religion

18

Lorini's denunciation succeeded in setting the machinery of the Catholic Church in motion

Lorini had allies, who exposed, as they saw it, "the errors of Galileo"

Galileo's enemies claimed that "Galileists" publicly declared God to be an accident and doubting miracles

The Church's chief theologians saw the Copernican universe as threatening to the social order

19

The church's upper echelons cared more about preserving the power of the papal super-state than getting astronomical facts correct

An influential Cardinal wrote:

"To affirm that the Sun, in its very truth, is at the center of the universe...is a very dangerous attitude and one that injures our faith by contradicting the Scriptures."

20

Biblical Citations (King James Version)

Chronicles 16:30 - Fear before Him, all the earth! The world also shall be stable, that it be not moved

Psalm 93:1 - The Lord is clothed with strength, wherewith he hath girded himself: the world also is established, that it cannot be moved

Psalm 96:10 - Say among the heathen that the Lord reigneth: the world also shall be established that it shall not be moved: he shall judge the people righteously

21

More Biblical Citations (King James Version)

Psalm 104:5 - who laid the foundations of the earth, that it should never be removed

Ecclesiastes 1:5 - The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose

Joshua 10:13 - And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. So the sun stood still in the midst of heaven, and hastened not to go down about a whole day

22

Galileo pleaded his case in a 1616 Letter

He asked that his idea not be condemned "without understanding it, without even having seen it"

Galileo's eloquent letter was forwarded to Rome where, "it sank out of sight as softly as a penny in a snowbank"

23

The Commissary-General forwarded two propositions of Galileo to eleven theologians, called "Qualifiers", for their evaluation:

The Sun is the center of the world and immovable

The Earth is not the center of the world, nor immovable

Four days later, on February 23, 1616, the Qualifiers unanimously declared both propositions to be "foolish and absurd" and "formally heretical."

24

Two weeks later, Pope Paul V -- described by the Florentine ambassador as "so averse to anything intellectual that everyone has to play dense and ignorant to gain his favor" -- endorsed the theologian's conclusions

The Pope directed that Galileo be admonished and to abandon his opinions

25

“The Commissary *command and enjoin*, in the name of His Holiness the Pope to relinquish altogether the said opinion that the Sun is the center of the world and immovable and that the Earth moves; nor further to hold, teach, or defend it in any way whatsoever, verbally or in writing; otherwise proceedings will be taken against him by the Holy Office.”

Galileo acquiesced to this injunction and promised to obey.

26

The Trial of 1633

Galileo's admonition stopped the Copernican movement dead in its tracks
For Galileo, his admonition marked the beginning of a period of silence
He busied himself with such tasks as using tables of the moons of Jupiter
for measuring longitude at sea

27

In 1623, a friend of Galileo, Cardinal Maffeo Barberini, was selected as Pope Urban VIII.

The new Pope held a generally positive view of the arts and science and allowed Galileo to pursue his work on astronomy

He even encouraged him to publish it, on condition it be objective and not advocate Copernican theory

28

In the early years of his reign, Pope Urban VIII held long audiences with Galileo

In private, the Pope seemed open to debate the Copernican system with Galileo

Galileo began work on a book that would eventually prove his undoing
Galileo's *Dialogue Concerning the Two Chief World Systems* was a book for the educated public, not specialists

29

Early news from Rome gave Galileo reason for optimism that his book would soon be published

The Vatican's chief licenser reportedly promised his help and said that theological difficulties could be overcome

When Galileo arrived in Rome in May 1630, he wrote: "His Holiness has begun to treat of my affairs in a spirit which allows me to hope for a favorable result."

30

Urban VIII reiterated his previously stated view that if the book treated the contending views hypothetically and not absolutely, the book could be published.

Galileo's Jesuit opponents in Rome were aiming to block publication

The first copy of Galileo's Dialogue came off the press in February 1632

The book, which quickly sold out, soon became the talk of the literary public

Shortly, Galileo's learned that orders had come from Rome to suspend publication

Jesuit enemies convinced the Pope that the *Dialogue* was thinly-veiled brief for the Copernican model

31

The Pope complained that Galileo deceived him **and** appointed a special commission to investigate the Galileo matter

The commission's report outlined a series of indictments against Galileo
On September 15, the Pope turned the matter over to the Inquisition

32

Galileo, 70 and ill, asked that proceedings against him be moved to Florence where he was now living

The Pope insisted **Galileo** make the two-hundred mile journey to Rome
In April 1633, Galileo was informed that he would stand trial before ten cardinals

33

The trial by the Congregation moved to its conclusion

A majority of the cardinals demanded Galileo be condemned to imprisonment

Galileo was forced to appear again for formal questioning about his true feelings concerning the Copernican system

34

"I held, as I still hold, as most true and indisputable, the opinion of Ptolemy, that is to say, the stability of the Earth and the motion of the Sun"
Galileo ended with the words, "I do not now hold the condemned opinion. I am here in your hands--do with me what you please."

35

On the morning of June 22, 1633, Galileo knelt and listened to his sentence:

We order that the book *Dialogue* of Galileo Galilei be prohibited by public edict

We condemn you to formal imprisonment in this Holy Office at our pleasure

We impose on you to recite the seven penitential psalms for the three years

And we reserve to moderate, commute, or take off, the whole or part of the said penalties and penances

36

Following the reading of the sentence, Galileo knelt to recite his abjuration:
I swear that in the future I will never again say or assert, verbally or in writing, anything that might furnish occasion for a similar suspicion regarding me

I, Galileo Galilei, have abjured as above with my own hand this twenty-second day of June, 1633

Why did Galileo now claim he no longer held the views he had held for so long?

37

CONCLUSION

Two days later, Galileo was released to the custody of the Florentine ambassador

Six days later, his custody was transferred to the Archbishop of Sienna

Later in the year, Galileo received permission to move into his own small farmhouse

He would grow blind and he died in 1642

38

Galileo Scientist or Heretic

39

In 1835 the Catholic Church formally dropped its opposition to the heliocentric concept when these works were finally dropped from the Index of Forbidden Books

Pope Benedict XV declares on April 20, 1921:

“... and though this Earth on which we live may not be the center of the universe as at one time was thought ... “

In 1935 Pope Pius XII called Galileo an "audacious hero."

40

One of the first steps of John Paul's papacy, which began in 1978, was to begin procedures leading to the rehabilitation in 1992 of Galileo

The formal rehabilitation was based on the findings of a committee of the Academy the Pope set up in 1979, soon after taking office

The committee decided the Inquisition had acted in good faith, but was wrong

41

At a ceremony in Rome in 1992, before the Pontifical Academy of Sciences, Pope John Paul II officially declared that Galileo was right
He expressed regret about how the Galileo affair was handled
He issued a declaration acknowledging error by the church

42

John Paul II absolved Galileo of his crimes and said, "A tragic mutual incomprehension has been interpreted as the reflection of a fundamental opposition between science and faith... this sad misunderstanding belongs in the past."

43

Epilogue

It turned out that Galileo's ideas were not entirely correct

Galileo believed that the sun was not just the fixed center of the solar system but the fixed center of the universe

We now know that the sun is not the center of the universe and that it *does* move—it simply orbits the center of the galaxy rather than the earth

THE END