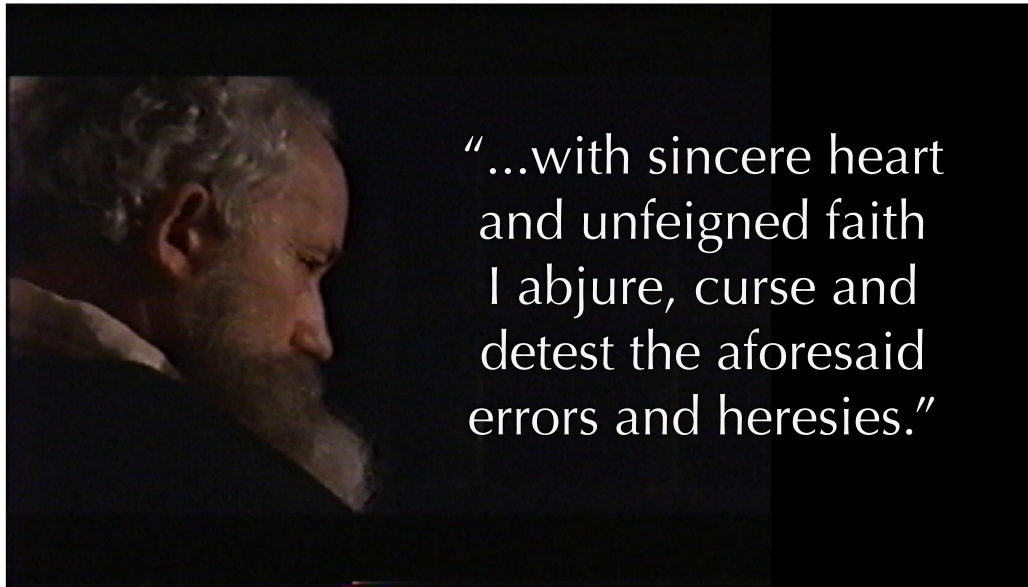


Galileo and the Church

Kerry Magruder
John and Drusa Cable prof of the History of Science
Curator, History of Science Collections
University of Oklahoma Libraries



Thank you for inviting me.



“...with sincere heart
and unfeigned faith
I abjure, curse and
detest the aforesaid
errors and heresies.”

On June 22nd, 1633, Galileo was led in a penitent's robe before a plenary session of Cardinals meeting in the Dominican convent of Minerva. He knelt before them, and recited from the prescribed statement:

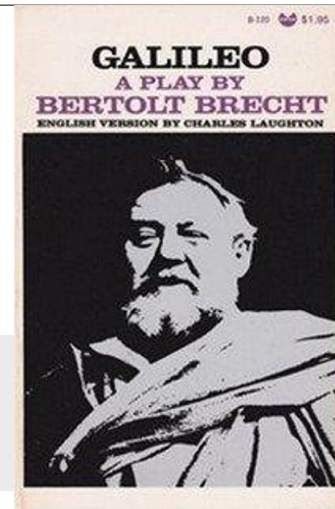
- “with sincere heart and unfeigned faith I abjure, curse and detest the aforesaid errors and heresies....” These errors included the Sun-centered cosmology proposed 90 years earlier by Nicolaus Copernicus, the most renowned Catholic astronomer of his generation. Unexpectedly, Galileo was sentenced to this humiliating act of public abjuration. Galileo's confession was distributed widely, and read aloud to Galileo's acquaintances in Florence.



To grapple with the Galileo Affair and what it means for us today requires a journey of open inquiry and a readiness to question anew what we have learned, especially from contemporary society, including popular culture. The journey must necessarily be personal and authentic, involving study and careful thought.

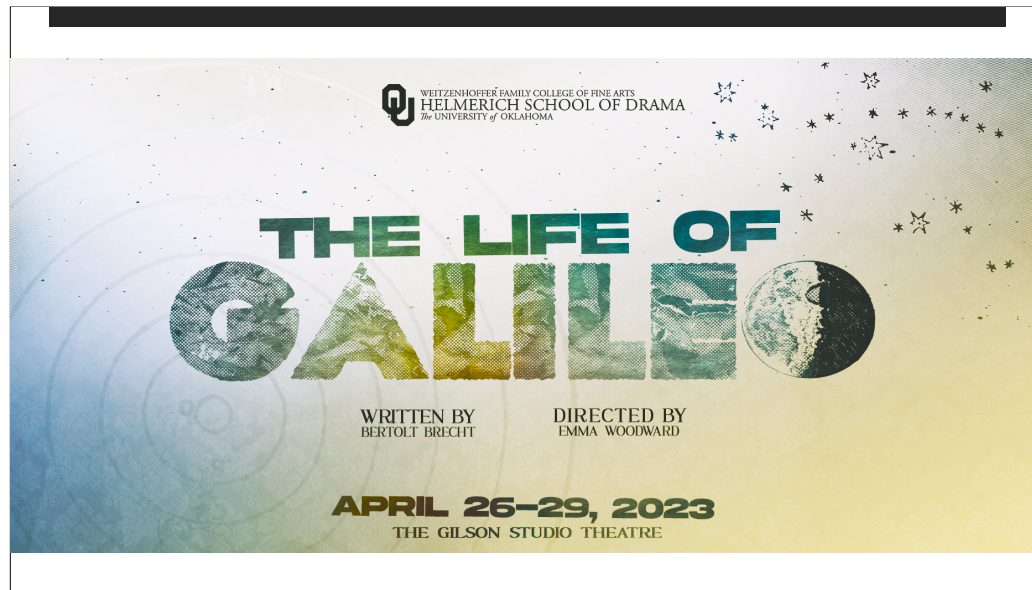
The Galileo Myth

- Trial, recantation, abjuration
- Overreach by powerful authorities
- Science (Reason) vs. Religion
- Triumph of authority, superstition, ignorance



I recommend beginning with Bertold Brecht, *The Life of Galileo*,* because Brecht's play has likely shaped popular beliefs about Galileo more than any other source.

- By "Galileo Myth" I mean the "meaning" of the Galileo story for us today, irrespective of the details and their historical accuracy. Brecht's account expresses the poignancy and tragedy of Galileo's trial,
- especially his coerced recantation and abjuration in the face of the
- overreach of powerful authorities severely transgressing their own legitimate spheres. Powerful people in the Church, as well as in the Universities, carried out their vendettas against Galileo, some with ulterior motives and some with hollow rationalizations that allowed them to believe they were in the right.
- Brecht also presents the Galileo Affair as an essential conflict between Science and Religion, where Science speaks for Reason and where Religion entails the
- Triumph of authority, superstition, and ignorance. In these ways Brecht presents the core meanings of the Galileo Myth. Other myths about Galileo, such as that he was the founder of modern science or the inventor of experimental method, seem to me to be planks shoring up Galileo as a mythic hero standing against the forces of darkness, illustrated supremely in the Roman Catholic Church at that time, or in whatever forces seek to oppress us today.



We are fortunate at OU that a brilliant production of Brecht's play was just put on by the Helmerich School of Drama with a talented group of undergraduate actors, directed by Emma Woodward, with dramaturgical support by James McCabe. Did anyone here see that play? I wish this luncheon were being held last week, so that you would have been able to know about it.

[I think it was the most effective production of Brecht I've seen, paradoxically because of the intimate setting in the studio theater. This play comes off better when it's performed by a group of very talented undergraduate actors in a university setting, not overproduced, but with creative props, costumes, and staging. It came off personal and authentic, and was a delight to attend. Emma and James, would you please stand? I'm sure some people will want to talk with you afterwards.]

The Galileo of History



However, eventually questions arise about historical truth and popular misconceptions of Galileo. To enter into that phase of the journey, remember that Brecht's play is less about the Galileo of history than about the Galileo myth. Brecht's intention was not that of a historian, to reconstruct a factual and true account of Galileo, that is, to seek understanding of Galileo in the context of his own times. Rather, Brecht sought to use the Galileo myth to critique his contemporary society, particularly the rise of fascism and the Nazi party, from the standpoint of his own Marxism. We might do the same today, if we seek to use the Galileo Myth to critique the rise of anti-science and authoritarian elements in our society, from whatever direction they might come. And I hope we will do so.

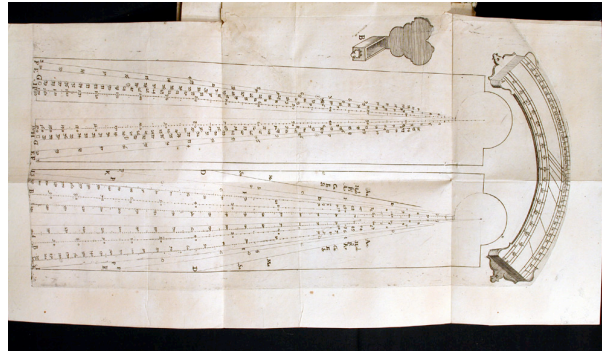
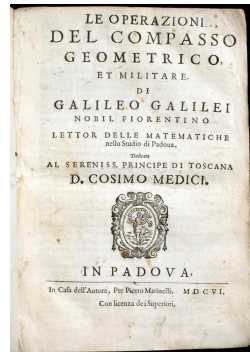
- Yet after reading Brecht, after coming to appreciate the Galileo Myth, let's also continue our personal journey to understand the Galileo of History.

Works of Galileo



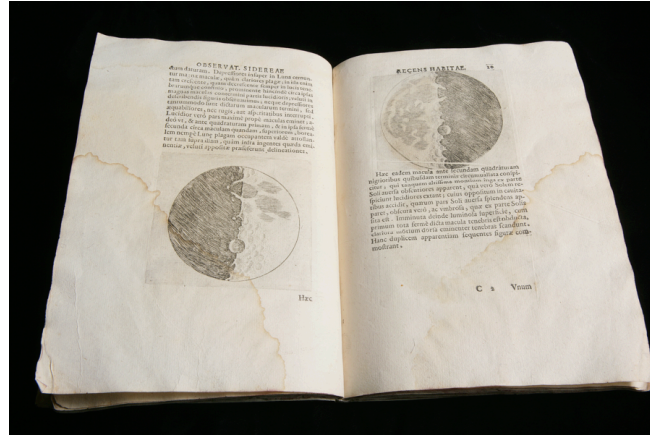
To do that, first, let's review some of the works of Galileo which Brecht mentioned in his play.

Galileo, *The Operation of the Geometrical and Military Compass* (Padua, 1606)

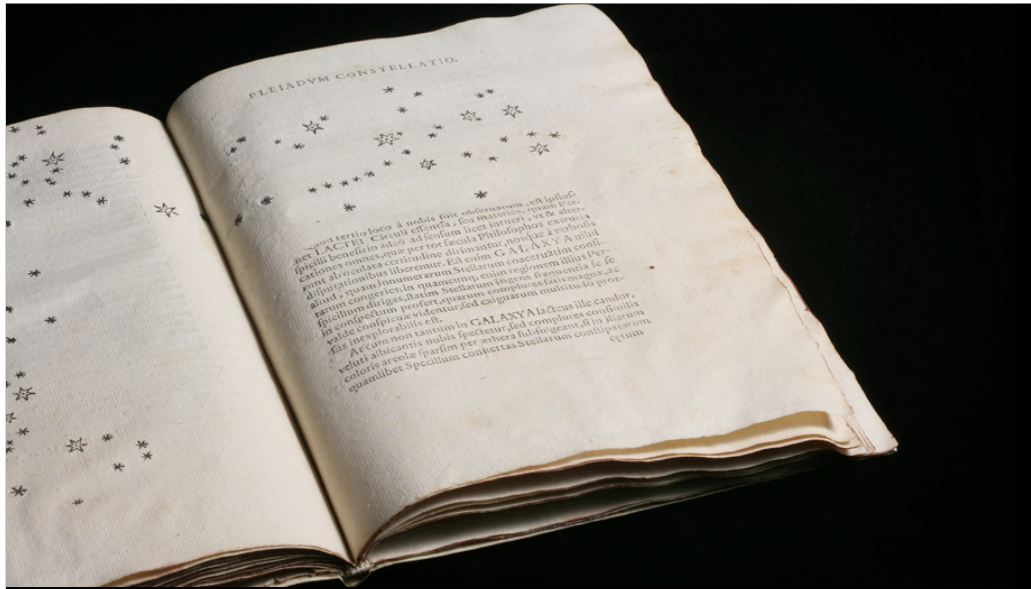


Galileo's first printed book was this manual for an engineering instrument, a sector compass, which he invented. It is an ancestor of the slide rule. This book is remembered and cherished by many today in fields as diverse as computer science and military operations. This is Galileo's rarest book. The OU copy is annotated by Galileo, and was the first copy off the printing press.

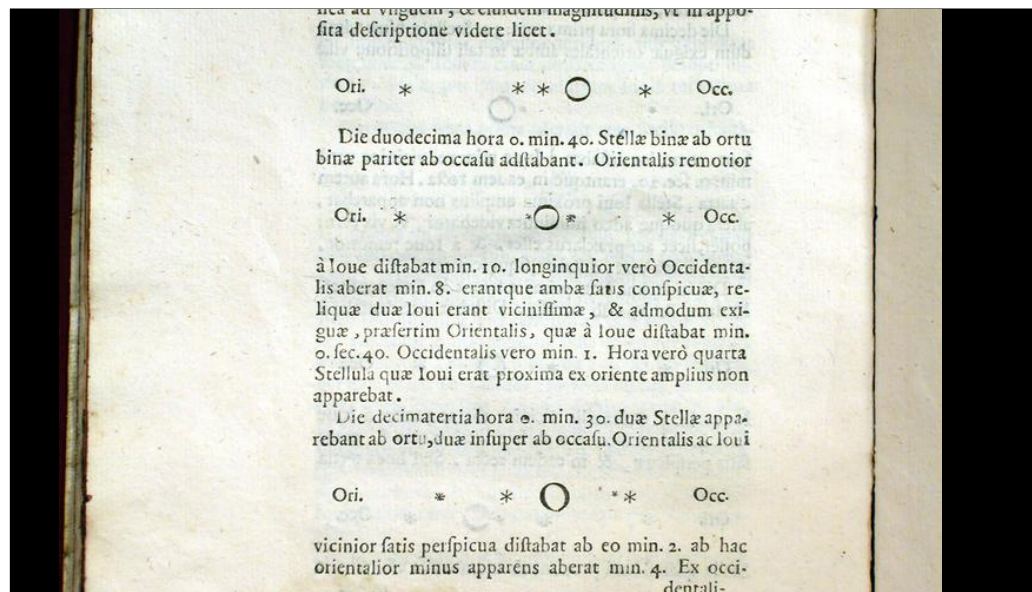
Galileo, *Starry Messenger* (Venice, 1610)



Then in 1610, Galileo's *Starry Messenger* became the first published report of observations made with a telescope. This sensational book, the only book Galileo wrote in Latin, made Galileo an international celebrity. It catapulted him from obscurity to European fame. In it he reported discoveries of mountains on the Moon...



Vast numbers of unsuspected stars



and four satellites around Jupiter, which he shrewdly named the Medicean Stars.



The OU copy is inscribed by Galileo to a friend who was a poet in the Medici court, when he arrived there himself just months after publication of the book.



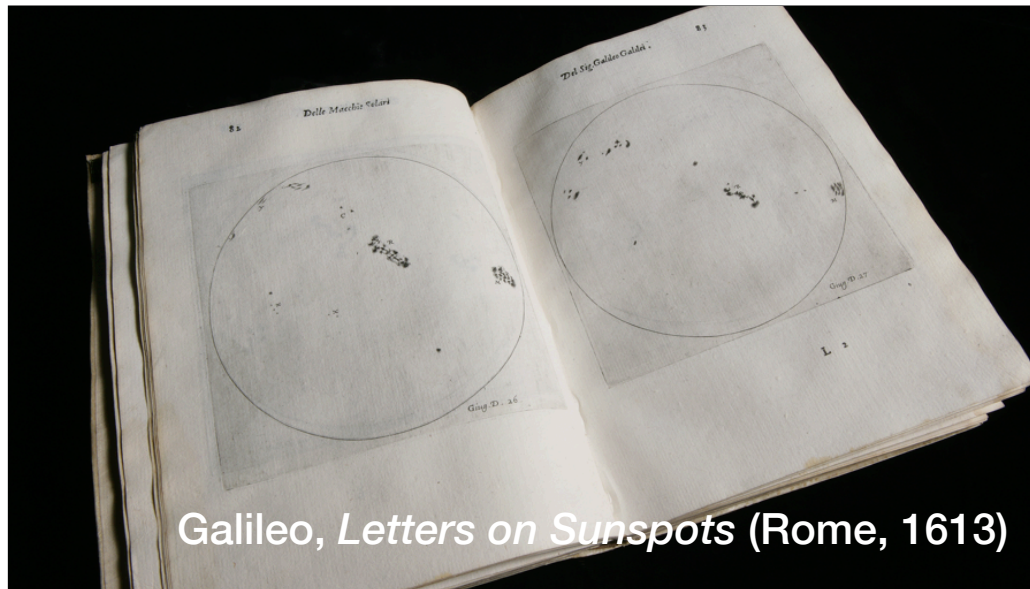
The following year, in Spring 1611, Galileo visited Rome in triumph.

- The leading Catholic astronomer of the day, Christoph Clavius, a Jesuit, affirmed Galileo's discoveries.
- Clavius and other Jesuit mathematicians and astronomers of the Collegio Romano certified his discoveries to Cardinal Robert Bellarmine. But these and Galileo's other telescopic discoveries, including the phases of Venus, did not prove Copernicanism:
- all of Galileo's observations were consistent with the system of Tycho Brahe, which many Jesuit astronomers supported. Galileo was feasted and honored by the Jesuit astronomers in Rome as the leading light of the Medici court.

Galileo, *Discourse on Floating Bodies* (Florence, 1612)



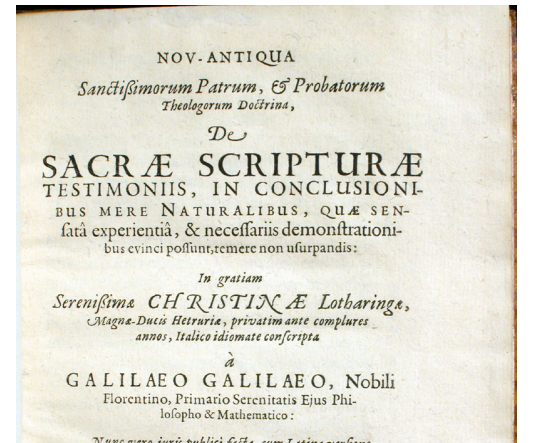
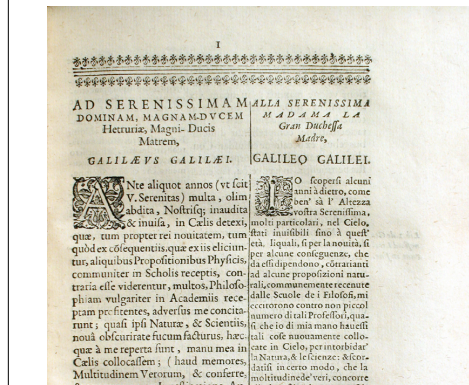
Galileo's next book, *Discourse on Floating Bodies*, had nothing to do with astronomy. With Galileo's mathematical analysis of floating bodies, he was making an incursion upon a traditional topic of qualitative Aristotelian physics. At that time, university physicists were not trained in mathematics, but Galileo was part of a generation of mathematicians who were claiming that mathematicians could do better physics than the physicists. Galileo confronted powerful physicists in the universities and many became his enemies.



Galileo, *Letters on Sunspots* (Rome, 1613)

In 1613, Galileo's *Letters on Sunspots* published detailed, full-page copperplate engravings as part of an argument which proved that sunspots lie on or very near the surface of the Sun, and are not little planets. Sunspots suggested the heavens might be corruptible, contrary to Aristotle. Galileo went to Rome, and demonstrated the sunspots to interested parties from the Medici villa there. His assistant at that time, Johann Schreck, shortly thereafter joined the Jesuits and took a telescope to China, where it was soon used in the emperor's court in Beijing.

Letter to the Grand Duchess Christina (1636)

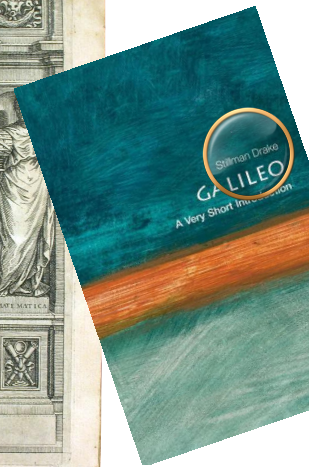


This is the first printing of Galileo's treatise on the Bible and science, which previously circulated in manuscript form. In it Galileo argued that the purpose of Scripture is to tell us how to go to heaven, not how the heavens go; Scripture never errs, but its interpreters do err; and read rightly, Scripture and Science will never conflict (there is a unity of truth). That which is obscure (figurative language) should be explained by which is clear (mathematical demonstrations). To show the traditional basis of his approach, he cited St. Augustine throughout. In theory, nothing would have prevented Roman Catholic theologians at the time from accepting the Copernican system, had they rigorously followed their own explicitly formulated principles of interpreting scripture, which Galileo articulated here.

Galileo, *The Assayer* (Rome, 1623)



Cardinal Maffeo Barberini → Pope Urban VIII



In 1623 Galileo's supporter and friend, Cardinal Maffeo Barberini, became Pope Urban VIII. The election of Barberini seemed to assure Galileo of support at the highest level in the Church.

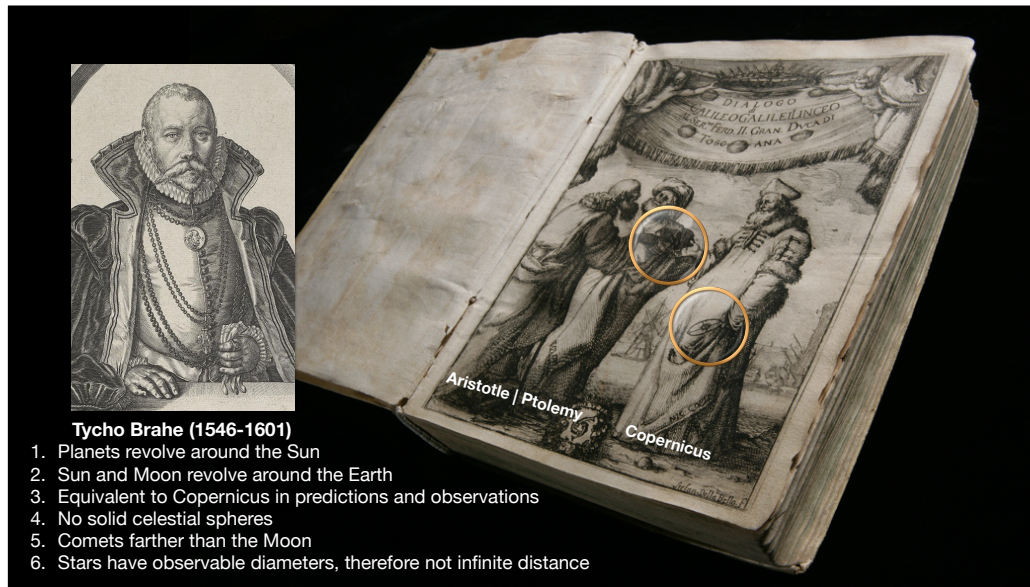
- Galileo then wrote *Il Saggiatore*, or *The Assayer*, for Urban's reading pleasure. Although it contains a magnificent polemic for the new discipline of mathematical physics, ironically its main point was to ridicule the Jesuits. Pope Urban had this book read aloud to him at the dinner table and laughed all the way through it. Afterward Urban wrote a poem praising Galileo for his wit.
- Brecht does not explain that in this book Galileo ridiculed a leading Jesuit astronomer for demonstrating correctly, and against Aristotle, that comets are farther away than the Moon. Tycho Brahe had observed comets in his day located farther than the Moon. The Jesuits confirmed that finding on the basis of their observations of three comets that appeared in 1618. Against them, Galileo argued the erroneous position that comets are optical illusions and therefore cannot be said to exist in any specific location. Anyone who imagines that Galileo was a humble doubter always dispassionately in search of the truth, just hasn't read *The Assayer*.
- The OU copy was formerly owned by Stillman Drake. Drake was a Galileo scholar and author of the Oxford Very Short Introduction to Galileo. The Drake-OU copy of *The Assayer* is an interesting early state of the book, which contains many printing errors corrected in other copies of the 1st edition. Drake validated the handwriting in 4 of OU's first editions as

Galileo's.

**Galileo,
*Dialogue on the
Two Chief Systems
of the World*
(Florence, 1632)**



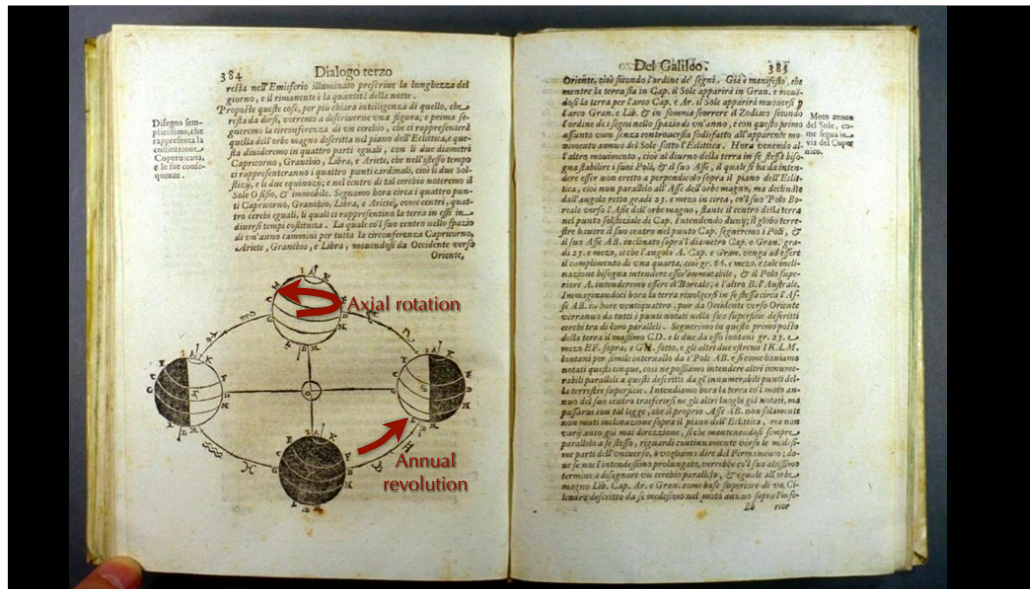
This is Galileo's *Dialogue on the Two Chief Systems of the World*, the book for which his former friend Pope Urban put him on trial. The two systems are the ancient Earth-centered cosmology of Aristotle and Ptolemy, and the 16th-century Sun-centered cosmology of Nicolaus Copernicus.



In the frontispiece, Aristotle and Ptolemy on the left hold an Earth-centered armillary sphere.

- On the right, Copernicus, dressed in Catholic garb, holds a Sun-centered model of the universe. But why just two systems? Galileo's title is disingenuous.
- Galileo nowhere mentions the most popular system of the day, the system of Tycho Brahe, which we've mentioned already.
- We need to say a little more about Tycho Brahe. In the generation before Galileo,
- Tycho placed all the planets in revolution around the Sun
- while the Sun itself revolved around the Earth.
- This elegant system was mathematically equivalent to Copernicus, with exactly the same predictions and observations.
- Tycho denied the crystalline spheres,
- and asserted that comets move through space at distances farther than the Moon.
- Moreover, using careful observing techniques, Tycho argued that stars do not appear as mathematical points of light, but have detectable diameters. This means that the stars cannot be of infinite distance from the Earth, as Copernicus assumed in order to explain the absence of stellar parallax (we won't go into that here). The telescope made this dilemma worse, as Galileo himself thought he observed visible diameters of stars through the telescope, privately recording observations which he never published. Δ In summary, Tycho was the leading observational astronomer of that era. No observations made during

Galileo's lifetime disproved the Tychonic system. Yet in the *Dialogo*, Galileo never publicly engages Tycho nor tries to refute Tycho's arguments; there are only two systems of the world in a binary choice. And Galileo's binary choice left out what was the most popular system among astronomers.



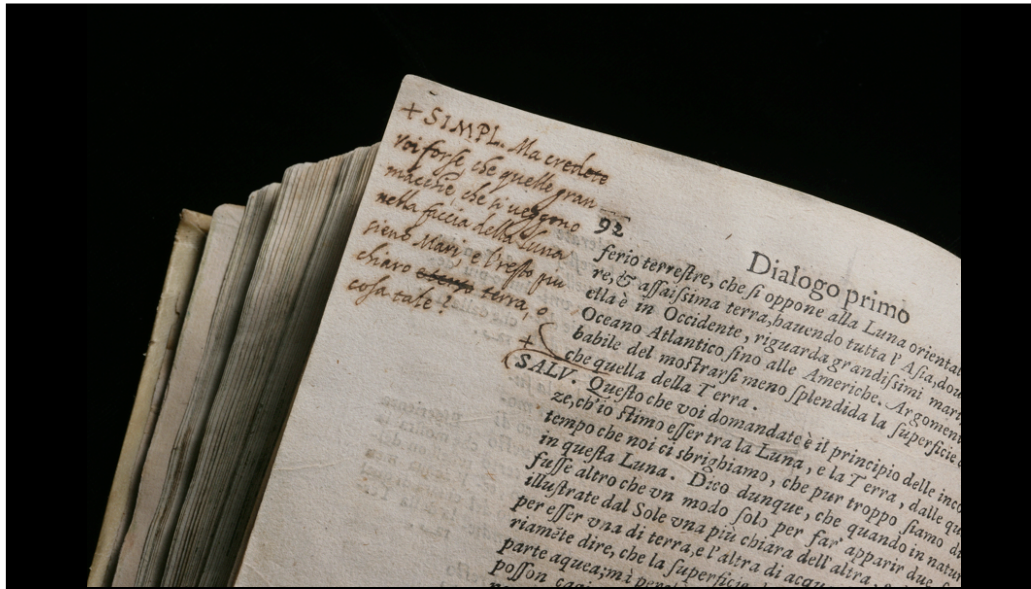
In the longest section of the book, Galileo presented his chief argument for Copernicus, a new theory of the tides. For Galileo, the tides result from the combination of the Earth's two motions:

- By itself, the axial rotation of the Earth would cause waters to move regularly from east to west, accounting for equatorial ocean currents.
- But this movement can never reach equilibrium, because it is continually compounded with the annual motion of the Earth around the Sun. This theory has many attractive features, but sadly it is incorrect.



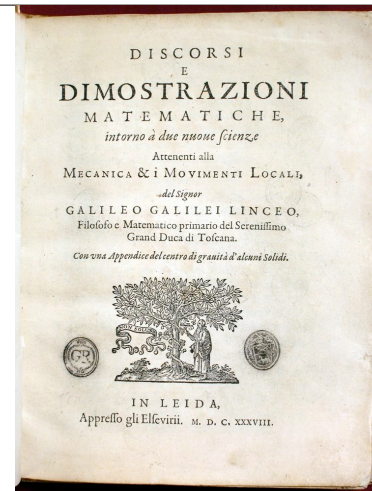
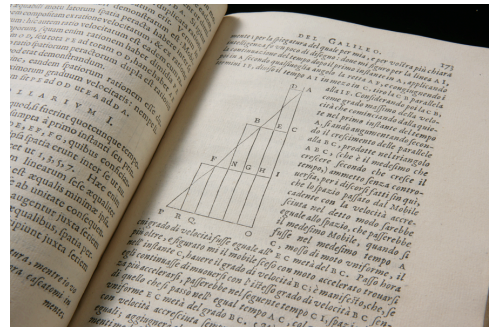
In the very last exchange of the Dialogue, poor simple-minded Simplicio concludes that Galileo's theory of the tides is only hypothetical, because God in his omnipotence could have produced the tides in some other way, if he had wanted to.

- Urban likewise insisted upon this limit to human certainty based on divine omnipotence. Hostile readers within the Vatican concluded that Galileo had written a satire identifying the pope with Simplicio.
- And for those like Urban who knew of Kepler's theory that the tides are caused by an invisible attraction between the Earth, Moon and Sun, Galileo's argument didn't "hold water" even on physical grounds. Urban suspended sales of the Dialogo and summoned Galileo to Rome for trial.



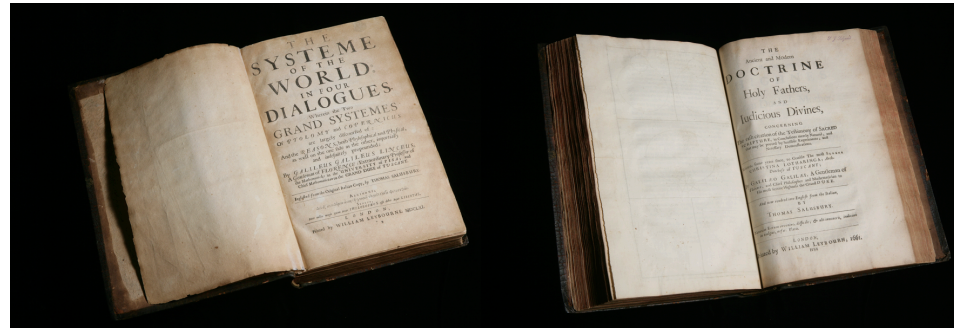
The OU copy contains Galileo's own handwritten annotations. I imagine us looking over Galileo's shoulder at his home in Arcetri, just outside Florence, where he lived under house arrest in the years after his trial.

**Galileo, *Discorsi* (Leiden, 1638)
“Discourse on Two New Sciences”**




This is Galileo's masterwork of physics, the *Discourse on Two new sciences*, published in Leiden in 1638. One of the new sciences is tensile strength. The other is motion, including the law of falling bodies, and the parabolic motion of projectiles.

Galileo, in Mathematical Collections (London, 1661), ed. John Salusbury.



The OU Galileo collection is world renowned. It contains 1st editions of all 12 of Galileo's printed books. Four OU copies contain Galileo's own handwriting. Plus we hold later editions, translations, and works of related figures. Here's just one example: Salusbury published the first English translations of Galileo, including the Letter to the Grand Duchess and the Dialogue on the Two Chief Systems of the World. We have reason to believe our copy barely escaped the Great Fire of London in 1666.

Popular misconceptions

"Galileo = Reason (or Science)"		
"As an astronomer, Copernicus was against the Church"	"As	
"Galileo's discoveries abolished the heavens"		
"Copernicus dethroned humanity, removing humanity from the center"	"C	
"Galileo's discoveries proved Copernicus"	"Gali	
"Giordano Bruno was a martyr for Copernicanism"		
"Galileo was tortured with the instruments of the Inquisition"	"Galilec	
"Catholics did not contribute to astronomy or science"		

Now let's turn to popular misconceptions. Imagine that you are at a coffee-house talking about Galileo with a friend. Your conversation touches upon some of the most common misconceptions, including ones propagated by Brecht. These include:

- "Galileo stands for Reason or Science." We have noted three of Galileo's errors: he rejected Kepler's theory of the tides, he rejected the Jesuit's arguments that comets are farther away than the Moon, and he failed to acknowledge or disclose that he himself saw through his own telescope that fixed stars did not appear as mere points of light, as Copernicus predicted and as the absence of stellar parallax required. By ignoring Tycho's arguments and ridiculing competent contemporaries he was anything but a paragon of humble doubt in the search for truth.
- "The Church stands for Faith, in contrast to Reason or Science." This, too, is simplistic. Let me complicate it for you: Many of Galileo's strongest supporters were in the Church, including at first, Maffeo Barbarini and some of the Jesuit astronomers. And many of Galileo's strongest opponents were in the Universities, not the Church. But the entire conception of faith as contrary to reason doesn't hold up. When it comes to the Galileo of history, reason, science, and faith are spelled with lower case letters. All sides exercised faith, all sides exercised reason; faith and reason worked together in complex and specific ways that cannot be universalized or spelled with ALL CAPS. These first two misconceptions are simplistic and fundamentally misguided.
- "As an astronomer, Copernicus was against the Church": actually, a good case can be made that Copernicus was the

Catholic Church's most respected and renowned astronomer during his own lifetime. His book was published with the encouragement of a prominent cardinal and dedicated to none other than the pope at that time. The OU copy was eagerly read and thoroughly annotated by Catholic astronomers within a decade of its publication.

- “As a scientist, *Galileo* was against the Church”: While personal piety is very difficult to authenticate and its outward manifestations can vary tremendously across different cultural settings, many historians of science assess that Galileo's faith was genuine by the standards of the time and that he actually did believe he could save the Church from a potential, egregious error. His decision “for the Church” was part of his motivation to relocate to Florence from the safety of the Republic of Venice.
- Brecht asserted that “Galileo's discoveries abolished the heavens”: In the patristic period, the church fathers explicitly affirmed that the highest heavens cannot contain God, who transcends space and time. Space and time, including the heavens, are part of creation. While God may freely choose to dwell within creation, he is not confined by it. Due to patristic influence a critique of Aristotle was progressing that, by the time of Galileo, saw leading Catholic theologians such as Robert Bellarmine already abandoning the unchanging solid crystalline spheres of Aristotle. Bellarmine himself, for example, had taught before Tycho and as far back as 1570 that there are no crystalline spheres, contrary to Ptolemy, and that the heavens are corruptible, contrary to Aristotle. So one might as appropriately say that Cardinal Bellarmine abolished the heavens.
- “Copernicanism contradicted the Bible”: Galileo's letter to the Grand Duchess Christina explained how traditional principles for interpreting the Bible, articulated by Augustine and accepted by Thomas Aquinas and other theologians ever since, were sufficient to allow for the compatibility of the Bible with the Copernican system. We should not be surprised that one of the earliest scholarly defenses of Copernicus came from a Spanish theologian in his commentary on the biblical book of Job! The problem was, however, that the Council of Trent then convened, in the generation between Copernicus and Galileo. At Trent positions hardened due to the intensification of conflicts between Catholics and Protestants across Europe. The Council of Trent reacted by prohibiting any interpretation of the Bible that was different from the conclusions of the church fathers. No novelties were to be allowed; no new interpretations. Since Copernicanism was not an option during the patristic period (obviously!) no church fathers had come out in favor of it. As a result, after Trent, Copernicanism was by definition contrary to the Bible. In a similar way, some Christians today might consider evolution or Big Bang cosmology contrary to the Bible, if their interpretations of the Bible have become so thoroughly entangled with young Earth creationism that they cannot imagine reading the Bible through any other lens. Yet Augustine insisted that we must always distinguish between the authority of the Bible itself and the authority of our own interpretations of the Bible.
- “Copernicus dethroned humanity, removing humanity from the center”: Actually, In the Aristotelian cosmos, the center of the universe was not a throne at all, but the gutter, the garbage dump, the only region of corruption and decay in the entire universe — not a dignified place to be, in contrast to the heavens as regions of light and love and vigor. To the contrary, both Copernicus and Galileo argued that the Sun-centered system elevated humanity by lifting the Earth into the heavens.

- “Copernicanism was pronounced heretical by the Catholic Church”: While an advisory board set up by the Inquisition urged that Copernicanism be pronounced heretical, the Church itself never officially took that step.
- “Galileo’s discoveries proved Copernicus”: Galileo’s discoveries of satellites around Jupiter and the phases of Venus were fully consistent with the system of Tycho Brahe, which was the most common system adopted by astronomers all over Europe. When Galileo wrote his Dialogue on the Two Chief Systems of the World, he disingenuously ignored the leading model among astronomers at the time, which was not the Ptolemaic.
- “Galileo’s theory of the tides proved Copernicus”: Kepler argued that the tides are caused by the gravitational attractions of the Moon and Sun, but Galileo rejected that theory because of his distaste for hidden forces acting across great distances (like gravity).
- “Giordano Bruno was a martyr for Copernicanism”: Bruno tragically was burned at the stake in Rome in 1600. But he was not a martyr for science nor for Copernicanism. First, Bruno was not a Copernican, but held to his own idiosyncratic cosmology, which he held for reasons that were hardly scientific. But more importantly, Bruno was executed for theological views, including his denial of the doctrine of the Trinity. It’s a sad story, indeed, but widely misunderstood.
- “Galileo was sentenced as a heretic”: Galileo was under a charge of “vehement suspicion of heresy,” which is a step short of heresy itself. We Protestants might carelessly gloss over such distinctions, but to a Catholic, that step, however short, still matters. Moreover, Galileo’s specific offense was not Copernicanism per se but disobedience to his previous agreement to write about Copernicanism only hypothetically.
- “Galileo was tortured with the instruments of the Inquisition”: The Medici were European powers on a global stage. As their leading intellectual figure, there was never any credible threat of torture.
- “Galileo defiantly said to himself, after his recantation, And yet it moves.”: This story was made up long after Galileo’s death. It’s in the same category as Newton getting hit on the head by a falling apple, or George Washington chopping down the cherry tree. [If we believe this then by the same standard of evidence we will need to believe those also.]
- “Catholics did not contribute to astronomy or science”: The Jesuits were trained in mathematics, including astronomy, and many led developments in the mathematical sciences for the rest of the century. Jesuit science is a topic that figures prominently in current historical scholarship. Robert Merton, the historian who argued for the Puritan origins of modern science, in later life said that he would have been better advised to argue for the Jesuits instead!
- “The Catholic Church has apologized for its conduct in Galileo’s trial”: Regrettably, No. While back in 1992 Pope John Paul II endorsed Galileo’s principles for biblical interpretation, he stopped short of an apology. Many Catholic observers argue that it is imperative for the Church to take the next step and formally apologize for its authoritarian overreach.
- Speaking as a historian, I would say that all of these are false. We might stay up late tonight talking about them! A semester course for graduate credit would not exhaust our inquiry into them. And these are by no means all of the popular misconceptions you may have encountered about Galileo and the Church.

- Galileo didn't drop balls off the Tower of Pisa, he didn't learn the law of the pendulum by watching a chandelier swing in a cathedral, and he didn't accept Kepler's three laws of planetary motion.

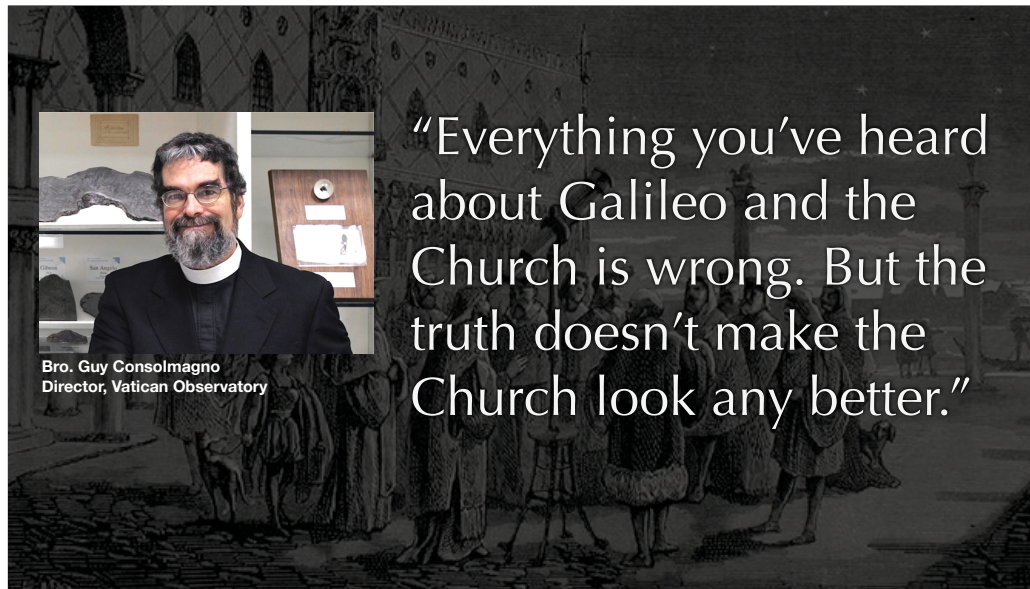


Conflict Complexity

To conclude, Galileo rightly stands as the paradigm example of an intellectual with novel ideas who was suppressed by a centralized institution more concerned with maintaining its authority and power than pursuing truth. Religious institutions, then and now, are sadly not immune to this temptation to exercise earthly power. With Galileo in mind, may we be fortified to stand against all powers and forces, whatever their nature, that would compromise freedom of inquiry and the pursuit of science and of truth. With this said, however, nearly all professional historians of science reject the widespread popular assumption that science and religion are locked in an inevitable conflict. Instead of a conflict model or a warfare thesis, historians

- adopt a complexity thesis: the relations between science and religion then, as now, are highly specific and defy easy summary.

As I've indicated, many of Galileo's enemies were in the church, but so were many of his most ardent supporters. Many of Galileo's most powerful antagonists were based not in the church but in the universities. The real story of Galileo is far more complicated than a simple conflict of science and religion, and far more interesting.



Brother Guy Consolmagno, an astronomer and director of the Vatican Observatory, summarizes the situation well:

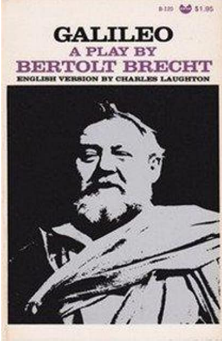
- “Everything you’ve heard about Galileo and the Church is wrong. But the truth doesn’t make the Church look any better.”



- If we keep the Galileo Myth and the Galileo of History in creative tension, we have a chance
- to be inspired by the Myth to protest illegitimate authority, while by the Galileo of History
 - to refrain from either demonizing our opponents or glorifying ourselves.



To continue your journey, I invite you to come see the original books in the History of Science Collections. I would be happy to show the books if you would like to arrange a group visit.



Discussion Guide
 Stillman Drake, Galileo: A Very Short Introduction
 by Kerry Mapster

Overview


Eight 50-minute sessions, discussing 1 chapter at a time, or about 15-20 pages per session.

Supplement the discussion questions with information in the appended **Timeline** (not necessarily covered in Drake).

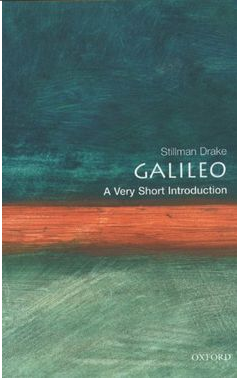
A few simple guidelines for leading a discussion:

1. Encourage open discussion.
2. Ask questions relevant to the topic.
3. Listen attentively.
4. Discussion questions are not true/false statements. Encourage interpretation based on information and evidence. Seek to elucidate rationales underlying different perspectives.
5. Encourage everyone to participate.
6. Let issues happen without rushing in. Or summarize and paraphrase. This helps everyone collect their thoughts and extend points just made.
7. Minimize didactic teaching; emphasize discovery and exploration.
8. Gently but firmly remind a "talking head" that the group's purpose is to listen attentively to everyone in turn, to encourage everyone to participate and to give everyone equal time. Recognize that "talking heads" may not perceive when they are talking too much, so they need gentle reminders. Be direct and diplomatic. "Thank you for sharing your point of view, now it's time to listen to someone else."

"Philosophy (i.e., physics) is written in this grand book—*I mean the universe*—which stands continually open to our gaze, but it cannot be understood unless one first learns to comprehend the language and interpret the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometrical figures, without which it is *humanly impossible* to understand a single word of it, without these, one is wandering around in a dark labyrinth."
 Galileo Galilei, *Il Saggiatore* (*The Assayer*, 1616)




v. 0.1: 7/16/14



Meanwhile, read Brecht's play to feel the force of the Galileo Myth.

- Then to pursue the Galileo of History, start with Stillman Drake's contribution to the Oxford Very Short Introduction series.
- I've prepared a discussion guide that goes through Drake chapter by chapter for an 8-week reading group.



The Works of Galileo

A guided tour

Kerry Magruder
University of Oklahoma
History of Science Collections


"Philosophy [i.e. physics] is written in this grand book—I mean the universe—which stands continually open to our gaze, but it cannot be understood unless one first learns to comprehend the language and interpret the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometrical figures, without which it is humanly impossible to understand a single word of its contents; else, one is wandering around in a dark labyrinth."
Galileo Galilei, *Di Saggiamenti* (The Assayer, 1610)

Foundations of Mathematical Physics: a few examples

Mathematics	Astronomy
Euclid, <i>Elements of Geometry</i>	Ptolemy, <i>Almagest</i> (ca. 150 AD)
Latin (Venice, 1476)	Regiomontanus, <i>Epitome of Almagest</i> (1496)
Arabic (Rome, 1584)	Nicolaus Copernicus, <i>On the Revolutions of the Heavenly Orbs</i> (1543)
English (London, 1570)	Johannes Kepler, <i>Astronomia Copernicana</i> (1596)
Aristotle, <i>Meteorology</i> , <i>Physics</i> , etc.	
First printing, ed. Niccolò Tartaglia, 1543.	

Timeline and Quotations

Year	Events
1564	Birth of Galileo Galilei, son of Vincenzo Galilei, in Pisa, February 15.
1574	Vincenzo moved his family back to Florence.
1575	Began education at the Monastery of Vallombrosa. Entered the Vallombrosian Order.
1577	Removed by his father before completing his novitiate year.
1581	Entered the University of Pisa to study medicine.
1585	Returned to Florence without a degree.
1588	Chosen as a replacement (meritor) in the center of gravity. Corresponded with Christoph Clavius, the Jesuit astronomer.
1589	Became lecturer in mathematics at the University of Pisa; 3-year contract.
1592	Resigned from Pisa because of controversy with Aristotelian professors.
Spring and summer	Returned to Florence.
September	Advanced lecturer in mathematics at the University of Padua, in the Republic of Venice. 3-year contract, renewable twice until 1610.
1596	Kepler, <i>Mysterium Cosmographicum</i> ("proving" Copernicusian, sent copy to Galileo. Galileo didn't read it, but wrote Kepler that he had been a Copernican "for several years".



HOLY CONGREGATION OF THE INDEX URGENT BUSINESS | CONFIDENTIAL

Officials of the Holy Congregation
Vatican City

February 20, 1610

Most Reverend Lord Cardinals,

Events of recent months have not taught youlessness, and I can assure that you appreciate the urgency of our situation. With knowledge of all sides underlying the Holy Faith will not and must have, then now comes need that within Vatican City, the Holy Office must have Galileo Galilei has been teaching and defending a new system of the world which entails these two propositions:

- The Earth moves in the heavens, and
- The Sun has a prominence in the center of the world.

These propositions are obviously foolish and absurd according to natural science. Nevertheless, seeing as Galileo continues to defend them, we must join together in the Holy Office to assess whether these propositions are:

- Falsely based on
- Erroneous in fact.

This will be formally handled if they explicitly contradict the sense of Holy Scripture in many places, according to the literal message of the verses. So we may conclude a lesser charge, that these propositions are merely erroneous in the faith, contradicting the common interpretation and understanding of the Holy Fathers and the doctors of theology.

No one is to doubt with to consider in your deliberations numerous passages from sacred Scripture which affirm the stability of the Earth and the mobility of the Sun.

Psalm 104: 5. This LORD reposes, He is clothed with majesty. The LORD has clothed and girded himself with strength; indeed, the Earth is firmly established, and will not be moved.

Psalm 104: 5. He set the Earth on its foundations; it can never be moved.

Ecclesiastes 1: 4-5. Generations come and generations go, but the Earth stands forever. The Sun rises and the Sun sets, and hurries back to rise again.

Ps 136: 8. In the heavens He has pitched a tent for the Sun, which is like a brigadier coming forth from his pavilion, like a chariot appearing to run the course. It rises east of one end of the heavens and makes its circuit to the other, nothing is hidden from Him.

Isaiah 10: 21-23. On the day the LORD gave the Assyrians over to Israel, Isaiah said to the LORD in the presence of Israel: "O Sun, cease thou from shining; O Moon, cease thou from being bright." "O Sun, cease thou from shining; O Moon, cease thou from being bright; for the nation I have brought forth in my anger, as it is written in the Book of Isaiah: "The Sun stopped in the middle of the sky and hid itself, giving power about a full day."

Isaiah 38: 7. "This shall be the sign to you from the LORD, that the LORD will do this thing that He has spoken: "I think I will escape the shadow on the stairway, which has gone down with the Sun on the stairway of Ariel; to go back ten steps." So the Sun stopped and hid her face on the stairway on which had gone down. (cf. 2 Chronicles 36)

Other important questions of interpretation include the locations of heaven and hell. Please draw up your conclusions in a report and file your arguments with this. Deliver the report in person to the Holy Office for a report of the father theologian at 3 p.m. sharp on 20 February 1610. At the time we will determine the fate of our Galileo. You need to provide the full report and explain the value that have been included therein in your Holy calling. And, of course, until the decree shall be issued by the Holy Office as a result of our deliberations at that meeting, keep the matter with the utmost confidentiality.

Download my Galileo timeline handout, which includes quotations from Galileo's works. It was made to accompany

- a guided tour of the life and works of Galileo which I've presented at universities across the country, including at Fermilab in the Chicago area and at the NASA headquarters in Langley, VA.
- I also have an online exercise for Galileo and the Bible you can work through, designed for use over a few weeks in a small group or Sunday School.

<https://kerrysloft.com/history-of-science/biblical-interpretation-exercise-galileo/>

<https://kerrysloft.com/history-of-science/life-and-works-of-galileo/>

<http://kerrymagruder.com/TH504/GalileoTour.pdf>



The documents of the case are conveniently translated and brought together by Maurice Finocchiaro in *The Trial of Galileo: Essential Documents*.

- Take a look at *Galileo Goes to Jail and other Myths about Science and Religion*, which has short chapters by leading scholars on various episodes in science and religion.
- The most comprehensive, insightful, and judicious analysis of the Galileo Affair in my opinion is Annibale Fantoli, *Galileo: For Copernicanism and For the Church*.
- Finocchiaro has an intriguing study of how the story of the Galileo Affair has been retold in every generation from 1633 through 1992, which includes a chapter on Brecht.

Thank you

Galileo and the Church

kerrymagruder.com/galileo-church/



These and other resources are listed on my personal blog, kerrymagruder.com/galileo-church/.
Thank you



BTW, the screenshot of Galileo comes from a NOVA dramatization, Galileo's Battle for the Heavens, in which actor Simon Callow played Galileo in the historical vignettes. The OU History of Science Collections received the top institutional credit in that film.