

The Uncertainty of Science and Faith and the Elegance of Galileo

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Abstrak

Kasus Galileo sering secara populer digunakan untuk menunjukkan ketegangan atau bahkan kontradiksi antara sains dan iman. Saya akan menunjukkan di sini bahwa yang tampak seperti kontradiksi itu sebenarnya muncul dari berbagai ketidakpastian dalam sains, dalam interpretasi Alkitab, ketidakpastian sejarah/politik, dan ketidakpastian sastra. Akibatnya, kasus Galileo bukanlah menunjukkan kontradiksi inheren dalam sains vs. iman, melainkan perkembangan pengertian dalam sains dan interpretasi Alkitab, yang diselingi oleh konteks sejarah dan sastra yang rumit. Pelajaran dari kasus Galileo mendorong kita untuk mengembangkan keterbukaan dan kerendahan hati yang sangat dibutuhkan untuk hidup secara integratif sebagai ilmuwan atau akademisi Kristen.

Kata-Kata Kunci: Galileo Galilei, heliosentrisme, iman, sains, tafsir bibliis

Abstract

The Galileo Affair has been popularly used to show the tension or even contradictions between science and faith. I will argue here that the seemingly contradictions stem from uncertainties in science, in the interpretation of Scripture, historical/political, and literary uncertainties. Thus the Galileo affair demonstrates not the inherent contradictions in science vs. faith, but the ever evolving understanding in science and biblical interpretation, interspersed by complex historical and literary context. The lesson from the Galileo affair prompts us to cultivate the openness and humility critically needed to live an integrated life as Christian scientists or academicians.

Keywords: biblical interpretation, faith, Galileo Galilei, heliocentrism, science

“the abjuration forced on Galileo in 1633
‘was intended to bend—or break—his will
rather than his reason.’ ”
— George Coyne

liocentrism.¹ But why did Galileo give up?
What made the Inquisition sentence him guilty
for “vehement suspicion of heresy”? Here, I
will argue that the Galileo affair demonstrates

On June 22, 1633, Galileo capitulated after more than a decade of controversy starting around 1615. Galileo finally wrote his abjuration letter and confessed to being “vehemently suspected of heresy” in regards to he-

¹“I have been judged vehemently suspected of heresy, namely of having held and believed that the sun is the center of the world and motionless and the earth is not the center and moves. Therefore, desiring to remove from the minds of Your Eminences and every faithful Christian this vehement suspicion, rightly conceived against me, with a sincere heart and unfeigned faith I abjure.” Maurice A. Finocchiaro, “Galileo Abjuration,” *The Galileo Affair, A Documentary History* (Berkeley: University of California Press, 1989), 292.

the epistemological and interpretive uncertainty inherent in science and faith, which when combined with some tension of authority made such affair inevitable. This essay starts by outlining the chronology of Galileo's affair, then shows some of the scientific and hermeneutic uncertainties that cause the crisis for Galileo, and finally concludes with some recent historiography that echoes the uncertainties and ambiguities of the affair.

The two stages of the Galileo affair signify that the crisis was not straightforward from the beginning. The first crisis was triggered by Galileo's writings *Starry Messenger* (1610) and *Sunspot Letters* (1613), which began to show his endorsement for the geokinetic theory (Copernican system) as opposed to the geostatic theory.² Following attacks by several authors on his writings, Galileo wrote a *Letter to Castelli*,³ which was later expanded in his long *Letter to Grand Duches Christina*. In this letter, Galileo asserts that the sun is located at the center of the revolutions of the heavenly orbs and does not change place, and that the earth rotates on itself and moves around the sun.⁴ Galileo also claims that the truth of Holy Scripture, when correctly interpreted, cannot contradict the true reasons and observations of human doctrines.⁵ According to Galileo, care should be taken in interpreting Scripture. One should not limit Scripture to the literal meaning in cases leading to contradictions or false propositions.⁶

Due to some complaints against Galileo before the Inquisition in Rome,⁷ Galileo went to Rome on his own initiative to clear his name and prevent the condemnation of Copernicanism in December 1615. He suc-

ceeded in clearing his name. The examination on his *Letter to Castelli*, *Sunspot Letters*, and hearsay evidence of his utterance of heresies failed to show any deviation from Catholic doctrines. However, on February 24, 1616 a committee unanimously reported that Copernicanism was philosophically and scientifically untenable and theologically heretical.⁸ Galileo therefore received a certificate from Cardinal Bellarmine, which clears his name and states that Galileo has not abjured in Rome any opinion or doctrine of his; nor has he received any penances.⁹ However, the same certificate also states that Galileo has been notified that the doctrine attributed to Copernicus is contrary to Holy Scripture and therefore cannot be defended or held.

Galileo then refrained from defending or explicitly discussing the geokinetic theory. However, in 1623 Cardinal Maffeo Barberini, an admirer of Galileo was elected Pope Urban VIII.¹⁰ This is the beginning of the second stage of Galileo crisis, which was even wrought with more uncertainty than the first. There is evidence that Urban VIII did not think Copernicanism to be a heresy, but he liked to argue that regardless the amount of evidence supporting the earth's motion, God is all-powerful and could have created a world in which the earth is motionless. During his visit to Rome in 1624, Galileo came away with the impression that there was nothing wrong for a hypothetical discussion of Copernicanism. Thus Galileo began writing, first a reply to an anti-Copernican essay by Francesco Ingoli. This *Reply to Ingoli* (1624)¹¹ was later combined with his *Discourse on the Tides* (1616)¹² into a new book titled *Dialogue on the Two Chief World Systems, Ptolemaic and*

² Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 29.

³ Maurice A. Finocchiaro, "Galileo to Castelli" *The Galileo Affair*, 49-54.

⁴ Maurice A. Finocchiaro, "Galileo's Letter to the Grand Duchess Christina," *The Galileo Affair*, 88.

⁵ *Ibid.*, 96.

⁶ *Ibid.*, 92.

⁷ Maurice A. Finocchiaro, "Lorini's Complaint" and "Caccini's Deposition," *The Galileo Affair*, 134-35, 136-41.

⁸ Maurice A. Finocchiaro, "Consultants' Report on Copernicanism," *The Galileo Affair*, 146-47.

⁹ Maurice A. Finocchiaro, "Cardinal Bellarmine's Certificate," *The Galileo Affair*, 153.

¹⁰ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 32.

¹¹ Maurice A. Finocchiaro, "Galileo's Reply to Ingoli," *The Galileo Affair*, 154-97.

¹² Maurice A. Finocchiaro, "Galileo's Discourse on the Tides," *The Galileo Affair*, 119-33.

Copernican (1632).¹³ However, a document was found in Rome, which says that Galileo has been given a special injunction in 1616, which prohibits Galileo to discuss the geokinetic thesis in any way.¹⁴ This document of February 26, 1616 is a source of debate because it is only a report, it does not bear Galileo's signature, and the official protocol, which the report points to, is missing.¹⁵ Nevertheless, Galileo entangled himself in trouble this second time with Rome. The *Dialogue* was seen as a clear violation of this special injunction, and Galileo was finally sentenced by the Inquisition trial in 1633.

How did the fate of Galileo seem to change drastically in the second crisis although he survived the first unscathed? First, there is always some uncertainty as science is at the brink of a new breakthrough. Although nowadays all primary school children may know about heliocentrism, things were less certain in Galileo's time. Copernicus' book *On the Revolutions of the Heavenly Spheres* (1543) only argued for a *simpler* and a *more coherent* explanation of the motions of heavenly bodies if the sun is assumed to be at the center and the earth taken to be the third planet circling the sun.¹⁶ This simplification can easily be understood from our modern point of view, since a lot of motions of the heavenly bodies can be attributed to the rotation and revolution of the earth. But this Co-

pernican thinking was controversial at the time; therefore it was presented as a hypothesis. Due to its hypothetical presentation, Copernicus' book was not prohibited until after the first Galileo crisis in 1616. So, there was an uncertainty how to take the new science of Copernicanism. It was seen less threatening if it was only taken as a hypothetical tool for easier calculation or explanation of the heavenly bodies.

This ambiguity was also reflected in Urban VIII's position towards the new theory in 1624. Pope Urban was very sympathetic to Galileo, and he played an important role in defending Galileo as a Cardinal in the first crisis. However his stance towards the Copernican theory defies easy interpretation. Two modern historians display different interpretations of Pope Urban VIII's attitude, which clearly accentuate the underlying ambiguity. Jerome Langford claims that by refusing to revoke the censure of 1616 Urban made clear to Galileo that Copernicanism is acceptable as hypothesis but not as a demonstration of reality.¹⁷ Maurice Finocchiaro, on the other hand, argues that Urban VIII did not think Copernicanism to be a heresy or declared a heresy by the Church in 1616.¹⁸ According to Finocchiaro, Urban thought that Copernicanism could never be proven and the decree of the Index that prohibited the book simple meant that the study and discussion of Copernicanism required special care and vigilance. Given that these two modern historians have published such disparate understandings of Urban VIII's attitude toward Copernican science, it is no wonder that Galileo came away with only a vague idea of what was actually permissible.

On the scientific level, there were also many ambiguities. Galileo's arguments for Copernicanism include his observations on the movement of sunspots; the phases of Ve-

¹³ William R. Shea and Mark Davie, "Dialogue on the Two Chief World Systems," *Galileo Selected Writings* (Oxford: Oxford University Press, 2012), 122-359.

¹⁴ Maurice A. Finocchiaro, "Special Injunction," *The Galileo Affair*, 147.

¹⁵ Maurice A. Finocchiaro, *The Galileo Affair*, 34, and Jerome J. Langford, *Galileo, Science and the Church* (Ann Arbor: The University of Michigan Press, 1992), 93. There was a hypothesis of fraud and insertion of the injunction to Galileo's trial documents to enable his accusation. However, this hypothesis has been rejected after a careful examination of the Galileo files, which showed that the entire document was written by the same hand which appeared to be that of the other documents of 1616. Annibale Fantoli, "The Disputed Injunction and its Role in Galileo's Trial," *The Church and Galileo*, ed. Ernan McMullin (Notre Dame: University of Notre Dame Press, 2005), 120.

¹⁶ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 16.

¹⁷ Jerome J. Langford, *Galileo, Science and the Church* (Ann Arbor: The University of Michigan Press, 1992), 114.

¹⁸ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 32.

nus which are similar to the phases of the moon, which indicate that Venus is circling around the sun; and the phenomenon of tides which he ascribed to the movement of the earth. However, some of these observations resulted from the use of Galileo's telescope, which was a controversy in itself. How could one be sure that his telescope did not distort reality? Moreover, there were also counter arguments. The Copernican theory seems to contradict our common perception. In his letter to Foscarini (1615), Cardinal Bellarmine claims that it is impossible to be unaware of the movement of the earth if it is really moving. If someone is on a moving ship, although it can appear to him as if the shore is moving away from him, he will know clearly that the ship moves and not the shore.¹⁹ There were also some other objections such as the *vertical fall objection* and the *projectile motion objection*.²⁰ Vertical falling objects seem not to exhibit any deviation caused by the earth movement, and equal force on ejected projectile seems to produce equal range of distance to the east and to the west. Of course, these objections can be simply clarified with Newtonian physics, and Galileo already gave hints that moving objects will be influenced by the motion of their inertial frame (e.g. a moving ship, from which a rock is dropped from its mast; or in which birds or flies are flying).²¹ However, without Newtonian physics, there were seemingly insurmountable uncertainties on both sides of the debate of the Copernican theory. Even Galileo's tides argument is actually erroneous in the light of Newtonian physics. Moreover, there was the prediction of the *Star Parallax* phenomenon as a convincing proof for the Copernican the-

ory, which could not be observed in Galileo's time.²²

However, the stronger opposition to the Copernican theory perhaps came from Scriptural objections. One of the most problematic passages used against the Copernican theory is the Joshua miracle (Joshua 10:12-13). In fact, Galileo provided a very clever argument to show that a literal interpretation of this passage is inappropriate. Galileo claims that the prolonging of the day in Joshua passage cannot result from stopping the sun even in the old Ptolemaic system; the sun must instead be accelerated to match the earth rotation to stay in a particular point on the sky.²³ Thus the only way to make the sun appears to stop on the sky is through stopping the rotation of the earth. However, such non-literal interpretation was seen to be putting uncertain scientific speculations above the certain authority of Scripture. Even worse, Galileo could be easily seen as wanting to promote a private interpretation of Scripture, which deviates from the common understanding of the Church fathers. This caused Galileo to look dangerously close to a protestant heretic, who would be strongly opposed by Rome after the council of Trent. Galileo believed that when correctly interpreted, Scripture cannot contradict science. Galileo then went out of his scientific field, thought things through and supplied alternative non-literal interpretation on difficult Scripture passages to harmonize them with the Copernican theory. However, his interpretations did not persuade his opponents, but rather intensify their oppositions. The huge uncertainty and ambiguity in science and Scripture interpretation seemed to create a large space of possible opposing opinions that led to the tragedy of Galileo.

¹⁹ Maurice A. Finocchiaro, "Cardinal Bellarmine to Foscarini," *The Galileo Affair*, 68.

²⁰ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 20.

²¹ Maurice A. Finocchiaro, "Galileo's Reply to Ingoli," *The Galileo Affair*, 182-87.

²² Star Parallax is the phenomenon of shifting position of a star against the background of farther stars because of the different position of the observer on earth caused by the earth movement. This Star Parallax could only be first observed with a much stronger telescope in 1838. Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 19.

²³ Maurice A. Finocchiaro, "Galileo's Letter to the Grand Duchess Christina," *The Galileo Affair*, 114-15.

The writing process and content of Galileo's *Dialogue* also display many traces of ambiguities. The form of a dialogue rather than a direct analysis seems to be chosen to avoid the impression of actively promoting the Copernican theory. This literary form was also necessary to ensure compliance to many restrictions and various censors for the printing permission.²⁴ Niccolo Riccardi, the Master of the Sacred Palace who was responsible for approving or prohibiting the publication of books in Rome also behaved ambivalently. On the one hand, he knew that Pope Urban VIII encouraged Galileo to write.²⁵ On the other hand, the Pope had not revoked the decree of 1616, and this decree should serve as a norm for Riccardi to judge Galileo's book. Indeed, there was a rewriting process for the preface and conclusion of the book before Galileo could secure the permission. The preface now indicates that the book was published to show to non-Catholics that Catholics knew all the arguments of the geokinetic (Copernican) theory.²⁶ Galileo even tried to exploit the ambiguities of his book in his trial by denying that he held the new system to be true. He also claimed that the intention of the book was to refute the new system.²⁷ Therefore, the whole Galileo affair involves many uncertainties and ambiguities: in the scientific data interpretation, in Scripture hermeneutic, in the attitude and decision of authorities in Rome, and even in the presentation and content of Galileo's *Dialogue* and the proceeding of his trial.

The same uncertainties continue through the contemporary historiography of the Galileo affair. Jerome Langford seems to argue that Galileo deserved the condemnation. He suggested that Galileo's audacity in putting

Pope Urban VIII's argument on the lips of his character *Simplicio* in the *Dialogue* made the pope angry and turned him into Galileo's opponent.²⁸ In his postscript, Langford admitted that although he sees Galileo to be brilliant and courageous, he also agrees that Galileo is unnecessarily combative, acerbic, headstrong, and volatile.²⁹ Finocchiaro, on the other hand, puts Langford's historiography into the "anti-Galilean" myth category. According to Finocchiaro, such historical myth often emphasizes Galileo's scientific and methodological shortcomings.³⁰ Interestingly enough, Pope John Paul II's address in 1992 also accentuates Galileo's misunderstanding and his lack of proof for Copernicanism of his time.³¹ Pope John Paul II continues to interpret Cardinal Bellarmine *Letter to Foscarini* as saying that one should be careful with scriptural interpretation and be open to scientific proofs contrary to the interpretation.³² George Coyne refutes Pope John Paul readings. He asserts that Cardinal Bellarmine actually insisted on not abandoning the traditional scriptural interpretations since it is impossible to prove Copernicanism.³³ Thus uncertainties and ambiguities of the Galileo affair are still shrouding our recent historiography.

How then should one act in the face of uncertainties? In the Galileo affair, the Church could probably not have done differently. Besides, perhaps it is easier to conclude like Jeremy Langford, that "Galileo had misused the Pope's friendship, openly disobeyed the expressed prohibitions against his theory, and plainly failed in his attempt to prove the

²⁴ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 33.

²⁵ Jerome J. Langford, *Galileo, Science and the Church*, 129.

²⁶ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 33. and "Preface to the Dialogue," 214.

²⁷ Jerome J. Langford, *Galileo, Science and the Church*, 133.

²⁸ Finocchiaro, on the other hand, indicates that Galileo simply complied with the explicit request to end the book with a statement of the pope's favorite argument. Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 34.

²⁹ Jerome J. Langford, *Galileo, Science and the Church*, 197.

³⁰ Maurice A. Finocchiaro, "Introduction," *The Galileo Affair*, 33.

³¹ George V. Coyne, "The Church's Most Recent Attempt to Dispel the Galileo Myth," *The Church and Galileo*, ed. Ernan McMullin (Notre Dame: University of Notre Dame Press, 2005), 341.

³² *Ibid*, 344.

³³ *Ibid*, 345

Copernican astronomy.”³⁴ Nevertheless, Galileo did abjure. That is perhaps the normal thing a seventy years old man would do if sentenced by the Inquisition. But perhaps Galileo did that out of humility in thinking he might be wrong. Humility is highly difficult in such controversy. Galileo elegantly abjured, and the world does not forget that.

Science, Theology, and the Integrated Life

It is perhaps rather obvious that science always evolves and sometimes disrupted by revolutionary breakthroughs. No scientist will claim to know the absolute truth in science, and they are familiar with falsifications that new theories bring to override old theories. On the other hand, few people realize that theology also evolves and changes. Biblical interpretation has also evolved gradually and sometimes revolutionized by new insights. One such breakthrough is how the New Testament writers reread the Old Testament in the light of the Jesus event. Passages in the Old Testament brought out a fresh understanding when God worked out God’s salvific plan in Christ.

Confronted with this difficulty of evolving science and Biblical interpretation, it took 359 years for the Catholic Church to acknowledge Galileo. In November 4, 1992, Pope John Paul II wrote in *L’Osservatore Romano* N. 44 (1264) confirming Galileo’s correctness:

Thanks to his intuition as a brilliant physicist and by relying on different arguments, Galileo, who practically invented the experimental method, understood why only the sun could function as the centre of the world, as it was then known, that is to say, as a planetary system. The error of the theologians of the time, when they maintained the centrality of the Earth, was to think that our understanding of the physical world’s structure was, in some way, imposed by the literal sense of Sacred Scripture.³⁵

³⁴ Jerome J. Langford, *Galileo, Science and the Church*, 150.

³⁵ Caltech Information Technology Services, “Faith Can Never Conflict With Reason,” *Excerpt from L’Osservatore Romano* N. 44 (1264), November 4, 1992

Formally closing a 13-year investigation of the Galileo’s case, Pope John Paul II confirmed the heliocentric position and acknowledged the error of the theologians of Galileo’s time in imposing the literal reading of Scripture.³⁶ Earlier in 1757, Galileo’s “Dialogue Concerning the Two Chief World Systems” was also removed from the Index, a former list of publications banned by the Church.

One of the reasons why it took literally hundreds of years for the Church to acknowledge that Galileo was right is that it also took the scientific community nearly that long to be able to observe the definitive proof of the heliocentric theory, that is, the star parallax.

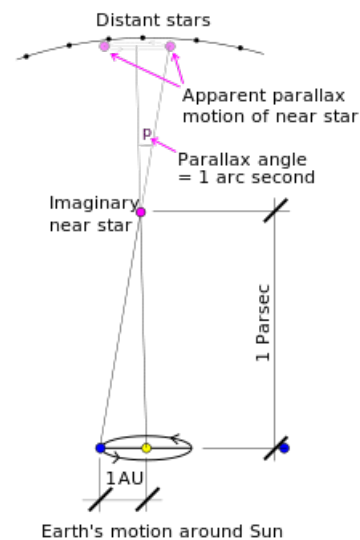


Figure 1. Stellar Parallax³⁷

The star parallax is the phenomenon of seemingly shifting position of a near star against some distant stars because of the Earth’s motion around the Sun, as shown in Figure 1. The first parallax measurement was successfully done by Friedrich Bessel using a Fraunhofer heliometer at Königsberg only in 1838, 205 years after Galileo’s trial. Please al-

³⁶ Alan Cowell, “After 350 Years, Vatican Says Galileo Was Right: It Moves,” *New York Times*, October 31, 1992. <http://www.nytimes.com/1992/10/31/world/after-350-years-vatican-says-galileo-was-right-it-moves.html>. Accessed December 11, 2017.

³⁷ Wikipedia, “Stellar Parallax,” https://en.wikipedia.org/wiki/Stellar_parallax#CITEREFZeilikGregory1998. Accessed December 11, 2017.

so note that the Newtonian physics came only in the 2nd half of the 17th century, thus Galileo could not express his arguments in terms of Newtonian physics and theory of gravity.

How then should we walk an integrated life as a Christian scientist or academician? First, it seems wise to avoid easy labeling on science or theory that we deem as Christian or unchristian. The case of Galileo has demonstrated that a revolutionary breakthrough in science would be very hard to recognize (otherwise it would not be a breakthrough but only some incremental improvement). It is then wise not to fix Christianity too close to any scientific theory that might be proven wrong when new theories come. Simply said, it is good to keep an open mind towards any scientific theory.

It is also important to have a clear idea what we mean when we say “theology is the queen of science.” It should not mean that theology must dictate our understanding of science, but rather to acknowledge that theology speaks about divine contemplation, salvation and the meaning of life itself.³⁸ It is also important to be aware of the fact that theological understanding is also evolving. In the case of Galileo, the interaction with science even contributes to improve hermeneutical reading of some passages in the Bible. So, it is not only theology that influences our understanding of science, but science also can renew and refresh our reading of Scripture. We should be open to both possibilities if we are to live an integrated life.

Bibliography

Caltech Information Technology Services, “Faith Can Never Conflict With Reason,” *Excerpt from L'Osservatore Romano* N. 44 (1264), November 4, 1992, <http://www.its.caltech.edu/~nmce>

³⁸Galileo. “Galileo’s Letter to the Grand Duchess Christina,” 1615. Finocchiaro, *The Galileo Affair*, 100.

nter/sci-cp/sci-9211.html. Accessed December 11, 2017.

Cowell, Alan. “After 350 Years, Vatican Says Galileo Was Right: It Moves,” *New York Times*, October 31, 1992. <http://www.nytimes.com/1992/10/31/world/after-350-years-vatican-says-galileo-was-right-it-moves.html>. Accessed December 11, 2017.

Coyne, George V. “The Church’s Most Recent Attempt to Dispel the Galileo Myth,” *The Church and Galileo*, edited by Ernan McMullin. Notre Dame: University of Notre Dame Press, 2005.

Finocchiaro, Maurice A. *The Galileo Affair, A Documentary History*. Berkeley: University of California Press, 1989:

Bellarmino, Cardinal. “Cardinal Bellarmine to Foscarini,” 1615. Finocchiaro, *The Galileo Affair*, 67-9.

Bellarmino, Robert Cardinal. “Cardinal Bellarmine’s Certificate,” 1616. Finocchiaro, *The Galileo Affair*, 153.

Caccini, Tommaso. “Caccini’s Deposition,” 1615. Finocchiaro, *The Galileo Affair*, 136-41.

Galileo. “Galileo to Castelli,” 1613. Finocchiaro, *The Galileo Affair*, 49-54.

Galileo. “Galileo’s Letter to the Grand Duchess Christina,” 1615. Finocchiaro, *The Galileo Affair*, 87-118.

Galileo. “Galileo’s Reply to Ingoli,” 1624. Finocchiaro, *The Galileo Affair*, 154-97.

Galileo. “Galileo Abjuration,” 1633. Finocchiaro, *The Galileo Affair*, 292-93.

Lorini. “Lorini’s Complaint,” 1615. Finocchiaro, *The Galileo Affair*, 134-35.

Lombardus et al. “Consultants’ Report on Copernicanism,” 1616. Finocchiaro, *The Galileo Affair*, 146-47.

———. “Special Injunction,” 1616. Finocchiaro, *The Galileo Affair*, 147.

Langford, Jerome J. *Galileo, Science and the Church*. Ann Arbor: The University of Michigan Press, 1992.

Shea, William R. and Mark Davie, "Dialogue on the Two Chief World Systems," *Galileo Selected Writings*. Oxford: Oxford University Press, 2012.

Wikipedia, "Stellar Parallax," https://en.wikipedia.org/wiki/Stellar_parallax#CITERFeilikGregory1998. Accessed December 11, 2017.