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The Galileo Affair In Context: An Investigation of Influences on The Church During Galileo's 1633 Trial

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I. Introduction

When most people learn about the Galileo controversy of 1633, their knowledge of the affair is most commonly comprised of the facts of his condemnation on counts of heresy and possibly some other details about how and why his inquisition was conducted. These details are often simply concerned with the Church's indefensible view of the earth as the center of the universe, combined with some scripture passages describing the sun as standing still or the earth being fixed in place and unmovable. These bits of information may very well have had some influence over the Church's decision to condemn Galileo, but they are very far from the only reasons behind this turn of events which, according to one Pietro Redondi, may not have been driven by the factors generally assumed at all. I hope to examine the philosophical and political factors of the day that would have motivated the Church's uncharacteristic persecution of Galileo, as well as a book by Redondi called "Galileo Heretic." Redondi's theory outlines a motive for the inquisition of Galileo separate from his heliocentric views and is based upon an anonymous Vatican document that thoroughly denounces Galileo's theories of matter and predates this trial. This document is used to substantiate Redondi's claim that Galileo's trial was brought about by his writings on atomism that might have challenged the Church's core doctrine of Transubstantiation, and that Galileo's inquisition was requested by Pope Urban VIII in order to draw attention to a less theologically critical controversy in Galileo's heliocentric views. I will demonstrate that there are more factors involved in the Galileo controversy than are commonly acknowledged, some of which indicate that this trial was not the product of astronomical discoveries, but of threatening advances in atomic theory.

Before I get to the issue of Roman Catholic astronomy, I will start with an overview of the Greek understanding of heavenly motion, in particular the way that their study of the sky progressed from a focus on the parapegmata and the cyclical nature of eclipses, seasons, and planetary motion to an observational discipline in search of scientific discoveries and explanations of the natural world. I will start with a discussion of Ptolemy's records of previous Greek astronomical observation and his proposed model and provide alternative viewpoints from authors such as Aristarchus. In addition, I will briefly discuss how the Greek philosophy of planetary motion in Aristotle was adopted by Thomas Aquinas and became the primary source for the Church's views on astronomy until the scientific revolution.

This discussion of Greek astronomy will not only demonstrate how the Church came to its views of the cosmos at the time of Galileo, but it will also serve to show the similarity between the evolution of Greek astronomy and that of the Catholic Church's own approach to the discipline. Just as the Greeks initially became interested in astronomy to create parapegmata, the Church founded its Vatican Observatory to come up with a solution to the problem of dating the Easter holy day, and the development of the Gregorian calendar.[1] Considering the Vatican's approach to science and particularly astronomy, which was even of particular interest to the Jesuits, the Church's earlier relationship with the progenitor of the Heliocentric theory in Copernicus, and its appearances of openness to new scientific ideas, Galileo's trial becomes increasingly out of character for the Catholic Church, making Redondi's theory of hidden motivation all the more plausible.[2]

[1] Heilbron 2009: 29-39.
[2] Schreiber, 1904:10, Scotti, 2017:154.

II. The Greek Origins of Astronomy and the Geocentric Theory

While the primary objective of this section is to demonstrate the Greek understanding of the heavens in order to provide background for the Catholic Church's Greek-derived views of astronomy entering the 17th century, this explanation requires some preliminary information about the evolution of scientific astronomy in Greek society. This overview will begin with the discipline's roots in nearby Babylon and end with Ptolemy, who will without a doubt be invoked along the way as his *Almagest* is the secondary source for most available information on earlier observers.

It is commonly noted that the Greeks derived much of their early practices in astronomical sciences from those of nearby Babylonians, who were already practicing observational scientific methods to chart the heavens and make predictions about celestial events when Greek scholars first became interested in this study.[3] Many of these first recorded instances of the Babylonians' dated observations are marked all the way back at the 8th century BCE, a time for which there is little record of scientific writings containing dates of observation and precise measurements in the ancient Greek cultures. Homer and Hesiod, who are both estimated to have lived in this same timeframe (the 8th century BCE), have accounts of eclipses, solstices, and constellations in their poetry and epic.[4] Examples from these authors are sometimes used to argue that some of the archaic Greeks wrote down more details than one might think, and that Homer and Hesiod ought to be considered as part of the history of Greek scientific astronomy. However, these two authors are not counted among the earliest examples of Greek astronomy by historians such as Anthony Aveni because they only contain brief depictions of celestial events,

[3] Goldstein and Bowen 1991:93.
[4] Lorimer 1951:92.

rather than the detailed scientific observation of astronomical phenomena we see in later examples.[5] I think that D. R. Dicks summarizes these points well when he says of Homer and Hesiod, "[Their] astronomical knowledge is based on the rough-and-ready observations, inaccurate by their very nature, unsystematically recorded and imperfectly understood."[6] Over time, written descriptions of the night sky evolved from the sorting of stars in constellations towards the development of parapegmata, which was the study of the sky as it relates to the prediction of seasons, solstices, and weather phenomena.[7] In his *Almagest,* Ptolemy identifies the first parapegmatists in the 5th century astronomers Meton and Democritus. Their early forms of these parapegmata were similar to a modern almanac, and were usually associated with the scheduling of time-sensitive agricultural tasks around the motion of celestial bodies, an idea which bears striking resemblance to passages in Hesiod:

> When Orion and Sirius reach heaven's middle, and rose fingered Dawn looks upon Arcturus, O Perses, then pluck [and take] all the grape clusters to the [house], and expose them to the sun for ten days and ten nights, put them in shade for five days, and on the sixth day decant the gifts of much cheering Dionysus into vats. But when the Pleiades and the Hyades and strong Orion are setting, right then be mindful of plowing in season; then may the seed be well lodged under the ground. (*Works and Days,* 609-617)

Here we can see that just like the early parapegmatists, Hesiod recommends harvesting at a specific time denoted by the positions of individual stars and constellations in the night sky. While the first parapegmata were composed of many similar examples, they did not contain predictions of planetary motion or eclipses and were still lacking the precise measurements which are the hallmark of scientific astronomy.

[5] Aveni and Ammerman 2001:85-86.
[6] Dicks 1970:37.
[7] Goldstein and Bowen 1983:331

When you look at the first detailed recorded astronomical observations by Greeks, you find the names of a few early Greek astronomers such as Eratosthenes, Archimedes, and Timocharus. All of these figures were active in the 3rd and 4th centuries BCE, although Timocharus is the only astronomer whose observations were both precisely measured and dated, and the earliest samples of these fall between the years 294 and 282 BCE.[8] An account of the earliest recorded Greek astronomical measurements shows what these ancient scholars were trying to accomplish in the discipline during these more advanced stages of Greek astronomy, such as Timocharus' recording of stellar declination, Eudoxus' early model of the planetary orbits, and Hipparchus' discovery of axial precession.[9]

In addition to these, the pursuit for an explanation of planetary motion had by this time become one of the most important topics in Greek astronomy. The theorizing and modeling associated with this endeavor began with Eudoxus in the 4th century BCE when he devised his own separate rotating spheres for the earth, planets, and the stars.[10] In his model, he had the earth at the center, surrounded by the sun, moon, and planets which were each rotating around the earth on a series of up to 3 rotating spheres for each celestial body.[11] Using more than one sphere for the planets allowed him to vary the axis of each rotating sphere for every planet to accurately model the retrograde motion observed when planets appeared to be moving backwards in the sky from their usual track.[12] With this model, Eudoxus was able to predict the movement of the heavens with accuracy and laid a foundation for others to build upon, but it was not without fault. One thing that Eudoxus' geocentric model failed to account for was the increasing or

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[8] Goldstein and Bowen 1991:95.
[9] Goldstein and Bowen 1991:101, 111; Goldstein and Bowen 1983:339.
[10] Goldstein and Bowen 1983:338
[11] Ibid
[12] Ibid:339

decreasing magnitude of the planets as they progressed through their orbits.[13] This phenomenon was in reality the visual manifestation of the planets moving closer to earth in their orbit around the sun, but was something Eudoxus' model could not explain. This was due to his implementation of perfect planetary spheres of orbit, which meant that planets would always stay the same distance from the earth at any given time. Eventually this issue was accounted for in later geocentric models of the solar system, but was not a major concern for the philosopher Aristotle, whose studies in astronomy were oriented more towards finding metaphysical meaning in the arrangement of the heavens instead of mathematical perfection. Aristotle's teacher Plato had come up with a simpler geocentric model of the solar system that placed the earth at the center, with the moon, sun, and planets on orbiting circles around it, and Aristotle continued to use it and develop his cosmology around it.[14] This Platonic or Aristotelian model of the solar system survives with minimal revision until the time of Ptolemy, who collects the majority of astronomical observations and theories into his work *The Almagest*, which he uses to further refine the Aristotelian model and iron out inconsistencies to create his own new Ptolemaic model of the solar system, which makes predictions of planetary motion extremely accurate.[15]

Radically dissenting opinions on Greek models of the solar system are hard to come by in ancient astronomy. In a brief history of Eudoxus, Plato, and Ptolemy, we have already seen three different models of the same cosmological principle that is the geocentric theory. Although there was at least one voice of opposition advocating for a sun centered model of our solar system in the 3rd century astronomer Aristarchus, no copies of his work on the subject have survived to the present day. According to secondary sources in Archimedes, Aristarchus proposed that the

[13] Goldstein and Bowen 1983:339.
[14] Plato, Gregory, and Waterfield 2008:26-27.
[15] Goldstein and Bowen 1983:331.

planets revolved around the sun and actually created his own working mathematical model for this concept.[16] It is noted that there is no record in Archimedes or any other secondary scholarship that would indicate that Aristarchus personally advocated for the truth of his model. Some even think it likely that Aristarchus as a mathematician and astronomer came up with a theory to explain observed phenomena and let the philosophers debate which bodies ought to move and which should be fixed by nature.[17] In any case, Aristarchus' model gained few supporters in the ancient Greek world and seems to have been forgotten. However, there is also a hypothesis that the 2nd century astronomer Hipparchus was supportive of Aristarchus' heliocentric model because he had pointed out certain inconsistencies in the Geocentric model. A passage from Ptolemy's *Almagest* says of Hipparchus:

> Hence it was, I think, that Hipparchus… demonstrated with every means at his command that they are represented by uniform circular motions, did not even make a beginning in establishing theories for the five planets, not at least in his writings which have come down to us. All that he did was to make a compilation of the planetary observations arranged in a more useful way, and to show by means of these that the phenomena were not in agreement with the hypotheses of the astronomers of that time. (*The Almagest* IX.2.H210)

This selection does not tell us whether Hipparchus accepted the commonly held geocentric theories of his day, but instead simply states that Hipparchus recorded his observations in a way that made it easier for other scholars to discover what was wrong with those theories. It does not yet seem that Hipparchus was advocating a heliocentric viewpoint, but he was one of the first Greeks to apply the concept of parallax to the heavenly bodies.

This idea of parallax was quite ingenious, having arisen from observing the shift in objects when viewing from one eye or the other, which holds the key to finding out if we are on

[16] Heath, Sir Thomas, and Aristarchus of Samos 1913: 302.
[17] Ibid: 304.

a moving body in our solar system. Parallax is a way of measuring distance using Euclidean geometry, where the apparent change in location of an object when viewed from separate locations will tell you the distance of that object in relation to the space between observation points.[18] Hipparchus used this method for determining an approximate distance to the moon with the knowledge that a lunar eclipse was full at the Dardanelles, but 75% full in Alexandria.[19] This same method could reasonably be expected to work for the stars in the same way it would if the earth were moving around the sun, because a view of a certain star on a given date and 182.5 days from then (on the other side of the sun) would appear to have shifted. This is something we are able to see today and can use it to calculate the distances to stars for which parallax is observable. Ptolemy says that “there is no other way, either, to make progress in our knowledge of this matter, since none of the stars has a noticeable parallax (which is the only phenomenon from which the distances can be derived).”[20] The major obstacle preventing the Greeks from detecting parallax in the stars was the lack of knowledge they possessed about how incredibly far away even the nearest stars are from earth. Because the Greeks didn’t observe parallax in the stars, they concluded that the earth must not be revolving around the sun but did not realize that the parallax that actually existed was much smaller than could ever be observed with the naked eye. This limitation of available technology is what drove Ptolemy to create elaborate explanations of rotating epicycles overlaid on deferents to account for the retrograde motion of the planets. This apparent validation of a geostationary model would have further strengthened the desire for Ptolemy and others to find philosophical meaning in the “perfect” circular motion of the heavens around us.

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[18] Toomer 1974:127.
[19] Ibid.
[20] Toomer, G., O. Gingerich, and Ptolemy: 419

The reason this background information on Greek ideas of the solar system has been included in a work on the motivations behind the Galileo affair is to identify the origins and history of the Geocentric theory that the Catholic Church stands behind in its confrontations with the renaissance scientist. Before turning to the Church at the time of Galileo, however, I would like to talk about Thomas Aquinas, who is a bridge between ancient Greek and early modern Church ideas. As one of the Roman Catholic saints given the distinction of Doctor of the Church, Aquinas was one of the most influential figures from all of history in shaping Catholic doctrine. He is best known today for his discussions of natural law and reconciling faith and reason through philosophy, as well as for his endeavors to prove the existence of God through the *quinquae viae* or “five ways” of argument in this pursuit.

III. Aquinas: The Bridge Between Aristotle and Catholicism

Thomas Aquinas borrowed extensively from the ancient Greek philosophers and refers to Aristotle in his *Summa Theologica* as “the Philosopher”.[21] He also wrote several commentaries on many of Aristotle’s works, and it is worth noting that the first two of Aquinas’ arguments for the existence of God come directly from Aristotle’s *Metaphysics.*[22] The first of these, based around the necessity for an “Unmoved Mover” was to both Aristotle and Aquinas the idea that the planets, just like any other objects, cannot move by themselves and would require a continuous application of force by a higher power to maintain the perfect and eternal circular motion observed over the centuries.[23] Although this argument for the necessity of a supernatural mover is now an unnecessary explanation for celestial motion due to Sir Isaac Newton’s established theory of gravitational attraction, it is understandable why a supernatural mover would have been a necessity in Aquinas’ day. Before anyone knew about the frictionless state that the planets orbit in due to the vacuum of space or the immense force being exerted on the planets by the of gravity or the sun, there would have been no logical reason for the planets to continuously move in the same path forever without some kind of intervention from a higher power to propel them.

Aquinas’ second argument from Aristotle’s body of work, although similar to the first, is different enough and relevant enough to be mentioned as well, although its links to astronomy are a little more complicated. This second argument from First Cause is manifested in Aristotle’s *Metaphysics* by the efficient cause or agent of every being. For a being to have an efficient cause is to have its very being dependent on this cause. For example in *Metaphysics*, Aristotle tells us

[21] Aquinas, Shapcote, Knight, and Cheung 1995: 1.1.4.1.
[22] Aquinas, Shapcote, Knight, and Cheung 1995: 1.2.3.2, Aristotle, Ross 2001: XI.1
[23] Ibid.

that the agent of a statue is the sculptor who chisels at it. In Aquinas' argument this dependency relationship is traced back as far as it will go, but because every entity must be brought into being by another, there comes a point where there needs to be an original agent or "First Cause" for at least basic elements. This original agent that caused at least one other being to exist must be eternal in order not to have been created by another agent preceding him, and Aquinas is calling this original agent God.

This argument for a God, like that of an unmoved mover, places some importance on the perfection of the circular orbits of the heavens, but in a more indirect way. For Aquinas and likely for Aristotle as well, the fastest and most logical way to reach the conclusion of the necessity of a first cause would be to point to the heavens and ask what caused the stars and planets to exist. For Aristotle, the celestial sphere was an elevated place superior to the earth with all its flaws, and Aquinas must have understood this concept as it comes from the Greeks. After all, Aquinas' view of earth was certainly colored by Christian ideas of sin and all the suffering that comes with it. It has been established that a first cause would necessarily be eternal, but looking to these more perfect entities in the heavens and asking what could create such beings would immediately refine the character of this "First Cause" and result in the answer Aquinas was looking for. A supremely perfect being that he calls God. Because the perfect circles of orbits in Geocentric models contribute to this elevated nature of the sky, this theory is linked (albeit loosely) to the Christian concept of God through the works of St. Thomas Aquinas.

Thomas Aquinas borrowed heavily from Aristotle's philosophical concepts, and thus could subsequently have been referenced by theologians in defense of a geocentric viewpoint, however, his works contain at least two areas which show that Aquinas was not certain that the ancient Greek interpretation of the celestial motion is an infallible explanation for celestial motion. In the context of our knowledge of the tripartite nature of the Trinity, Aquinas says:

> Reason may be employed in two ways to establish a point: firstly, for the purpose of furnishing sufficient proof of some principle, as in natural science, where sufficient proof can be brought to show that the movement of the heavens is always of uniform velocity. Reason is employed in another way, not as furnishing a sufficient proof of a principle, but as confirming an already established principle, by showing the congruity of its results, as in astrology the theory of eccentrics and epicycles is considered as established, because thereby the sensible appearances of the heavenly movements can be explained; not, however, as if this proof were sufficient, forasmuch as some other theory might explain them. (*Summa Theologicae* 1.32 Reply to Objection 2)

Here Aquinas is using this digression to prove a point about the two ways that reason can help inform views of the Trinity both in developing theories and confirming already established ones. The last couple of lines show that Aquinas is not strictly opposed to other interpretations of the layout and movement of the solar system if another more probable or well substantiated theory should be discovered. Another place where Aquinas shows indifference to the geocentric theory is in his commentary on Aristotle's work called *De Caelo:*

> …we must keep in mind that certain "anomalies," i.e., irregularities, appear with respect to the motions of the planets. For the planets seem to be now swifter, now slower, now stationary, now retrogressing. Now this does not seem to be appropriate to heavenly motions, as is evident from what has been said above. Therefore, Plato first proposed this problem to an astronomer of his time, named Eudoxus, who tried to reduce these irregularities to a right order by assigning diverse motions to the planets; a project also undertaken by later astronomers in various ways. Yet it is not necessary that the various suppositions which they hit upon be true — for although these suppositions save the appearances, we are nevertheless not obliged to say that these suppositions are true, because perhaps there is some other way men have not yet grasped by which the things which appear as to the stars are saved…. On these questions, I say, it is well that we should seek to increase our understanding, though we have but little to go upon, and are placed at so great a distance from the facts in question. (*De Caelo* II.17/12)

In these passages, Aquinas is shown to have a firm understanding of the inconsistencies inherent in the geocentric model of the solar system passed down by the Greeks. When first considering the influences of the Roman Inquisition-era Catholic clergy that would compel them so swiftly to accuse Galileo of heresy, Aquinas emerges as one of the main suspects. This was particularly because of his great interest in the ancient Greek metaphysics and his love of Aristotle, the ancient philosopher who created his own version of early geocentric models to demonstrate the circular and eternal nature of the heavens. These concepts of circular perfection, eternity, and the grand design of the heavens are frequently found in Aquinas' writings, and he even uses Aristotle's cosmological theories in his own arguments for the existence of the Christian God. However, the two passages provided above should begin to persuade us that the geocentric theory was simply to him the best explanation of his time. His exhortation for us to increase our understanding of our solar system combined with his entire corpus of work on the relationship between faith and reason should be enough to convince us that no one who sincerely applies Thomistic principles to their role in the Church would have been so quick to criticize and condemn the findings of Copernicus and Galileo.

As mentioned earlier, the geocentric model as promoted by Aristotle does not afford humanity the privileged place in the cosmos which is often associated with the biblical creation and salvation stories. The Aristotelian model and cosmology well preceded Christian beliefs, and its placement of earth at the center of the universe matched up with a more literal interpretation of the biblical account quite well. In Genesis the sun was created after the earth and the focus is primarily on the earth and mankind. It makes sense that any theory putting the sun the center of the solar system would call into question assumptions long held by the Church.[24] However, the

[24] Bergman 2015:202

immovable quality of the earth in Aristotle's model of the solar system does not signify some higher or divine privilege but is indicative of quite the opposite. The circular, eternal, and 'perfect' motion of the planets and the sphere of stars is meaningful to the ancient Greeks as showing the 'divinity' of the heavenly objects in contrast with the straight and finite motion that is universally terrestrial and human.

It is not clear whether this interpretation was recognized by the Catholic authorities of Galileo's day, and so it is still possible that the Church's reaction to the heliocentric theory was truly rooted in fear of an impending identity crisis following the fall of the ancient Greek model. Nevertheless, even if the Church was worried about where humanity would fit in the positional hierarchy of the universe, this concern does not seem to be enough on its own to justify Galileo's Inquisition before at least investigating his claims on a scientific basis. If it turned out Galileo was right, then the Church would have to grapple with this issue no matter what. If he was truly wrong, why should the Church be more concerned with keeping him quiet on the topic than disproving the ideas that they wanted to prevent from spreading.

Aristotelian ideals retained in the framework of Christian theology certainly may have been an unspoken factor in the Church's inquisition of Galileo, but the issue of scriptural evidence for a stationary earth is referenced directly in the writings of Cardinal Bellarmine, a central figure in the first trial of Galileo.[25] Examples of such passages can be found in the Psalms, which reads "You set the earth on its foundations, so that it shall never be shaken."[26] Another widely referenced passage from both Catholic and Protestant opponents comes from Joshua in the context of a battle between the Israelites and the Amorites: "On the day when the

[25] Redondi 1987: 39.
[26] Ps. 104:5 NRSVCE.

Lord gave the Amorites over to the Israelites, Joshua spoke to the Lord; and he said in the sight of Israel, 'Sun, stand still at Gibeon, and Moon, in the valley of Aijalon.' And the sun stood still, and the moon stopped, until the nation took vengeance on their enemies."[27] Before the Church took action against the Heliocentric theory, the works of Galileo and Copernicus had attracted the attention of a Carmelite named Father Foscarini. He attempted to reconcile the Copernican model with these biblical passages that were otherwise interpreted as evidence for a stationary earth and synthesize a mathematically sensible and theologically acceptable conclusion.[28] In a letter to Father Foscarini, Cardinal Bellarmine outlines his views on how the budding scientific theory should and should not be applied by faithful Catholics:

> First. I say that it seems to me that Your Reverence and Galileo did prudently to content yourself with speaking hypothetically, and not absolutely, as I have always believed that Copernicus spoke. For to say that, assuming the earth moves and the sun stands still, all the appearances are saved better than with eccentrics and epicycles, is to speak well; there is no danger in this, and it is sufficient for mathematicians. But to want to affirm that the sun really is fixed in the center of the heavens and only revolves around itself without traveling from east to west, and that the earth is situated in the third sphere and revolves with great speed around the sun, is a very dangerous thing, not only by irritating all the philosophers and scholastic theologians, but also by injuring our holy faith and rendering the Holy Scriptures false.[29]

There are several important points to consider here, the first being the way that the Cardinal thinks Copernicus' theory ought to be applied. When he speaks of "saving appearances", he seems to mean that a heliocentric model can certainly be used as a hypothetical model if it helps simplify the mathematics of predicting heavenly motion, but that taking it as a real and physical fact of the motion or position of the earth is philosophically and scripturally problematic. A literal belief in a moving earth for Cardinal Bellarmine is not primarily faulty because of the

[27] Jsh. 10:12-13 NRSVCE.
[28] McMullin, Ernan 2005: 262.
[29] Blackwell, Bellarmine, and Foscarini 1991:265.

scripture passages suggesting otherwise, but more because of the interpretation already provided by the Church Fathers on these examples:

> Second. I say that, as you know, the Council prohibits expounding the Scriptures contrary to the common agreement of the holy Fathers. And if Your Reverence would read not only the Fathers but also the commentaries of modern writers on Genesis, Psalms, Ecclesiastes and Josue, you would find that all agree in explaining literally that the sun is in the heavens and moves swiftly around the earth, and that the earth is far from the heavens and stands immobile in the center of the universe. Now consider whether in all prudence the Church could encourage giving to Scripture a sense contrary to the holy Fathers and all the Latin and Greek commentators.[30]

It is important to note the distinction he is making between a strict literal reading of the Bible and the decisions of the Church Fathers about which passages are meant to be interpreted in such a sense. Bellarmine seems to imply that he would not have a problem with the metaphorical reading of many passages that Fr. Foscarini is using to reconcile the Bible with a Copernican solar system if it were not for the authoritative nature of the early saints' own writings and interpretations.

[30] Ibid: 266.

IV. Galileo's Trial: Persistence or Atomic Theory?

When we turn to the 1600s and investigate the attitudes of the Catholic Church to identify the influences that pushed it to criticize Galileo, an important movement that comes to mind that might contain sources of motivation for his prosecution. Galileo's scientific achievements and corresponding scrutiny come in the later years of the Protestant Reformation, which seems to have provided unique challenges to the Heliocentric principle. The distinction noted above concerning Catholic and Protestant interpretations of scripture is necessary when looking into the ways that the ongoing Reformation may have influenced the way that Galileo's claims appeared as threats to Church doctrine and tradition.[31] One of the common themes among Protestant denominations has been the principle of *Sola Scriptura,* which is the belief that the Bible is perfect, complete, and the only necessary authority for Christian teaching.[32] This sometimes leads to a rejection of other human sources of various Christian traditions and dogmas in favor of an extremely straightforward acceptance of the literal biblical account. This idea is specific to Protestantism, which is why I initially found the Inquisitor's focus on biblical passages to be curiously out of character for the clergymen of the Catholic Church. Throughout most of history, Catholics have been much less opposed to metaphorical and allegorical readings of the Bible removed from the simple text when handed down from theological authorities such as Church Doctors, Fathers, and venerated Saints.[33]

This context of the Protestant Reformation can help clarify the distinction made in the Church's criticism of Galileo. It would make sense for Catholic clergy to focus on the contradiction of established theological sources such as St. Basil, who summarily confirms his

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[31] Prasad 2018: 17.
[32] Ibid: 20.
[33] Ibid: 21.

position on the Geocentric system saying, “It is not, they go on, without reason or by chance that the earth occupies the centre of the universe. It is its natural and necessary position… Do not then be surprised that the world never falls: it occupies the centre of the universe, its natural place…If there is anything in this system which might appear probable to you, keep your admiration for the source of such perfect order, for the wisdom of God.”[34] The emphasis on these kinds of sources of Christian doctrine did not arise in Catholicism during the Reformation and had been the norm long before Martin Luther’s revolution, and one of the factors that was a product of the Reformation was the Church’s fragility and defensiveness about all of its traditions that were under attack from the newly separated protestant denominations.

Many people are aware that Nicolaus Copernicus was one of the first and most well-known proponents of a Heliocentric theory that bears his name today as the Copernican Model, and that his book *De Revolutionibus Orbium Coelestium* was placed on the Catholic index of prohibited books. However, it is less well known that this denunciation of Copernicus’ ideas and his expansive treatise on the subject came in 1616, after the first trial of Galileo for teaching these ideas.[35] Even though there was not a widespread movement against the new Copernican theory, we can find at least one voice of disapproval in the writings of Giovanni Tolosani, a Dominican astronomer who wasted no time in publishing an extensive critique of Copernicus’ book just two years after its publication in 1545. Tolosani took issue with the new heliocentric model because according to him it failed to account for heavenly motion any more accurately than the Aristotelian model and was only supported by evidence that Copernicus gathered after

[34] Basil.
[35] Redondi 1987: 38.

formulating his 'absurd' cosmology.[36] Although there is certainly evidence for at least one Catholic voice of disapproval, there are few others in the Church who immediately took issue with these principles, and *De Revolutionibus Orbium Coelestium* continued to be taught at least as theory in prominent Catholic universities until the time of Galileo.[37] The tide seems to have shifted at least in part due to the overwhelming number of Protestant authors criticizing both the theory itself and anyone who did not find it problematic. In fact, when Copernicus' book was first published in 1543, it was dedicated to Pope Paul III and was met with genuine interest by the clergy well before its printing at a presentation of the theory to many high-ranking members of the Church at Rome in 1533.[38] A letter from Cardinal von Schonberg to Copernicus in 1536 demonstrates the regard that clergy members had for him when he writes:

> Some years ago word reached me concerning your proficiency, of which everybody constantly spoke. At that time I began to have a very high regard for you, and also to congratulate our contemporaries among whom you enjoyed such great prestige. For I had learned that you had not merely mastered the discoveries of the ancient astronomers uncommonly well but had also formulated a new cosmology. In it you maintain that the earth moves; that the sun occupies the lowest, and thus the central, place in the universe; that the eighth heaven remain perpetually motionless and fixed; and that, together with the elements included in its sphere, the moon, situated between the heavens of Mars and Venus, revolves around the sun in the period of a year. I have also learned that you have written an exposition of this whole system of astronomy, and have computed the planetary motions and set them down in tables, to the greatest admiration of all. Therefore with the utmost earnestness I entreat you, most learned sir, unless I inconvenience you, to communicate this discovery of yours to scholars, and at the earliest possible moment to send me your writings on the sphere of the universe together with the tables and whatever else you have that is relevant to this subject. Moreover, I have instructed Theodoric of Reden to have everything copied in your quarters at my expense and dispatched to me. If you gratify my desire in this matter, you will see that you are

[36] Westman 2011: 195-197.

[37] Singham, 51
[38] Scotti, 154

> dealing with a man who is zealous for your reputation and eager to do justice to so fine a talent. Farewell.[39]

The contents of the letter show the genuine excitement felt at Copernicus' new discoveries and the last sentence especially shows that Cardinal von Schonberg isn't reading these works to find inconsistencies with Catholic dogma and rather gives Copernicus the benefit of the doubt and is genuinely invested in his work.

At first, Copernicus' ideas were not more mathematically perfect than the Aristotelian model due to the fact that Copernicus uses circular orbits for his model, rather than the elliptical orbits we see in modern versions. In spite of this, it seems to have been well received by the Catholic Church at first as shown by the above examples. The question then is what would have changed the Church's position on the matter over the 73 years between the publishing of *De Revolutionibus Orbium Coelestium* and its placement on the *Index Librorum Prohibitorum* in 1616. An investigation into the agents of this change in attitude produces the writings of several prominent Protestant Reformers who display unequivocal condemnation of Copernicus' heliocentric theory, and who support their disapproval primarily by way of scripture passages.[40]

Some of these voices include John Calvin in his *Commentary on Genesis* and *Commentary on Psalms 91*, where he uses biblical passage as absolute and literal truth to argue against an orbiting earth.[41] Martin Luther himself is said to have offered his own opinion on Copernicus at dinner with his friend Anthony Lauterbach, who recorded Luther as saying "So it goes now. Whoever wants to be clever must agree with nothing that others esteem. He must do something of his own. This is what that fellow does who wishes to turn the whole of astronomy

[39] Schönberg.

[40] Westman 2011: 109-110.
[41] Kobe 1998: 193.

upside down. Even in these things that are thrown into disorder I believe the Holy Scriptures, for Joshua commanded the sun to stand still and not the earth'."[42] Martin Luther's friend Phillip Melanchthon was also a vocal critic of Copernicus who went so far as to call for state governments to intervene and suppress his books and the teaching of heliocentric theories. In his three part response to *De Revolutionibus Orbium Coelestium*, Melanchthon cites a myriad of biblical passages and states: "Encouraged by this divine evidence, let us cherish the truth and let us not permit ourselves to be alienated from it by the tricks of those who deem it an intellectual honor to introduce confusion into the arts."[43] He firmly believed that Copernicus' extreme ideas were designed to gain attention and appear learned to his contemporaries, and he was certainly not alone. During the period between Copernicus' death and Galileo's trial, so many Protestant figures came forward against heliocentrism that some scholars attribute the Church's swift realignment preceding Galileo's 1616 trial largely to these outside influences.[44]

It is telling that most Catholic opposition comes so many years after the publishing of the Copernican theory and after this mounting opposition from influential Protestant figures. Their cry of heresy on a scriptural basis seems to be responsible for the use of scripture passages by Catholic opponents in defense of a geocentric viewpoint. It is also likely that the intensity of Protestant opposition to these theories and other Catholic teachings in general may have influenced members of the clergy to act more swiftly and severely than usual to condemn what they perceived to be dangers to Catholicism's reputation or its core beliefs.

Some beliefs that may have been threatened by Galileo include the privileged place of the earth as well as the scriptural authority of many revered Fathers and Doctors of the Church.

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[42] Kobe 1998: 192
[43] Ibid: 194.
[44] Singham, 52

According to Pietro Redondi though, the more important doctrine at risk was transubstantiation, one of the seven sacraments which formed the foundation of Catholic life and religious practices. The challenge is found in Galileo's book *The Assayer*, published in 1622, in which he attempts to explain the composition of light and matter. He recalls days of the eminent Greek thinkers Hero and Democritus when he gives an account of the way physical material as well as light can be broken down into infinitesimal pieces, attributes light to energetic and "fiery" particles and heat to the process of these particles piercing the skin in either pleasant or painful ways[45]. One particular section is noted for containing atomic ideas as well as dealing with the sensation of taste in a way that could certainly be problematic for the doctrine of the Eucharist.

> Perhaps the origin of the other two senses lies in the fact that there are bodies which constantly dissolve into minute particles, some of which are heavier than air and descend, while others are lighter than air and rise up. The former may strike upon a certain part of our bodies that is much more sensitive than the skin, which does not feel the invasion of such subtle matter. This is the upper surface of the tongue; here the tiny particles are received, and mixing with and penetrating its moisture, they give rise to tastes, which are sweet or unsavory according to the various shapes, numbers, and speeds of the particles. (*The Assayer*, *275-276)*

The correlation between these ideas of atomic theory and Gaileo's 1633 trial is presented in the form of a newly discovered anonymous document labeled "G3", which was sent to the Vatican and heavily criticizes *The Assayer* on the basis of incompatibility of Galileo's theories of matter and the doctrine of transubstantiation. Redondi hypothesizes that this document may have been

[45] Redondi 1987: 14

written by a rival of Galileo, a father Horatio Grassi, whose scientific theories about comets were torn apart in Galileo's book.[46] It is said the two scientists had an intense rivalry publishing papers back and rebuttals, but after Galileo's stinging and satirical invective in *The Assayer*, Grassi took a different route and framed his rebuttal as having extremely grave philosophical and theological implications.[47]

In any case, this letter makes plain the claim that transubstantiation would be disproven by such an atomic model of matter because of the doctrine's dependence on the duality of the Eucharist. Transubstantiation is the belief that as a priest consecrates the bread and wine of communion at Catholic mass, those materials are transformed in substance to the body of Jesus Christ while maintaining the "accidentals" or appearances of bread and wine. The anonymous author of this "G3" Vatican document document claims that that only the Aristotelian duality of matter and form can accurately explain the transformation of matter in the eucharist, and that this concept belongs to a school of philosophy that Galileo is attacking on multiple fronts. It is important to note that at the time this letter was written, *The Assayer* had already cleared the Vatican censors for publication. It is likely that someone in the Church was upset by the content of *The Assayer* who felt Galileo was threatening a teaching integral to the identity of the Catholic Church in the tumultuous period of the Reformation, even though the book had already been examined and nothing objectionable found. This leaves open the possibility that Galileo was not sentenced to lifetime imprisonment for his Copernican views, but instead his theories of matter that undermined a theologically essential topic. Redondi argues that the evidence seems to point to such a cover up, and that the reason for such concealment was multifaceted. In part, setting up

[46] Redondi 1987: 49.
[47] Redondi 1987: 191.

a trial on the grounds of Heliocentric beliefs was designed to keep accusations of Galileo's atomism out of the public eye. This prevented claims of doctrinal instability from being picked up and used against the Church by Protestants who thoroughly rejected transubstantiation.[48] Doing so also served to "save appearances" for the Catholic Church, which would have seemed fickle to submit Galileo to an inquisition for the contents of a book that had already been approved by Church officials.

Redondi suggests that after Galileo's friend Pope Urban VIII ascended to the papacy and received the denouncement of *The Assayer* as outlined above, he set up a trial for Galileo based on his infringement of the 1616 edict prohibiting Galileo from teaching or holding Copernican views, an edict that suspiciously remained without signature and one whose receipt Galileo himself denied.[49] The idea behind this theory is that Urban VIII was doing his old friend a favor by having him tried and placed under house arrest, a move which may have spared him his life, since being found guilty of heresy against the doctrine of transubstantiation would have surely resulted in more severe penalties than the ones Galileo actually received.[50]

It appears all the other options facing the Church after these accusations against *The Assayer* presented the potential for adverse effects. If the Pope commissioned an inquisition on these grounds, he would have introduced the possibility of condemning a work already certified to be free of Catholic objections, along with that of capital punishment for his old friend and papal scientist Galileo on charges of heresy.[51] On the other hand, if the Church ignored the anonymous letter and rumblings about Galileo's controversial book, it would have run the risk of

[48] Redondi 1987: 113.
[49] Ibid: 87.
[50] Ibid: 197-198.
[51] Ibid: 258.

others escalating these issues into a catastrophe for Catholics and Protestants alike who would be questioning the Church's decision to clear *The Assayer* for publication.[52] Galileo's book *Dialogue Concerning Two Chief World Systems* seemed to have been poorly received in many circles. This meant that less attention would have been drawn to an investigation of its mocking tone and Heliocentric position, as many people in Catholic and Protestant communities already took issue with it. Pope Urban VIII was already facing criticism from Cardinals in Spain who accused him of being far too tolerant of heretics, and needed to distance himself from anyone subject to so much criticism.[53] Despite having personally advocated for Galileo's authorship of the *Dialogue,* it seems possible that it was expedient for the pope to send a committee to investigate this latter work rather than allow issues in the Assayer to become publicly opposed. An investigation and judgement on Galileo's *Dialogue* would have the dual purpose of appeasing Galileo's anonymous detractor and increasing Jesuit opposition as well as eliminating the pope's risk of an association with an accused heretic if Galileo's atomic theories should be brought to light.[54]

This proposed timeline is certainly very interesting and has merit in its ability to incorporate many details of the trial into Redondi's theory. It also includes recently discovered documents supporting the idea which Redondi himself first discovered, but there are scholars who sincerely disagree with this interpretation. Among them is Stillman Drake, an expert and accomplished writer on Galileo's scientific achievements and trial, who dismisses the entire theory in the space of a footnote, saying: "[T]he book *Galileo: Heretic* by Pietro Redondi [is] designed to show that not Copernicanism, but atomism, was the basis of Galileo's trial and

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[52] Redondi 1987: 152.
[53] Ibid: 229.
[54] Ibid: 229,244

condemnation. A single undated and unsigned document addressed to an unnamed theologian is treated as exposing the scores of signed and dated records and letters as evidentially worthless."[55] Stillman mentions Redondi and his theory while discussing two books by Galileo, *The Assayer* and *Discourse on the Comets.* Both of these books were part of Galileo's ongoing feud with Horatio Grassi, who prompts Stillman's mention of Redondi's theory that Grassi is featured in.

Another more expansive review comes from Richard Westfall, who offers high praise for Redondi's writing style and level of detail that allows the reader to better understand the nuances of 17th century religion and politics.[56] He is skeptical of the theory of hidden motivation due to three deficiencies in its explanation. The first objection is that Redondi paints the Jesuits too emphatically as strong traditionalists opposed to scientific advancements in his assessment of their backing Grassi in his dispute with Galileo.[57] I think he makes a fair point here, as *Galileo Heretic* provides little evidence for Grassi's exceptional ability to convince the majority of his order to join him in his debate.

An additional issue that Westfall proposes is the lack of evidence that Galileo truly believed in an atomic theory of matter, and he claims that there is minimal evidence in his primary works to support a claim that is so important to the core of Redondi's argument.[58] It is true that atomism is not what Galileo is best known for, but we know that he promotes the division of matter into infinitesimal pieces in *The Assayer* while theorizing about the sensation of touch, when he says "Perhaps the origin of two other senses lies in the fact that there are bodies

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[55] Stillman: 179
[56] Westfall: 399
[57] Ibid: 400-401
[58] Ibid: 405

which constantly dissolve into minute particles…"[59] and later in the same work tries to explain heat as invisible flaming particles penetrating the skin. Additionally, we can recall the aforementioned passage from *The Assayer* where Galileo attempts to explain differences in the way things taste as the differences between the particles that comprise these foods. Galileo also makes an attempt to describe how heat might be composed of infinitesimal particles of fire in his *Discourse on Floating Bodies.*[60] Westfall may be correct to a certain degree when he says that the passages supporting Galileo's status as an atomist are limited, but I still think that the ones mentioned just now are enough to make Redondi's theory believable.[61] Although the textual evidence is somewhat slim, it does not deny the fact that someone was concerned enough with these examples of atomism in *The Assayer* to write to the Vatican with a warning against these views. Whether this was simply an attempt by Horatio Grassi to discredit his rival is not clear, but I feel that these 3 or 4 passages are enough to at least entertain the theory of atomism as a contributing factor to Galileo's trial.

The last comment that Westfall makes is that for all the hypothesizing Redondi engages in when attributing the "G3" anonymous document to Grassi, it would be best to support his case if the author was not Grassi at all.[62] As noted above, the more people that considered Galileo to be both an atomist and dangerous to core doctrine, the more plausible Redondi's theory of the Church's need to "save the appearances" becomes. Although there is certainly room for critique of this account of Galileo's trial, there is no doubt in my mind that readers of Redondi's work

[59] Galilei, and Drake 275-276.
[60] Redondi 1987: 14
[61] Westfall, 405
[62] Westfall, 411

will gain a better understanding of all the factors and political motivations that may have influenced the Church's second inquisition of Galileo.

I believe that Peter Burke, a history processor at Emmanuel College, expresses similar opinion in his review of *Galileo Heretic.*

> *Galileo: Heretic* is certainly a highly sophisticated piece of narrative, moving with ease between the events of the Galileo affair and the story of Redondi's own detective work, his quest. It is also a good deal more than that. Even if its conclusions were to be rejected, the book would retain much of its value as history for its account of the Roman intellectual world in the first half of the 17th century and for the method which underlies this account.[63]

In another passage from Burke's review, he describes Redondi's book as overly dramatic, but does not deny the possibility that Galileo was tried for reasons beyond those stated by the Catholic Church.[64] I do not believe that Redondi has conclusively proven that atomism was the hidden reason that Pope Urban VIII ordered Galileo's inquisition, since there is no good way to validate his interpretation of the events. Even though his work will likely remain just a theory, I am convinced that there was more to the Galileo affair than the Church's rejection of the Heliocentric theory due to of Aristotelian ties and scriptural references. I believe that there are factors such as Protestant pressure and Catholic politics that ought to be considered as part of Galileo's story, and I think the evidence Redondi provides is legitimate. Redondi claims that Galileo's inquisition was declared to be on grounds of heliocentrism in order keep the atomism in *The Assayer* and its incompatibility with transubstantiation out of public view where it could be used against the pope or the Catholic Church. The "G3" document in the context of Galileo's rivalry with Grassi, the atomist contents of the Assayer, and the difficult position of Pope Urban

[63] Burke 1988: 2-3
[64] Burke 1988: 4

VIII are all together enough for me to consider this theory well within the realm of historical plausibility.

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