An early theological application of Galileo's "doctrine" of motion: Insights from Benedetto Castelli's first letter to Galileo (April 1, 1607)

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Abstract
In 1607, Benedetto Castelli sent a letter to Galileo Galilei from Cava de' Tirreni. This correspondence provides valuable insights into Castelli's mathematical training and is significant for two main reasons. First, it demonstrates that by 1607, Galileo had already articulated key principles of his scientific work, such as the relativity of motion and a concept resembling inertia. Thus, the letter serves as an important source on Galileo's advanced thinking prior to the publication of *Sidereus Nuncius* (1610). Second, it explores the relationship between Galileo's ideas on motion, the eternity of the world, and the existence of God. Castelli refutes Aristotelian errors and underscores the limitations of Galilean science regarding theological matters, aiming to prevent conflicts between scientific inquiry and religious truths. This letter thus highlights the early debates sparked by Galileo's new "doctrine" of motion, occurring before any of his major findings were published.

Keywords
Galileo Galilei, Benedetto Castelli, Jacopo Zabarella, motion, eternity, creation, existence of God

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1. Introduction

When asked "Does the eternity of motion make God unnecessary?", a historian of philosophy would likely respond with a spontaneous and firm "No, it doesn't". To arrive at this answer, it suffices to consider Aristotle's argument for the necessity of an unmoved mover that has always and will always set the entire universe in motion. This argument also reappears in Thomas Aquinas's first way *ex motu*, which indirectly suggests that the eternity of motion, and thus of the universe, does not necessarily contradict the existence of a God who creates all things *ex nihilo*. Throughout history, many examples like these can be found. They are generally referred to as 'cosmological proofs'; that is, arguments developed to demonstrate that certain features of the universe (such as motion) are logically tied to the existence of God.[1]

Being aware of all this, it becomes quite challenging to interpret the words that Benedetto Castelli wrote to Galileo in a letter from 1607:

> if it were true that motion is eternal, I could become atheistic and say that we don't need God. What a wicked blasphemy![2]

Castelli seems to answer the initial question in the affirmative, as it appears that, for him, the eternity of motion does indeed make God unnecessary. But why does he place the eternity of motion in contradiction with the existence of God? Is it possible that a Benedictine like him was unaware of the well-known arguments developed by Aristotle and Aquinas? Moreover, why would he express all of this specifically to his mathematical mentor, Galileo?

As I will attempt to show, Castelli's words do not suggest that the eternity of motion is incompatible with the existence of God. His polemical target was not the concept of eternal motion as being contrary to revealed truth. Instead, he was criticizing the efforts of those who sought to use Galileo's science to prove the existence of God.

Castelli's 1607 letter, then, conveys a cautionary message aimed at preventing a theological shift in Galileo's science. At the same time, it offers important evidence that, some years before the exegetical dispute leading to the so-called *Copernican Letters* (1613-1615), there had been an attempt to apply Galileo's new natural philosophy to theological issues, such as the creation of the world and the existence of God. Particularly notable is Castelli's cautious stance, where he clearly delineates the limits of Galilean science.

[1] For insights on cosmological proofs, see the classic study by Craig, *The Cosmological Argument from Plato to Leibniz*. In particular, pages 20-47 for his discussion on Aristotle and 158-175 for an examination of Thomas's first way.

[2] "[…] se fusse vero che il moto fosse eterno, io potrei doventar ateista e dire che di Dio non havemo bisogno, bestemia scelerata" (OG, X, 170). The English translation of certain sections of this letter is drawn from the version found in Redondi, "From Galileo to Augustine", 180-182.

While other scholars have examined this letter, I believe it has not been fully understood.[3] It is a brief yet dense text, rich with content and implicit references to vexed questions on the eternity of motion, often discussed in relation to Book VIII of Aristotle's *Physics*. To fully grasp its significance, it will be necessary to contextualize it using commentaries and textbooks that were circulating during Castelli's time. The goal here is not to trace Castelli's direct sources but to examine the background sources that illuminate some standard arguments shaping the cultural framework within which both Castelli and Galileo operated. Due to textual similarities with Castelli's exposition, I have prioritized quotations from Jacopo Zabarella's commentary on the *Physics*.

First, however, it seems fitting to begin by sketching a profile of the letter's recipient, Galileo in 1607. Following that, I will consider and analyze the letter in nearly its entirety, excluding the final lines where Castelli invites Galileo to address his reply to Ermagora Basadelli, as these require a separate study to explore Basadelli's role in the early correspondence between Castelli and Galileo.[4]

2. Galileo in 1607

In 1607, Galileo was a professor of mathematics at the University of Padua. Fifteen years earlier, he had moved from the Grand Duchy of Tuscany to the Republic of Venice, after spending three years – between the winter of 1589 and the fall of 1592 – teaching mathematics at the University of Pisa. At this point, Galileo was 43 years old and had spent nearly half his life teaching mathematics.[5]

At the time, he had published only two books under his own name, both concerning a measuring instrument known as the geometric compass. The first book, *The Operations of the Geometric and Military Compass* (*Operazioni del compasso geometrico militare*, 1606), was a manual on how to use a multifunctional compass Galileo had invented to simplify a wide range of measurements and calculations, particularly for military applications. With the help of Marcantonio Mazzoleni, Galileo began manufacturing and selling these com-

[3] The theses of Bucciantini and Redondi will be addressed *infra*, in Section 3.2.

[4] OG, X, 171: "Horsù: mi manca la carta; se V.S. si degnerà di scrivermi, potrà indirizzare la lettera in Roma a D. Hermagora da Padoa in Monte Cavallo, che l'haverò sicure". Another letter from Castelli, written in Cava in October 1607, was sent to Basadelli and also partially addressed to Galileo. For details, see OG, X, 183-184, and the complete version in Castelli, *Carteggio*, 35-37.

[5] For details on Galileo's move from Pisa to Padua, see Favaro, *Galileo Galilei e lo Studio di Padova*, I, 25-50, and Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 78-82. Galileo began teaching mathematics at a very young age. Documents show that in 1588 he taught mathematics to the Benedictine Epifanio Parini (born Sebastiano) at the Abbey of Passignano, near Florence. See OGA, IV, 23.

passes.[6] He likely hoped that the sales would help cover his increasing living expenses, which his modest professor's salary struggled to meet.[7] Moreover, he probably believed the compass could strengthen his connections with the Grand Duchy of Tuscany. In fact, he dedicated the book to Prince Cosimo de' Medici, hoping to win the favor of Cosimo's father, Grand Duke Ferdinand I de' Medici, and hasten his return to Tuscany.[8] Unfortunately, the compass did not generate the profits he had hoped for, and the book, instead of facilitating his return, brought him trouble. Galileo's work was plagiarized, which forced him to write – probably around June 1607 – a second book defending himself against the false accusations of Baldassarre Capra (*Difesa contro alle calunnie ed imposture di Baldessar Capra*, 1607).[9]

Though Galileo had only published two books on a measuring instrument by 1607, he was far more than just an ingenious inventor or unlucky "entrepreneur", as one might put it. His work on the geometric compass was merely the tip of a vast iceberg. Since his time as a professor in Pisa, Galileo had developed a deep interest in several philosophical topics, particularly problems related to motion, which he discussed with colleagues, students, and friends. By 1607, he had written many works that he either preferred to publish under pseudonyms or chose to keep private in his drawer.

If one could peer into that drawer, they would find, alongside his youthful work on the hydrostatic balance (*La bilancetta*)[10] and notes on Aristotelian natural philosophy and

6 See OG, II, 363-424. For Stillman Drake's English translation, see Galilei, *Operations of the Geometric and Military Compass*. For further information on Galileo's compass, see Favaro, *Galileo Galilei e lo Studio di Padova*, I, 165-192; Drake, "*Tartaglia's Squadra and Galileo's Compasso*"; Valleriani, *Galileo Engineer*, 27-41.

7 For an in-depth look at Galileo's financial situation in Padua, consult Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 110-113.

8 As is well known, Mario Biagioli regarded the compass and the telescope as crucial instruments of credit; see Biagioli, *Galileo's Instruments of Credit*, 1-19. Although Galileo officially returned to Tuscany in 1610, he often spent his summers in Florence prior to that. In 1605, he was invited by Grand Duchess Christina of Lorraine to spend his summers at the Villa Pratolino (cf. OG, X, 156), where he introduced Prince Cosimo to mathematics and taught him how to use the geometric and military compass. See Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 115.

9 See OG, II, 513-599. Camerota notes that Galileo's defence against Baldassarre Capra was published in August, just before he sent a copy to Prince Cosimo (cf. Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 129; OG, X, 177-178). One may add that internal evidence suggests Galileo wrote the defence in June. In the preface (*A i lettori*), he states that Capra translated the *Operations of the Geometric and Military Compass* into Latin "ed alcune cose frivolissime aggiungendovi, lo ristampa *tre mesi sono*" (OG, II, 533, emphasis added). A few pages later, Galileo notes that Capra's plagiarism was published "li 7 marzo del 1607" (*ibid*., 539).

10 See OG, I, 215-228. For a recent study on this early work by Galileo, see Mottana, *Galileo e la bilancetta*.

logic (MSS Gal 46 and 27),[11] a variety of writings: two lectures on the size and depth of Dante's *Inferno*, delivered at the Academy of Florence between 1587 and 1588 (*Due lezioni all'Accademia Fiorentina circa la figura, sito e grandezza dell'Inferno di Dante*);[12] possibly a commentary on Ptolemy's *Almagest* (never found, if it existed);[13] some early writings on motion (*De motu antiquiora*);[14] a compendium of Sacrobosco's *Sphere* (*Trattato della sfera ovvero cosmografia*);[15] two versions – one longer than the other – of a treatise on the workings of machines (*Le mecaniche*);[16] a treatise on the rudder (now lost);[17] two writings on military architecture (*Breve istruzione dell'architettura* and *Trattato di fortificazione*);[18] numerous drawings and theorems related to motion (MS Gal. 72);[19] and intriguing works and notes on solid geometry (*Theoremata circa centrum gravitatis solidorum* and *Postille ai libri De Sphaera et Cylindro di Archimede*).[20]

In the same drawer, one would also find fascinating material that Galileo likely felt too fearful to publish. Thanks to his correspondence with Jacopo Mazzoni and Johannes Kepler, we know that by 1597, Galileo had already "come to the opinion of Copernicus

[11] Favaro transcribed large portions of MS Gal. 46 in the National Edition (OG, I, 15-177) and partially transcribed MS Gal. 27 (OG, IX, 280-281, 291-292). William F. Edwards published the complete transcription of MS Gal. 27 in 1988 (see Galilei, *Tractatio De Praecognitionibus et Praecognitis and Tractatio De Demonstratione*). Mario O. Helbing recently edited another transcription in the Appendix to the National Edition (see OGA, III, 15-100). The composition dates of both manuscripts are debated but are generally believed to predate Galileo's move to Padua in 1592.

[12] See OG, IX, 29-57, and Galilei, *Due lezioni dell'Accademia Fiorentina circa la figura, sito e grandezza dell'Inferno di Dante*.

[13] Galileo himself refers to this commentary in his early treatise on local motion; see OG, I, 314.

[14] See OG, I, 251-419.

[15] See OG, II, 211-215. On this treatise, see Cardoso-de Andrade Martins, "*O* Trattato della Sfera …"; de Andrade Martins, "*Galileo Galilei, y la tradición del* Tractatus de sphaera"; Cardoso-de Andrade Martins, "*Galileo's* Trattato della sfera".

[16] See OG, II, 155-191. An English translation by Stillman Drake is included in Galilei, *On Motion and On Mechanics*, 147-186. For a critical edition, see Galilei, *Le mecaniche*.

[17] According to Camerota, letters written by Giovanni Ciampoli between 1624 and 1625 suggest that Galileo composed a "trattato sul timone" during his time in Padua. See Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 86; Ciampoli's letters in OG, XIII, 295, 246-247, 254. Additionally, Camerota highlights an interesting fragment in OG, VIII, 609. See also OG, X, (Galileo to Contarini, March 22, 1593), 55-57, and *ibid.*, (Contarini to Galileo, March 28, 1593), 57-60.

[18] See OG, II, 15-146. For information on Galileo's courses on fortifications, see Valleriani, *Galileo Engineer*, 71-89.

[19] This important manuscript can be viewed online, <https://teca.bncf.firenze.sbn.it/ImageViewer/servlet/ImageViewer?idr=BNCF0003760961#page/1/mode/2up> (last accessed October 15, 2024). For a recent study of the manuscript, see Büttner, *Swinging and Rolling*.

[20] See OG, I, 187-208 (*Theoremata*), 233-242 (*Postille*).

many years prior" (*in Copernici sententiam multis ab hinc annis venerim*).[21] In a letter to Kepler, Galileo mentions that by 1597, he had written numerous refutations of arguments against the Copernican system ("*multas conscripsi et rationes et argumentorum in contrarium eversiones*"), but he preferred to keep them hidden, fearing ridicule. In the same letter, he also asserts that heliocentrism allowed him to explain certain terrestrial phenomena that were otherwise inexplicable ("*ac tali positione multorum etiam naturalium effectuum caussae sint a me adinventae, quae dubio procul per communem hypothesim inexplicabiles sunt*").[22] Thus, it is possible that by 1607, Galileo had already formulated his first theory of tides, based on the Earth's double circular motion on its axes and around the Sun.[23]

Despite not yet being recognized as a philosopher, in 1607 Galileo was already more than just an esteemed professor of mathematics.[24] His interests were wide-ranging, and his research in natural philosophy had led to significant discoveries. A letter written in 1602 to Guidobaldo del Monte reveals that by the early 1600s, Galileo had already developed the concepts of isochronism and the law of chords.[25] At the same time, he shared with Paolo Sarpi a keen interest in the properties of magnets,[26] worked on the construction of a thermoscope,[27] and served as the 'print supervisor' (*censore sopra le stampe*) for the Accademia dei Ricovrati.[28] By 1604, he had also arrived at the correct law of free fall, although he still adhered to the mistaken belief that the velocity of a falling object was proportional

21 OG, X (Galileo to Kepler, August 4, 1597), 67-68. On this letter, see Bucciantini, *Galileo e Keplero*, 49-68. The letter to Mazzoni (May 30, 1597) is transcribed in OG, II, 197-202.

22 OG, X (Galileo to Kepler, August 4, 1597), 68.

23 See Drake, *Galileo Studies: Personality, Tradition, and Revolution*, 200-213; Drake, *Galileo at Work*, 36-38. While Drake linked this theory to Sarpi's 1595 observations, Camerota noted that Galileo may have been aware of a similar theory in Andrea Cesalpino's *Quaestiones peripateticae*, published in 1571 (see Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 98-99). Cesalpino was one of Galileo's teachers in Pisa.

24 In 1604, Vincenzo Gonzaga, Duke of Mantua, invited Galileo to become his court mathematician. Although Galileo was interested, he would have accepted the position if the pay had been higher. See Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 116; OG, X (Galileo to Vincenzo Gonzaga, May 22, 1604), 106-107.

25 See OG, X (Galileo to Guidobaldo del Monte, November 29, 1602), 97-100. On this letter, see Büttner, *Swinging and Rolling*, 61-73.

26 See OG, X (Sarpi to Galileo, September 2, 1602), 91-93; Favaro, *Galileo Galilei e lo Studio di Padova*, I, 237-243.

27 See *ibid*., 193-212; Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 130-132; Valleriani, *Galileo Engineer*, 158-172. Valleriani argues that a 1626 letter from Galileo to Marsili has never been cited as evidence that Galileo had already built and used the thermoscope by 1606 (see *ibid*., 160, n. 8). However, Camerota had already pointed this out (see Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 593, n. 231).

28 See OG, XIX, 207-208; Lazzarini, *Galileo, Padova e l'Accademia dei Ricovrati*.

to the distance it fell.[29] By 1607, however, he likely began to reject this principle, ultimately replacing it with the understanding that velocity is proportional to time.[30]

Additionally, from the fall of 1604 onwards, Galileo corresponded with figures like Ilario Altobelli and Leonardo Tedeschi, who kept him informed about a remarkable discovery: the observation of a new star in the supposedly incorruptible sky.[31] Shortly afterward, Galileo perhaps co-authored, or simply inspired, three works: The *Dialogue of Cecco di Ronchitti of Brugine concerning the New Star* (*Dialogo de Cecco di Ronchitti da Bruzene in perpuosito de la stella Nuova*, 1604);[32] Astolfo Arnerio Marchiano's *Discourse on the New Star* (*Discorso sopra la Stella Nuova comparsa l'Ottobre prossimo passato*, 1605);[33] and the *Considerations of Alimberto Mauri on Some Passages in the Discourse of Lodovico delle Colombe about the Star Which Appeared in 1604* (*Considerazioni d'Alimberto Mauri sopra alcuni luoghi del discorso di Lodovico delle Colombe intorno alla stella apparita* [nel] *1604*, 1606).[34] When it came to controversies in natural philosophy, Galileo seemed to prefer working under aliases.

Thus, Galileo was being quite truthful when, in 1597, he told Kepler about his fears of publicly opposing the Aristotelians.[35] This provides yet another clue that by 1607, Galileo's unpublished writings may have been even more substantial than we might imagine.

[29] See OG, X (Galileo to Sarpi, October 16, 1604), 115. For insights on the "spontaneity" of thinking in terms of space rather than time, see Koyré, *Etudes Galiléennes*.

[30] See Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma*, 144-148. Camerota presents compelling evidence that Galileo recognized and rectified his initial mistake between 1607 and 1609.

[31] See OG, X, 116-120, 122-133.

[32] See OG, II, 307-334. For an English translation by Drake, see Galilei, *Galileo against the Philosophers*. Favaro suggests that this work was written by Girolamo Spinelli with Galileo's assistance, although the extent of Galileo's contribution remains uncertain (see OG, II, 272; Favaro, "Galileo Galilei ed il «Dialogo de Cecco di Ronchitti da Bruzene in perpuosito de la stella nova»", 195-237). Recently, Matteo Cosci argued that Galileo is the only author of this dialogue (see Cosci, "Astronomia pavana nel *Dialogo de Cecco*").

[33] This work is not included in the National Edition of Galileo's works. Maria Laura Soppelsa hypothesized that Arnerio served as "portavoce o eventuale schermo mimetico dello stesso Galilei" (Soppelsa, *Genesi del metodo galileiano*, 27). She also noted interesting parallels between Arnerio's *Discorso* and Galileo's lessons on the *nova* (see *ibid*., 32, n. 19). Recently, Matteo Cosci proposed that Astolfo Arnerio Marchiano is merely a pseudonym for Galileo (see Cosci, "Galileo *alias* Astolfo Arnerio Marchiano").

[34] This work was also excluded from the National Edition by Favaro, likely because Galileo assured Ludovico delle Colombe that he was not the author of the *Considerations*. See OG, X (Lodovico delle Colombe to Galileo), 176-177. For the English translation by Drake, see Galilei, *Galileo against the Philosophers*, 73-130. Recently, Matteo Cosci has sought to prove that Galileo is the true and sole author (see Cosci, "Galileo *alias* Alimberto Mauri").

[35] In this sense, as Maurice Clavelin emphasized, Galileo's time in Padua was marked by a "silent Copernicanism" (see Clavelin, "Le copernicanisme Padouan de Galilée").

3. Castelli's first letter to Galileo

Benedetto Castelli's letter adds an intriguing dimension to this already multifaceted picture. Dated April 1, 1607, the letter states that, according to Galileo, "motion is nothing other than a change of one thing in relation to another" (*il moto non sia altro che una mutazione di una cosa in relazione a un'altra*) and that "a mover is necessary to start the motion, but the lack of obstacles is sufficient to continue it" (*a principiar il moto è ben necessario il movente, ma a continuarlo basta non aver contrasto*). This correspondence provides significant evidence that by 1607, Galileo had embraced the concept of the relativity of motion, along with an idea that closely parallels our modern understanding of inertia.[36]

Moreover, this letter also sheds light on an otherwise obscure period of Castelli's life.[37] In 1607, Castelli was in the Kingdom of Naples, residing at the Benedictine Abbey of La Trinità della Cava, near Salerno. He had moved there from the Abbey of Santa Giustina in Padua, where, between 1603 and 1604, he had met Galileo, who provided him and another Benedictine, Girolamo Spinelli, with private mathematics lectures.[38] It is likely that even before his encounter with Galileo, Castelli had received some foundational education in geometry, arithmetic, and perhaps astronomy. At the monastery of San Faustino in Brescia, Benedetto Castelli was probably introduced to these subjects, although his primary focus was theology.[39]

[36] See OG, X, 170. Galileo first introduces and publishes his inertial conception of motion in the *Letters on Sunspots* (1613) (see OG, V, 134, and the English translation in Galilei-Scheiner, *On Sunspots*, 125). Franco Giudice effectively highlights the continuity between Galileo's cosmological and mechanical reflections (see Giudice, "Galileo's Cosmological View", 60-63).

[37] On Castelli's life, see OG, XX, 412-413; Masetti Zannini, *La vita di Benedetto Castelli*; Drake, "Castelli, Benedetto"; Shore, "Castelli, Benedetto (Antonio)"; Ricciardo, "Introduzione". On Castelli's family, see Piccinali, "La famiglia di Benedetto Castelli".

[38] See Favaro, *Galileo Galilei e lo Studio di Padova*, I, 150. As for the histories of S. Giustina Abbey and Cava Abbey, they have been intertwined since 1492. In 1392, Pope Boniface IX elevated Cava to city status, making it a cathedral headed by a bishop. Subsequently, the Benedictine rules and customs began to decline. In 1482, Cardinal Oliviero Carafa was appointed to restore these traditions. The Abbey was given *in commendam* to him, who then entrusted it to diligent monks from S. Giustina in 1492. In 1497, Pope Alexander VI abolished the commandery, suppressed the bishopric, and sanctioned the perpetual union between Cava and S. Giustina (see Mattei Cerasoli, "La badia della SS. Trinità di Cava", 191-194). From 1504, when the Abbey of Monte Cassino joined the community of S. Giustina, the latter became known as the 'Community of Monte Cassino'. At the time Benedetto Castelli was assigned to the Trinity Abbey at Cava, it was still administered by the monks of S. Giustina.

[39] Luca Piccinali has conducted a significant study on Castelli's work in Brescia and Padua (see Piccinali, "La formazione scientifica di Benedetto Castelli", 49-121). He highlights that the Benedictines had access to various important texts in mathematics and astronomy but also notes that "la maggior parte dei testi fosse di carattere religioso, dai testi sacri ai Padri della Chiesa per arrivare sino a san Tommaso e ai testi di autori ecclesiastici cinquecenteschi. Questo per sotto-

The April 1607 letter is the earliest surviving evidence of the connection that Galileo and Castelli established in Padua. It appears that the two quickly developed a close friendship, as Castelli promised Galileo to keep him informed about his circumstances (*"stato mio"*) before leaving Padua. Indeed, the letter begins with Castelli apologizing for his inability to fulfill this promise immediately (*"debito mio"*), explaining that he had been delayed by certain "current troubles" (*correnti turbolentie*).[40] He then mentions that, at Cava, he is lecturing on Euclid, providing him with an opportunity to outline the progress he has made in his mathematical studies.

After leaving Padua, Castelli focused on Euclid's *Elements*, progressing from Book VII to the 40th proposition of Book X.[41] After encountering significant challenges with that proposition, he moved on to Book XI and continued seamlessly through Book XII, eventually tackling Book XIII to the very end of the *Elements*. Shortly after, he began studying Ptolemy's *Almagest*, though he struggled with the "first corollary" (*primo corollario*) of Chapter XII and sought "some enlightenment" (*qualche lume*) from Galileo on the matter.[42] Castelli also delved into the *Sphaerics* by Theodosius of Bithynia, as well as the first

lineare che almeno da quando Castelli aveva dieci anni (1588) la sua educazione gli fu sempre e solo impartita da ecclesiastici su libri per la maggior parte di argomento religioso" (*ibid*., 115). Furthermore, according to Massimo Bucciantini, the Abbey of S. Giustina "era considerato il centro culturale dell'ordine benedettino cassinese, in cui, tra l'altro, erano forti gli influssi della tradizione ne[o]platonica, e dove le discussioni sul ruolo e il grado di certezza delle matematiche si intrecciavano a quelle sui rapporti tra matematica e teologia, tra simbologia cristiana e figure e simboli geometrici" (Bucciantini, "Atomi geometria e teologia nella filosofia galileiana di Benedetto Castelli", 173).

40 "Per le correnti turbolentie son stato necessitato a mancar del debito mio, con non dar conto a V.S. del stato mio: hora, con l'occasione del nostro Capitolo Generale, prima li faccio profonda riverenza, dandoli aviso che il stato mio è assai megliore di quello a che io sto di continuo preparato; poi vivo al servitio di questo mio prelato [viz. Lorenzo Pacifico of Antwerp: see Mattei Cerasoli, "La badia della SS. Trinità di Cava", 214], che non manca di honorarmi [...]" (OG, X, 169).

41 "[...] leggo poi una lettione d'Euclide, del quale io già ho visto il 7o, 8o, 9o et sin alla quarantesima del Xo, et di lì, suffocato dalla moltitudine (per confessar il peccato mio) de' vocaboli, profondità delle cose e difficultà di demonstrationi, mi son trasferito al'XI, XII, e XIII, de' quali ho visto tutto quello che dalle viste propositioni dependeva. Dopoi ho datto l'assalto a Tolomeo, ma son restato intricato al primo corollario del capitolo duodecimo: se V.S. mi vole favorire con darmi qualche lume, infilzarò quest'obligo con gli altri. Ho datto di piglio alli Elementi Sferici di Theo[dosio], et insieme ho cavati gli piedi dalle sette prime propositioni di Archimede De iis que vehuntur in aqua: all'ottava, starò aspettando in luce il trattamento suo De centro gravitatis solidorum, il quale alla detta materia mi pare necessario" (*ibid*., 169-170).

42 It should be noted that in that part of the *Almagest*, Ptolemy does not mention any corollary. However, the term "correlarium primum" appears in one of Luca Gaurico's marginal notes in the ninth chapter of the first book of the 1528 Latin edition: "Correlarium primum: Data alicuius arcus chorda, nota fiet chorda arcus residui de semicirculo" (Ptolemy, *Almagestum seu Magnae Contructionis Mathematicae Opus*, 5r).

seven propositions of Archimedes' *On Floating Bodies*.[43] Concerning Proposition VIII, Castelli expressed a desire to wait until Galileo's treatise *On the Center of Gravity of Solid Bodies* was published, convinced of its importance to the subject.[44]

The first paragraph of the letter concludes with a curious remark about Castelli's efforts to introduce his pupils to Galileo's "rare virtues" (*rare virtù*).[45] By 1607, at Cava de' Tirreni, Castelli was already acting as a proponent of Galileo's ideas.

The letter also includes two other brief yet substantial paragraphs. In the first of these, Castelli states that Galileo's "definition of motion" (*definitione del moto*) led him to conclude that Aristotle's argument for the eternity of motion is unconvincing:

> In recent days, I had the occasion to express my thought regarding Aristotle's reasoning put forward to confirm the eternity of motion, which concludes that motion existed before the first motion of his opponent [*il primo moto del'avversario*]. This reflection was prompted by the definition of motion provided to me by Your Lordship – that is, motion is nothing but a change of one thing in relation to another. Therefore, I have decided to send a copy to Your Lordship so that, if any withdrawal or correction is needed, you may kindly inform me.[46]

In the paragraph that follows, which concludes the letter, Castelli elaborates on this point. To better understand the topics he addresses, the final paragraph of the letter will be divided into two parts, each analyzed separately: the first (3.1) concerning Aristotle's proof of the eternity of motion, and the second (3.2) addressing a new proof for the existence of God.

[43] In *On Floating Bodies*, the concepts of circumference and sphere are pivotal in Archimedes' demonstrations (see Archimedes, *De iis quae vehuntur in in aqua libri duo*, 1r-1v).

[44] Proposition VIII is presented without proof, which Commandino provides in his Latin edition (see *ibid.*, 6r-6v). Castelli argues that the proposition can be better understood in the context of Galileo's *Theoremata circa centrum gravitatis solidorum*, which he began at a young age and continued while in Padua (see OG, I, 181-185). Galileo ultimately chose not to publish this treatise after discovering that Luca Valerio had already provided a satisfactory solution for determining the center of solid bodies (see OG, VIII, 313). Given Castelli's belief that Galileo would eventually publish it, it seems likely that in 1607, he had not yet encountered Valerio's work, first published in 1604 and again in 1661, nineteen years after Galileo's death.

[45] "Gli miei discepoli adorano le rare virtù, et a' nostri secoli uniche, di V.S., delle quali spesso ne faccio quella che io posso mentione" (OG, X, 170).

[46] "Mi è poi occorso, a' giorni passati, sfogar un pensier mio circa la ragione d'Aristotele addotta per confirmar l'eternità del moto, la quale conclude esser stato il moto avanti il primo moto del'avversario; e perché a questo m'indusse la definitione del moto dattami da V.S., cioè che il moto non sia altro che una mutatione di una cosa in relatione a un'altra, ho fatto disegno, come si sia, mandarne copia a V.S., acciò, se ci è bisogno di annullatione o di correttione, si degni compiacermene" (*ibid.*).

3.1. On Aristotle's proof of the eternity of motion

Castelli refers to a specific passage from Aristotle's *Physics*, which, in the modern citation system based on August Immanuel Bekker's edition, corresponds to *Phys*. 251a16-20. In Castelli's time, references followed the division used by Averroes in his commentary on Aristotle's works.[47] The passage in question aligned with texts 5-6 of Book VIII of the *Physics*, which, in William of Moerbeke's *translatio nova*, reads as follows:

> Text 5. Therefore, it is necessary that [the moving things] either were made at some point, when they did not exist, or that they are eternal.[48]
> Text 6. If, then, each of the mobile or mover [things] was made, it is necessary that another change and motion occurred beforehand, by which that which is capable of being moved or of moving was made.[49]

The Jesuits of Coimbra, in their renowned commentary on the *Physics* (1592), offered the following paraphrase:

> [Aristotle] proves that there was no first motion, but that before any other motion, one already existed, and he argues as follows: If motion had a beginning in time, either the mover and the mobile [*movens et mobile*], to which this first motion would belong, would have started at some point, or they would have existed from eternity. If they started at some point, then it must have been through some motion; for this reason, the motion that was previously called the first would no longer be the first.[50]

In text 4 (*Phys*. 251a8-16), Aristotle had argued that motion is always associated with "things" (the term "*res*" is used in both the *nova* and the *vetus* to translate the Greek "πράγματα"). So, there can be no motion without things. At least two things are essential: the

[47] For the *Physics*, see the fourth volume of the Giunta edition: Aristotle, *De physico audito libri octo*. This work includes both the *translatio vetus* and the *nova*, which I will refer to later for convenience, but also because it was preferred by some commentators, including Zabarella.

[48] "Ergo et haec necessarium est aut facta aliquando esse, cum non essent; aut perpetua esse" (Aristotle, *De physico audito libri octo*, 341v, L-M).

[49] "Si igitur factum est mobilium, ac motivorum unumquodque, necessarium est prius, quam accepta, aliam esse factam mutationem, et motum, secundum quem factum est id, quod potest esse motum, aut movisse" (*ibid*., 342r, B-C).

[50] "Probat [Aristoteles] nullum fuisse primum motum, sed ante quencunque alium extitisse, ratiocinaturque in hunc modum. Si exordium temporis motus habuisset, vel movens et mobile, cuius esset ille primus motus, coepissent aliquando, vel fuissent ab aeterno; si aliquando coepissent; igitur per aliquem motum: quare iam motus ille, qui antea primus dicebatur, primus non esset" (Conimbricenses, *In octo libros Physicorum*, 701).

mobile (*mobile*), which is capable of being moved, and the mover (*movens*), whose capacity (or potentiality) for motion is already realized (or actualized) and thus can set the mobile in motion. This is how motion can occur, which Aristotle defines as "the act of the mobile inasmuch as it is mobile".[51]

As the Jesuits of Coimbra explain in the aforementioned passage, Aristotle asserts that if motion had a beginning, then both the mover and the mobile would have had to come into existence, meaning they were generated. However, for Aristotle, the process of generation can only happen through change (*mutatio*) and motion (*motus*). So, the idea that motion had a beginning leads to the conclusion that there was motion prior to the supposed first motion; therefore, motion is eternal. Consequently, since motion cannot be separated from things – such as the celestial spheres in Aristotelian cosmology – it follows that the universe is also eternal. The eternity of motion thus demonstrates the eternity of the world.

Here is how Castelli succinctly summarizes Aristotle's reasoning:

> So, having supposed that the existence of the mover and the mobile [*movente e mobile*] must precede motion, Aristotle continues and says: Either they were made or they are eternal. If they are eternal, why was motion not made? If they were made, then [they were made] through motion; thus, there was motion before motion.[52]

In this passage, Castelli also summarizes part of text 7 (*Phys*. 251a20-28) from Book VIII of Aristotle's *Physics*, which considers the possibility that mover and mobile have existed forever. In this case, too, Aristotle concludes that motion is eternal.[53]

In Castelli's summary, however, Aristotle asks a sort of rhetorical question: "If they are eternal, why was motion not made?" (*se eterni, perché non si faceva il moto?*). Although Aristotle does not actually pose this question, a very similar paraphrase can be found in Jacopo Zabarella's commentary (published posthumously in 1601): "… why, indeed, did

[51] "Incipiemus autem primum ex definitis a nobis prius in physicis. Dicimus itaque *motum esse actum mobilis, secundum quod est mobile. Necesse est ergo existere res, quae possunt moveri secundum unumquemque motum*. Et sine etiam motus definitione omnis utique confitebitur necessarium esse moveri id, quod potest moveri secundum unumquemque motum: ut alterari quidem alterabile, ferri atuem secundum locum mutabile. Quare prius oportet combustibile esse antequam comburant, et combustivum, prius quam comburat" (Aristotle, *De physico audito libri octo*, 340r-v, F-G, emphasis added). The definition of motion is taken from Book III, text 4, of the *Physics* (see *Phys*. 200b32-33), where Aristotle also claims, in text 6, that there can be no motion without things (see *Phys*. 201a10-11).

[52] "Supposto donque da Aristotele che a principiar il moto è necessario che preceda la essistentia del movente e mobile, segue dicendo: O che questi sono fatti, o eterni: se eterni, perché non si faceva il moto? Se fatti, adonque per moto: talché era il moto avanti il moto" (OG, X, 170).

[53] See Aristotle, *De physico audito libri octo*, 342v, I.

[mover and mobile] not make motion?" (… *cur enim non faciebant motum?*).[54]

Moreover, Castelli summarizes text 6 with the phrase, "if they were made, then through motion" (*Se fatti, adonque per moto*). This is later repeated in Latin: "*si facta* […] *ergo per motum*".[55] This identical phrasing also appears in Jacopo Zabarella's commentary on text 6.[56] Later, in his commentary on text 9, Zabarella summarizes Aristotle's reasoning with the expression, "*si factum: ergo per motum*". Here, "*factum*" refers to "the mobile, namely, the universe" (*mobile, nempe, universum mundum*). The mover is identified by Zabarella as God.[57] However, the mover in texts 5 and 6 of Book VIII of the *Physics* is clearly a thing, a *res* that, while moving, sets the mobile in motion. Therefore, by equating it with God – who, in the Aristotelian tradition, is the unmoved mover that is always in act and devoid of matter – Zabarella appears to stretch the interpretation of the passage.

At any rate, mobile and mover were already mentioned by Zabarella in his comment on text 5, which, in its structure, accords with the one of the previously quoted passage from Castelli's letter:

> Having established that motion requires a mover and a mobile, Aristotle begins to argue here by assuming an opponent who claims that motion has begun. He asks his opponent whether mover and mobile were made or are eternal. By so doing, from either assumption he can demonstrate that there was a prior motion before the first motion, which implies a contradiction.[58]

Here, there is a reference to a supposed "opponent" ("*Aristoteles… supponens adversarium dicentem incoepisse omnino motum*"), which also appears in Castelli's letter ("…il primo moto del'avversario"), but for which there is no trace in Aristotle's text.[59]

[54] "[…] Aristoteles […] dicit primum positionem hanc cuilibet consideranti videri irrationabilem quod motor, qui est aptus movere, et mobile aptum moveri, praefuerint aeterno tempore absque ullo moto, cur enim non faciebant motum? cur tunc potius quam antea?" (Zabarella, *In libros Aristotelis physicorum commentarii*, 104r).

[55] See *infra*, n. 71.

[56] "Dubitari hic posset adversus illam consequentiam Aristotelis, *si facta, ergo per motum* […]" (Zabarella, *In libros Aristotelis physicorum commentarii*, 103v, emphasis added).

[57] "[…] quando enim quaerit Aristoteles si fuit primum initium motus motor et mobile suntne facta an sunt aeterna? nos respondemus motorem quidem semper fuisse, et semper eodem modo se habuisse; sed mobile, nempe, universum mundum, esse factum a Deo" (*ibid*., 108r).

[58] "Iacto illo fundamento quod motus requirit motorem, et mobile, Aristoteles hic incipit argumentari, et supponens adversarium dicentem incoepisse omnino motum, quaerit ab eo an motor, et mobile sint facta, an sint aeterna, ut ex utrolibet dato ostendat fuisse motum priorem primo motu, quae est implicatio contraditionis" (*ibid*., 103r).

[59] See *supra*, n. 46.

It is likely that this was a common way to present these passages from the *Physics*.[60] Therefore, it is uncertain whether Castelli drew directly from Zabarella's commentary. Nonetheless, it can be concluded that Castelli's reading of texts 5 and 6 from Book VIII of the *Physics* was certainly mediated by some form of commentary, which is not surprising.

What is surprising, however, is how Castelli refutes Aristotle's argument for the eternity of motion. Typically, it was customary to distinguish the concept of generation from that of creation. It was believed that while generation occurs through physical motion and requires pre-existing matter, creation is instantaneous and *ex nihilo*, meaning it comes from nothing.[61] Thus, Aristotle's argument had limited validity, as it applied only to what was generated from something else and could not be applied to what was created by God from nothing.[62]

According to Thomas Aquinas and other commentators, when arguing for the eternity of motion, Aristotle implicitly assumed the principle *ex nihilo nihil* (nothing comes from nothing) as the foundation of his reasoning. Therefore, his argument can be solved by appealing to creation from nothing. However, Zabarella did not entirely agree with Aquinas. While he acknowledged that the unexpressed principle *ex nihilo nihil* effectively served as a cornerstone of Aristotle's argument, he also believed that the notion of creation *ex nihilo* could not be used to refute it.[63]

[60] I found no mention of the "opponent" in the other commentaries I reviewed while writing this paper.

[61] I am simplifying for the sake of clarity. For the different ways in which the term *creatio* was used, see Conimbricenses, *In octo libros Physicorum*, 706-707.

[62] This is well exemplified by Benet Perera in his well-known textbook, where he responds to Aristotle, Proclus, and Averroes: "[…] rationes Aristotelis, quae tali fundamento nituntur atque fulciuntur [i.e., ex nihilo nihil], infirmas esse necesse est. Nam et primam materiam, et primum mobile, et omnes coelos de novo productos esse dicimus, non per motum physicum et ex aliquo subiecto, ut Aristoteles argumentatur, sed per creationem ex nihilo"; "[…] aliud est loqui de generatione uniuscuiusque rei particularis, aliud vero de procreatione Universi et omnium entium, quae ex aliquo subiecto antecedente non potuerunt existere. […] Ad haec, quod vere generatur, id est per motum efficitur, id et in tempore, et ex aliquo subiecto fieri necesse est; at procreatio Mundi non est motus, nec in tempore fit, immediate enim fit a Deo, qui in tempore non operatur"; "[…] creare mundum ex nihilo, non potest nisi is qui habeat infinitam vim et potestatem, quique sit summe bonus et sapiens, hunc autem Deum esse, manifestum est apud omnes" (Perera, *De communibus omnium rerum naturalium principijs et affectionibus libri quindecim*, 466d, 479d-480b, 499c).

[63] "Admonere autem hic volo me hac in re non omnino Divo Thomae assentire, quod enim dicat rationem Aristotelis ita solvi, id quidem verissime dicitur, sed quod haec fuerit Aristotelis mens, nempe, quod de creatione cognoverit, quod fieri possit ex nihilo, et de sola generatione dixerit quod nihil potest ex nihilo fieri; hoc quidem ego nullo modo sentio, sed credo Aristotelem negasse omnem productionem ex nihilo, neque cognovisse creationem, siquidem non fuit Christianus, quando igitur utitur hoc principio ex nihilo nihil fit, puto ipsum semper intelligere

In his commentary on the *Physics*, Zabarella argues that Aristotle's proof for the eternity of motion is compelling as long as one accepts the principle *ex nihilo nihil*. However, Christian thinkers, who believe the truth has been revealed through faith, start from a different principle – namely, the principle that God created the universe *ex nihilo*. While this latter position is indeed true and must be affirmed by Christians, Aristotle's argument remains logically valid and irrefutable when based on the principle *ex nihilo nihil*. In summary, Zabarella concludes that these are two antithetical positions because they rest on opposing principles. And it makes no sense to engage in a discussion with those who do not share the same argumentative principles ("*certum est nullam esse posse disputationem inter eos, qui non conveniunt in pincipijs*").[64]

Those like Philoponus, who wish to "fight for Christian truth against Aristotle" (*pro Christiana veritate contra Aristotelem pugnare*), risk misinterpreting Aristotle simply to refute him. In fact, Philoponus mistakenly believed that Aristotle did not use the principle *ex nihilo nihil* in Book VIII of the *Physics*. According to Zabarella, Simplicius and others also erred when, responding to Philoponus, they conceded that Aristotle did not employ that common principle, but rather his own, specifically his definition of motion as "the act of the mobile inasmuch as it is mobile".[65]

Castelli was most likely aware of these discussions and interpretations. However, his refutation of Aristotle's argument for the eternity of motion begins – this is noteworthy – with the new definition of motion proposed by Galileo. He does not rely on the Christian concept

id universaliter verum esse, ita ut nulla detur productio nisi ex praesupposita materia, hoc enim ita constituto valida est consequentia haec, factum, ergo per motum, sed eo negato, ut nos negare debemus, ratio Aristotelis corruit, et nihil habet efficacitatis" (Zabarella, *In libros Aristotelis physicorum commentarii*, 108r). A few lines earlier, Zabarella refers to "S. Thomas in prima parte summae quaestione quadragesima sexta articulo primo".

64 "Contra vero in Philosophia Aristotelis est principium indemonstrabile, quod nullo modo potest aliquid fieri ex nihilo, at certum est nullam esse posse disputationem inter eos, qui non conveniunt in pincipijs, vana est igitur omnino haec disputatio [de creatione contra Aristotelem], nec nos in praesentia aliud dicere debemus, nisi quod in principijs Aristotelis haec ratio est validissima, et insolubilis, a nobis tamen Christianis facile solvitur negato illo principio ex nihilo nihil fit, dicimus mundum a Deo creatum statim incoepisse moveri, nec ostendi posse quod fuerit motus alius prior illo primo, propterea quod creatio fit sine ullo motu, et nulla praesupposita materia" (*ibid*., 108r-v).

65 "Ioannes igitur volens pro Christiana veritate contra Aristotelem pugnare, conatus est hanc primam rationem demoliri, totaque disputatio ipsius tribus capitibus continetur, ut apud Simplicium legere possumus [...]. Objicit Ioannes Aristoteli quod non usus sit hoc principio, ex nihilo nihil fit, ex quo haec demonstratio fuisset validissima. Ad hoc Simplicius, et alij respondent concedendo non usum esse Aristotelem hoc fundamento, quoniam (dicunt) maluit uti principijs proprijs, quam principio illo nimis communi, ideo uti voluit definitione motus, ut principio proprio, et ex natura motus demonstrare motus aeternitatem. Sed horum sententia mihi non probatur [...]" (*ibid*., 107v-108r).

of creation *ex nihilo*, nor on the notion of an omnipotent God who creates the world from nothing instantaneously and without physical motion. Instead, he relies on Galileo's new definition that "motion is nothing but a change of one thing in relation to another". Thus, even if Aristotle based his argument solely on his own definition of motion (as interpreted by Philoponus, Simplicius, and others), his argument for the eternity of motion would still be flawed because it stems from a fundamental misunderstanding of what motion truly is.

In response to Aristotle's conclusion, "if made, then through motion", Castelli asserts that this is a "distorted consequence" (*consequenza stroppiata*). He attempts to demonstrate this by proposing and confirming "two lemmas, which are true not only in themselves but also within Aristotle's own doctrine".[66]

The first lemma states that "if the totality of things were to be made, it would be impossible to do so through motion". Although Castelli argues that this lemma can be derived from Aristotle's doctrine, he actually derives it from Galileo's understanding of motion:

> And the reason is that, given the definition of motion, one must first look for something in relation to which the change occurs, and since we are proposing the production of the totality of things, nothing can be found: therefore, [the totality of things] is not produced through motion, which was our point.[67]

Castelli argues that, because motion requires a change relative to something else, it would be impossible to find anything against which the totality of things could begin to move. If nothing exists outside this totality, motion cannot occur. Therefore, if the universe was created, it could not have been through motion.

From this, it seems that, for Castelli, the complete absence of any relata removes the necessary condition for the *existence* of motion, suggesting that motion is *ontologically* understood as a relative state. It is hard to know whether this truly reflects the full scope of Galileo's definition of motion in 1607. Unfortunately, his response to Castelli's letter (if there was any) has not survived.

However, it is important to emphasize, once again, that Castelli challenges Aristotle's conclusion by resorting to Galileo's new definition of motion, which does away with the concepts of act, potency, mover, and movable. This shift is far from insignificant. Also,

[66] "Che questa sia una consequenza stroppiata, io lo provo, proposti prima e confirmati doi lemmi, verissimi non solo da sé, ma nella dottrina istessa d'Aristotele" (OG, X, 170). The expression "consequenza stroppiata" reminded me of Galileo's use of "conseguenza stravolta" a few years later in his argument against Ludovico Delle Colombe (see OG, XI, 149).

[67] "Il primo è, che se il tutto si facesse, saria impossibi[le] farsi con moto. La ragione è, perché ricercandosi, per la definitione del moto, qualche cosa a rispetto della quale si faccia la mutatione, et essendo da noi proposta la mutation del tutto, niente si ritrova: adonque non si fa con moto, che era il proposito nostro" (OG, X, 170).

although Castelli concedes that his objection aligns with what even the Aristotelians are willing to concede (that is, the universe was not created through motion), his argument differs from theirs. While they invoke God's omnipotence and creation *ex nihilo*, he draws on Galileo's definition of motion. In summary, Castelli seeks to challenge Aristotle on his own ground, but with a new weapon – Galileo's natural philosophy.

To illustrate Aristotle's paralogism, Castelli also invokes the principle *ex nihilo nihil*, which he calls an "axiom".[68] The second "lemma" states that

> it would not be absurd, contrary to what the Peripatetics claim, that if the totality of things were made, it would be made from nothing. Indeed, it is not only unproblematic but also necessary that, if the totality of things were to be made, it would come from nothing. Thus, we can say that the axiom *Ex nihilo nihil* should, by necessity, be understood and limited (if it has any semblance of truth) to particular productions, not to that of the totality of things (if it were to be made).[69]

As noted, for some commentators, Aristotle's argument is grounded in the principle *ex nihilo nihil*. When based on this principle, Zabarella argued that the argument is compelling and irrefutable. However, by denying this foundational principle, one can rightly assert that the world was created by God *ex nihilo*. In Zabarella's view, these conclusions arise from opposing axioms, resulting in different and non-communicating conceptual frameworks.

Castelli seems to critique positions like this, arguing that it is incorrect for the "Peripatetics" to claim that it is absurd to accept creation *ex nihilo* once the axiom *ex nihilo nihil* is acknowledged. According to Castelli, this axiom is limited by definition: it can only be applied to the production of particular things, not to the totality of things.

Whether successful or not, Castelli's attempt reflects a desire to dismantle Aristotle's argument without relying on the terminological and conceptual distinctions between generation and creation. Even if, as some commentators believed, Aristotle used the principle *ex nihilo nihil*, he applied it incorrectly, as he used it in the one context where it is inapplicable: the generation of the universe. Thus, Aristotle failed to recognize that the generation of the universe represents a singularity that cannot be explained through that common principle.

[68] See also Perera, *De communibus omnium rerum naturalium principijs et affectionibus libri quindecim*, 479d: "[…] Proclus *ex illo communi axiomate* Ex nihilo nihil fit, conatur ostendere Mundum non potuisse generari […]" (emphasis added).

[69] "Il secondo è, che non sarebbe un assurdo quello che per tale si va predicando da' Peripatetici, che se il tutto si facesse, si farebbe di niente, poiché non solo non è inconveniente, ma saria necessario che, facendosi il tutto, di niente si facesse: talché potiamo dire che l'axioma Ex nihilo nihil va inteso e limitato a forza (se però have spetie di verità) alle prodottioni particolari, non a quella del tutto (se si facesse)" (OG, X, 170).

In this respect, the 1607 letter displays argumentative features similar to those used by Galileo himself in his many debates against the Aristotelians. Castelli seeks to illustrate that, in a sense, Aristotle has undermined his own position. By acknowledging the possibility that the universe might have had a beginning, he simultaneously ruled out the possibility that it could have been generated through motion and from something else. Yet he failed to recognize this point. Using a metaphor that Galileo would later employ in the *Dialogue*, one could say that, for Castelli, Aristotle created the organ of philosophy – namely, logic – but failed to master how to play it.[70]

In general, Castelli's intention is not to prove that the world had a beginning or that Galileo's science can demonstrate this. Instead, he aims to refute the argument that Aristotle believed he had used to establish the eternity of motion and the universe. He does this within the limits of human understanding, as a natural philosopher would.

This point becomes evident when Castelli summarizes his refutation:

> Now, how can this good man infer: if they were made, then [they were made] through motion, when neither he nor anyone else, who has even a little understanding of words, can say that universal production occurs (if it occurs) through motion? Does he not see that, while he admits [that they were made], he is cutting off the path for himself, since this passage "*si facta*", as in the first lemma, does not allow one to say "*ergo per motum*"?[71]

And right afterward:

> I am not saying that it [i.e., motion/the world] was made or not made, but that its progress doesn't teach me anything [about whether it was made].[72]

As a believer and a member of the Benedictine order, Castelli could certainly assert that the world was made, meaning it was created *de novo* by God. However, he believes such a statement would be unprovable using only human reason. He prefers to limit him-

[70] See OG, VII, 59-60. See also Galilei, *Dialogo*, II, 204-206, wich quotes a passage by Niccolò Aggiunti (Castelli's pupil), transcribed and translated by Michele Camerota.

[71] "Hora, come può inferire quest'huomo da bene: Se son fatti, adonque per moto? se né lui né altri, che habbiano solo un puoco di lume di intelligenza di parole, ponno dire che la prodottione universale si faccia (se si fa) con moto? Non vede egli che, mentre mi dona, non concede, questo passo *si facta*, che immediate da sé stesso si tronca la strada, come nel primo lemma, di poter dire: *ergo per motum*?" (OG, X, 170).

[72] "Io non dico né che sia fatto né che non sia fatto, ma che il progresso suo non mi fa guadagnar niente" (*ibid.*). This sentence is somewhat ambiguous. While the term "progresso" could be interpreted as referring to Aristotle's logical argument for the eternity of the world, I am more inclined toward another interpretation, which I will explain below.

self to presenting his perspective as a natural philosopher. In this role, he cannot determine, based on observations of natural phenomena, whether the world had a beginning or has always existed ("… il progresso suo non mi fa guadagnar niente").

At that time, not everyone shared this view, but Castelli certainly finds himself in good company, as Thomas Aquinas also asserted that "the novelty of the world cannot be demonstrated from the world itself" (*novitas mundi non potest demonstrationem recipere ex parte ipsius mundi*).[73]

Castelli's primary objective is to demonstrate that Aristotle was an inconsistent natural philosopher, as he failed to recognize the inherent limits of the discipline he practiced in the *Physics*. Aristotle deluded himself into believing he had proven the eternity of motion and, by extension, the eternity of the universe. This was actually evidence of his inability to fully understand motion and argue correctly.

3.2. On a new proof for the existence of God

Seamlessly, Castelli introduces a new argument that some believed could prove the existence of God:

> Then, from the doctrine of Your Lordship [Galileo] that a mover [*movente*] is necessary to start the motion, but the lack of obstacles is sufficient to continue it, makes me want to laugh [*mi vien da ridere*] when they magnify such a doctrine as though it made the existence of God known to me. For, if it were true that motion is eternal, I could become atheistic and say that we don't need God. What a wicked blasphemy![74]

Two distinct interpretations of this passage have been proposed. Both, in my opinion,

[73] See Thomas Aquinas, *Summa theologiae*, 352, cols. 1-2 (i.e., I, q. 46, a. 2). Not everyone agreed with this conclusion. Some argued that it could indeed be demonstrated that the world had a beginning. The issue is also addressed in Galileo's *Juvenilia*, where it is argued that, although it is impossible to prove that God created the world *de novo* ("quandoquidem demonstrare non potest […]"), it can still be shown in various ways, such as by appealing to the Holy Scriptures and the Fourth Lateran Council (see OG, I, 26). This stands in stark contrast to the conclusion reached by the Jesuit Muzio Vitelleschi of the Collegio Romano in his *reportationes*, where he writes that "lumine naturali non solum quomodocumque cognosci potest mundum non fuisse aeternum, sed ita probari ut non melius in philosophia probentur multa quae censentur physico demonstrare" (APUG, Muzio Vitelleschi's *reportationes*, FC 392, f. 8v). Vitelleschi deliberately positions himself in opposition to the thesis of Thomas Aquinas.

[74] "Dalla dottrina poi di V.S., che a principiar il moto è ben necessario il movente, ma a continuarlo basta il non haver contrasto, mi vien da ridere quando esaltano questa dottrina come quella che mi faccia venir nella cognitione dell'esistentia di Dio; consciosiacosaché se fusse vero che il moto fosse eterno, io potrei doventar ateista e dire che di Dio non havemo bisogno, bestemia scelerata" (OG, X, 170).

are influenced by an underlying bias: Castelli was a man of God, and as such, he criticized anything that contradicted the truth of faith.

On the one hand, Massimo Bucciantini, who has highlighted the significance of the 1607 letter since 1992, argued that it is crucial to differentiate between the referents of two expressions used by Castelli in the quoted passage. The "doctrine of Your Lordship" that Castelli mentions is not the same as the one he later critiques, which he explicitly refers to as "such a doctrine". This latter doctrine, Bucciantini claimed, specifically relates to the Aristotelian concept of the eternity of motion that Castelli had previously challenged. While he initially critiques this doctrine from a logical-scientific perspective, in the quoted passage, he shifts his focus to a metaphysical and theological viewpoint.[75]

Thus, Bucciantini contended that for Castelli

> the impossibility of reconciling the Aristotelian conception of the eternity of the world with the Christian thesis of creation – and, therefore, the accusation that the conception of the eternity of motion makes God unnecessary – establishes the full superiority of Galileo's science of motion over that of Aristotle.[76]

This interpretation encounters at least one significant difficulty. If it were correct, indeed, Castelli would blatantly contradict himself: how can the Aristotelians, who apparently seek to prove the existence of God based on "such a doctrine", which for Bucciantini means the eternity of motion, be refuted "if it were true that motion is eternal"? Evidently, Castelli's main target is neither the Aristotelians nor the eternity of motion.

On the other hand, Pietro Redondi, argued that "such a doctrine" specifically refers to Galileo's assertion that "a mover is necessary to start the motion, but the lack of obstacles is sufficient to continue it". Thus, Redondi identified the polemical target of Castelli as those who aimed to prove the existence of God by employing 'Galilean inertia'.[77] He claimed that, as a Christian, Castelli could not accept that the universe was created by God through motion. In other words, Castelli struggled to justify Galileo's "inertia" based on the existence of God. In 1607, Castelli was not

[75] See Bucciantini, "Atomi geometria e teologia nella filosofia galileiana di Benedetto Castelli", 174-175, and n. 9 against Libero Sosio's interpretation.

[76] "[…] l'impossibilità di conciliare la concezione aristotelica dell'eternità del mondo con la tesi cristiana della creazione – e, quindi, l'accusa rivolta alla concezione dell'eternità del movimento di fare a meno dell'operato di Dio – sanciscono la piena superiorità della scienza galileiana *de motu* rispetto a quella aristotelica" (*ibid*., 174).

[77] While I am not entirely opposed to the anachronistic use of the term 'inertia' for the sake of convenience, I disagree with Redondi's claim that Castelli was specifically referring to "inertial rectilinear motion" (see Redondi, "From Galileo to Augustine", 181).

> as ingenious a theologian as Descartes to postulate inertia on the immovability of God. Castelli had only his faith to rely on when he reminded Galileo at the end of his letter that, "if it is true that motion is eternal, I could begin atheistic (*ateista*) and say we don't need God. What a wicked blasphemy!"[78]

Redondi's interpretation, while containing some interesting insights, is, in my view, misleading. It is incorrect to assert that Castelli highlights the "impious" nature of attempts – whether Aristotelian or otherwise – to prove that the world was created through motion in his 1607 letter.[79] Castelli's objective is quite different.

First, as noted, he argues against Aristotle that it is impossible to prove the eternity of motion without exceeding the limits of natural reason. In this sense, Castelli believes that there can never be a 'cosmological' proof of the eternity of motion and the world; that is, a proof relying on the sensible data that natural philosophers study. This skepticism applies also to the beginning of motion, which cannot be demonstrated in natural philosophy according to Castelli. Secondly, he expresses his discontent with those who use Galileo's doctrine to argue that motion requires at least an initial mover, i.e. God, in order to continue indefinitely from that point onward. Indeed, consistent with his earlier claim about the impossibility of proving the beginning or eternity of motion, Castelli finds this argument for God's existence to be ridiculous. He contends that if, by some other means, it were discovered one day that the world is eternal, those who accepted this 'Galilean' proof for God's existence would ultimately have to become atheists. "What a wicked blasphemy!"

Castelli remarks that all of this "makes [him] laugh" (*mi vien da ridere*). This expression, to an attentive reader, evokes the attitude of the unbelievers mentioned by Thomas Aquinas in the *Summa theologiae*, where he states that creation *de novo* is a matter of faith ("*credibile*") and is not subject to scientific demonstration ("*non autem demonstrabile vel scibile*"):

> that the world had a beginning is an object of faith, but not of demonstration or science. And it is useful to consider this, lest anyone, presuming to demonstrate what is of faith, should bring forward reasons that are not cogent, so as to give occasion to unbelievers to laugh, thinking that on such grounds we believe things that are of faith.[80]

78 *Ibid*., 182.

79 "In this letter, Castelli went on to argue about the danger of holding that the world had been created "by motion"; this was tantamount to claiming that motion was as eternal as God. Those Aristotelians who deduced the eternity of the world from the perpetual revolutions of the heavens ('if they are created, then it is by motion') were *impious*. However, enthusiasts who took God to be the initial source of an inertial rectilinear motion were also wrong" (*ibid*., 181, emphasis added).

80 "Unde mundum incoepisse est credibile, non autem demonstrabile vel scibile. Et hoc utile est ut consideretur, ne forte aliquis, quod fidei est demonstrare praesumens, rationes non necessa-

To prevent unbelievers from having material for mockery (*materia irridendi*) – essentially, an opportunity to ridicule Christians – Thomas cautiously advised avoiding certain types of demonstration altogether. Castelli echoes this sentiment but directs his warning specifically at some of the early 'users' of Galileo's doctrine.

His admonition is addressed to Galileo, not, as David Wootton has claimed, because Galileo himself suggested using his own doctrine of motion to prove God's existence.[81] There is no basis to entertain this hypothesis. It is entirely possible that Castelli felt comfortable confiding in his mentor about individuals known to both of them. Perhaps he believed that Galileo essentially shared his views.

At any rate, it is noteworthy that in the 1607 letter Castelli seems to already align himself with the distinction of domains and disciplines that Galileo would later defend in the *Copernican Letters*. Castelli consciously contrasts the "theological drift" that some attempted to impose on Galileo's science. This is not the same as Redondi's claim that Galileo's "mechanics involved a theological drift", and that this "problematic link between motion and creation was indeed very close to the problem of time as discussed by Augustine against the Manichees".[82] I highlight this point because Redondi's view has been taken up by Kenneth J. Howell, who suggested that

> Galileo's reason for appealing to Augustine [in the *Letter to Christina*] results in part from his view of the relativity of motion, an argument that reflects a closer continuity between his science and his interpretation of Scripture that has generally been recognized.[83]

The idea of a "link" or "continuity" between Galileo's science and his reflections on theological matters stems partly from a misinterpretation of Castelli's 1607 letter. In fact, Castelli's real aim was to prevent Galileo's new "doctrine" of motion from being misused and improperly applied by others in theological discussions about creation and the existence of God.

4. Conclusion

When asked "Does the eternity of motion make God unnecessary?", Castelli would undoubtedly have replied with a spontaneous and firm "No, it doesn't". This is made clear through a close reading of Castelli's first letter to Galileo. If my interpretation is valid, this

rias inducat, quae praebeant materiam irridendi infidelibus, existimantibus nos propter huiusmodi rationes credere quae fidei sunt" (Thomas Aquinas, *Summa theologiae*, 352, col. 2; i.e., I, q. 46, a. 2).

81 See Wootton, *Galileo: Watcher of the Skies*, 240-250.

82 Redondi, "From Galileo to Augustine", 181. See also Id., "Natura e Scrittura".

83 Howell, *God's Two Books*, 187.

letter is an invaluable testimony to the state of the debate surrounding Galilean science before any formal publication on the subject.

It is likely that someone well-known to both Castelli and Galileo attempted to prove the existence of God through Galileo's doctrine of motion. This certainly occurred in Padua, although it is nearly impossible, at this time, to determine who applied Galilean science to theological matters.[84] However, this effort was not well-received by Castelli, who promptly alerted his master to ensure that the new science would not be ridiculed. He wanted to prevent any association of the new science with clumsy arguments about creation and the existence of God. There is no doubt, in my opinion, that Castelli's caution stemmed from a deep grounding in theology, particularly from reading Aquinas.[85]

In this regard, my interpretation of the letter diverges sharply from Pietro Redondi's view that Galileo's science of motion had theological roots in Augustine's reflections on time. Redondi argues that Castelli failed to see this link or reconcile Galilean inertia with a God as creator. However, his claim that Galileo "applied [Augustine's metaphysics of time] to dynamics" remains unproven and cannot be inferred from Castelli's 1607 letter.[86] Instead, as I have shown, there is a clear connection between Castelli's cautious approach to Galileo's science in theological matters and Thomas Aquinas's arguments.

At the same time, Castelli illustrated how fruitful the new science could be in countering Aristotle's paralogisms. In his 1607 letter, he says that he has come to understand the flaws in Aristotle's proof of the eternity of motion after reflecting on Galileo's new definition of motion. Thus, by setting aside arguments based on distinctions between act and potency, mover and mobile, generation and creation, Castelli was able to critique Aristotle from the standpoint of a natural philosopher.

In 1607, Castelli praised Galileo's new philosophy of nature over the Aristotelian one while also urging caution in this praise. The risk was that one could exaggerate to the point of venturing into areas where Galileo's science would never gain traction. It is quite possible that by 1607, when Castelli wrote his letter, he was already aware of which arguments resonated with Galileo.

[84] As shown above in Section 2, Galileo was accustomed to discussing his scientific findings with his pupils and friends.

[85] See *supra*, n. 39.

[86] Redondi, "From Galileo to Augustine", 182. Redondi has further argued that "Galileo ha bisogno di Dio come garante della razionalità naturale e delle leggi matematiche dei fenomeni. Ma non Galileo come persona, è la sua scienza meccanica, il suo copernicanesimo, la sua fisica matematica a fondarsi su un'idea del mondo come risultato di un disegno razionale miracoloso." (Redondi, "Natura e Scrittura", 156). However, in my view, this assertion still lacks sufficient textual evidence.

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Abbreviations

OG = Galilei, Galileo. *Opere*. National Edition, edited by Antonio Favaro, 20 vols. Firenze: Barbèra, 1890-1909.

OGA = Galilei, Galileo. *Opere*. Appendix to the National Edition, edited by M. Camerota *et al.*, 4 vols. Firenze: Giunti Editore, 2013-2019.

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