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(COPERNICAN) EXPERIENCES AND THE (COPERNICAN) BIBLE IN GALILEO'S *LETTER TO CASTELLI*

Abstract: *The article focuses on Galileo's* Letter to Castelli, *21 December 1613. The author analyzes Galileo's hermeneutical principles established in the first part of the letter (the Bible should be excluded from natural investigation) and his literal interpretation of the passage from the Book of Joshua 10, 12–13, in Copernican terms, in the second part of the letter. Galileo appears to use the Bible as a scientific authority, supporting his Copernican views, and thus he seems to contradict his own hermeneutical principles. The author argues that Galileo's position is consistent, especially if one takes into account the historical context of its genesis, that is, in the context of the constant, theologically-inspired attacks on Copernicus and Galileo and his commitment to the heliocentric world system (the movement of the earth contradicts the Bible) and in the context of his newly-made telescopic observations and discoveries.*

Keywords: *Galileo; Letter to Castelli; heliocentrism; Biblical hermeneutics, natural investigation*

(Kopernikánská) zkušenost a (kopernikánská) bible v Galileově *Dopisu Castellimu*

Abstrakt: *Článek se zaměřuje na Galileův* Dopis Castellimu *z 21. prosince 1613. Autor anylzuje Galileovy hermeneutické principy představené v první části dopisu (bible by měla být vyloučena ze zkoumání přírody) a jeho doslovnou interpretaci pasáže z knihy Jozue (10: 12–13), v duchu kopernikanismu, která se objevuje ve druhé části dopisu. Zdá se, že Galileo užívá bibli jako vědeckou autoritu a na podporu svých kopernikánských názorů, a tak se ocitá v rozporu se svými vlastními hermeneutickými principy. Autor tvrdí, že Galileovo stanovisko je konzistentní, zvláště pokud se vezme v úvahu historický kontext jeho vzniku, tj. kontext stálých, teologicky motivovaných útoků na Koperníka, Galilea a jeho věrnost heliocentrickému systému světa (pohyb Země odporuje bibli) a kontext jeho nedávných teleskopických pozorování a objevů.*

Klíčová slova: *Galileo; dopis Castellimu; heliocentrismus; biblická hermeneutika; zkoumání přírody*

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In recent decades there have been some attempts to revive the old thesis about Galileo being a bad scientist and a good theologian.[1] According to this interpretation, Galileo was wrong in the scientific, epistemological domain. He should have accepted Cardinal Bellarmine's famous demand to speak about the motion of the earth and the sun being at rest *ex hypothesi* or *ex suppositione*, that is, only hypothetically.[2] On the other hand, Galileo was paradoxically right in the domain of biblical hermeneutics. In his Copernican letters he explicitly claimed that questions pertaining to natural philosophy should not be treated as matters of faith, that is, he understood that the Bible is an authority only in matters of faith and morals. Against this – let us call it – "Galileo, the good theologian" thesis, there is, at least at first sight, manifest evidence in these very letters. In these writings Galileo appears to use the Bible as a scientific authority, supporting his Copernican views, and thus he seems to contradict his own hermeneutical principles.[3]

In what follows, I will focus on the theological aspect of the issue, limiting myself to the first of Galileo's Copernican letters, his *Letter to Castelli*, 21 December 1613, and closely examine it.[4] I will go through Galileo's hermeneuti-

[1] See also Luca BIANCHI, "Urbain VIII, Galilée et la tout-puissance divine." In: BERETTA, F. (ed.), *Galilée en procès, Galilée réhabilité?* Saint-Maurice: Éditions Saint-Augustin 2005, pp. 68–70 (67–90). For a broader analysis of the Copernicanism versus Bible issue, see, for instance, Kenneth J. HOWELL, *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science*. Notre Dame: University of Notre Dame Press 2002.

[2] See Piero DINI, "Letter to Galileo, 7 March 1615." In: Maurice A. FINOCCHIARO, *The Galileo Affair: A Documentary History*. Berkeley – Los Angeles – London: University of California Press 1989, pp. 58–59, and Robert BELLARMINE, "Letter to Foscarini, 12 April 1615." In: FINOCCHIARO, *The Galileo Affair*, pp. 67–69. Galileo responded to this challenge in Galielo GALILEI, "Letter to Dini, 23 March 1615." In: FINOCCHIARO, *The Galileo Affair*, pp. 60–67. See also his notes, known today as "Considerations on the Copernican Opinion." In: FINOCCHIARO, *The Galileo Affair*, pp. 70–86.

[3] See, for example, Paolo ROSSI, "Galileo e il *Libro dei Salmi*." In: *La szienza e la filosophia dei moderni*. Torino: Bollati Boringhieri 1989, p. 83 (67–89); Ernan McMULLIN, "Galileo's Theological Venture." In: McMULLIN, E. (ed.), *The Church and Galileo*. Notre Dame: University of Notre Dame 2005, p. 101 (88–116).

[4] Galileo GALILEI, "Letter to Castelli, 21 December 1613." In: FINOCCHIARO, *The Galileo Affair*, pp. 49–54. Galileo's *Letter to Castelli* is usually analyzed and interpreted as a preliminary step to his *Letter to Monsignor Dini,* 23 March 1615, and his *Letter to the Grand Duchess Christina*, written in 1615 and published only in 1636. My aim is to examine *Letter to Castelli* on its own terms and in the context of its genesis. In *Letter to Dini* and *Letter to the Grand Duchess Christina*, Galileo obviously develops and accentuates in a significant manner some of the fundamental themes and points from *Letter to Castelli*, but he also takes into consideration some additional events that happened in between, for example, the theological interventions of Cardinal Roberto Bellarmine and Paolo Antonio Foscarini. Bellarmine

cal principles established in the first part of the *Letter to Castelli* – I will skip the introductory passage – and his literal interpretation of the passage from the *Book of Joshua* (or Josue) 10, 12–13, in Copernican terms in the second part of the letter. And I will address the following questions: What is Galileo really doing in this letter? What is his argumentative strategy? Is Galileo really contradicting himself? For a better understanding of his position, I will situate *Letter to Castelli* (1) in the context of the constant, theologically-inspired attacks on Copernicus and Galileo and his commitment to the heliocentric world system (the movement of the earth contradicts the Bible) and (2) in the context of his newly obtained telescopic observations, discoveries, that is, new experiences, which encouraged him to defend the heliocentric cosmology more and more openly. I will argue that in *Letter to Castelli* Galileo's biblical hermeneutics, established in the first part of the letter, and his *literal* interpretation of the Joshua passage in favor of a heliocentric cosmology that Galileo develops in the second part of the letter, are consistent, especially if one takes into account the historical context of its genesis.

1. Galileo's Copernicanism and the theological front: *Letter to Castelli*

Galileo was, as is known from his letters to Jacopo Mazzoni[5] and Johannes Kepler,[6] a convinced Copernican already in the 1590s. He did not publish

intervened with the evocation of *Psalm* 18 (19): 16, which seems to him to be the greatest enemy against heliocentrism in Scripture. See Piero DINI, "Letter to Galileo, 7 March 1615." In: FINNOCHIARO, *The Galileo Affair*, pp. 58–59, and Galileo's reply in Galielo GALILEI, "Letter to Dini, 23 March 1615." In: FINOCCHIARO, *The Galileo Affair*, pp. 60–66. Foscarini wrote *A Letter Concerning the Opinion of the Pythagoreans and Copernicus about the Mobility of the Earth and the Stability of the Sun and the New Pythagorean System of the World*, "in which it is shown that that opinion [i.e. the Copernican] agrees with, and is reconciled with, the passages of Sacred Scripture and theological propositions which are commonly adduced against it", published in January 1615. The English translation of Foscarini's letter is taken from Richard J. BLACKWELL, *Galileo, Bellarmine, and the Bible*. Notre Dame – London: University of Notre Dame 1991, p. 217 (217–251). For the Italian original, see, for example, Massimo BUCCIANTINI – Michele CAMEROTA, *Galileo Galilei: Sienza e religione. Scritti copernicani.* Rome: Donzelli 2009, pp. 117–154. For the rhetorical analysis of the *Letter to Castelli*, see Andrea BATTISTINI, *Galileo e i gesuiti. Mitti letterari e retorica della scienza*. Milan: Vita e pensiero 2000, Chapt. 3: "Scienza come retorica: la lettera copernicana a Benedetto Castelli," pp. 87–124.

[5] See Galileo GALILEI, "Letter to Mazzoni, 30 May 1597." In: *Le Opere di Galileo Galilei*. Ed. A. Favaro, Florence: Barbéra 1890, II, pp. 49–48. *Le Opere di Galileo Galilei* shall be hereafter referenced as *OGG*.

[6] See Galileo GALILEI, "Letter to Kepler, 4 August 1597." In: *OGG*, X, pp. 67–68.

anything about his Copernican commitment because he was afraid of being ridiculed. His Copernicanism surfaced a decade and a half later, after his discoveries with the telescope, published in *Sidereus nuncius* (*A Sidereal Message* or *The Starry Messenger)* on 13 March 1610. From *Sidereus nuncius* onwards, Galileo increasingly treated the Copernican heliocentric system as a proven fact. After *Sidereus nuncius*, he expressed his conviction in several (semi-)private letters, and finally and definitely with the publication of *Istoria e dimostrazioni intorno alle macchie solari e loro accidenti comprese in tre lettere,* known also as *Lettere solari* (*Letters on Sunspots* or *On Sunspots*), published under the auspices of Accademia dei Lincei on 22 March 1613. In the third letter, for instance, he affirmed that the movement of the "Saturnian stars" and the phases of Venus, agree

> in a wondrous manner with the harmony of the great Copernican system, to whose universal revelation we see such favorable breezes and bright escorts directing us, that we now have little to fear from darkness and cross-winds.[7]

At least as far the last sentence is concerned, Galileo was wrong. Several months later, on 14 December 1613, Benedictine Benedetto Castelli, Galileo's former student and collaborator, wrote a letter to Galileo, reporting to him the event that took place after a meal at the Medici court, at that time in Pisa.[8] After the meal, Castelli was pressed by the Grand Duchess Christina of Lorraine regarding the apparent contradiction between the Copernican heliocentric cosmology and the Bible, especially with the passage from the *Book of Joshua*, where it is said that Joshua (Josue) commanded the sun and the Moon to stand still over the valley of Ayalon to allow the Israelites to defeat their enemies.[9]

1.1 Letter to Castelli

In reply to this challenge, Galileo wrote his famous *Letter to Castelli*.[10] If we disregard the introductory matters, and focus only on the issues we are

[7] Galileo GALILEI – Christoph SCHEINER, *On Sunspots*. Chicago – London: University of Chicago Press 2010, p. 296.
[8] For a summary of the letter and the most important quote, see p. 145 below.
[9] For the quote of the passage, see p. 136 below.
[10] For a brief overview of Galileo's "Letter to Castelli, 21 December 1615," see, for example, Giorgio de SANTILLANA, *The Crime of Galileo.* Chicago – London: University of Chicago Press 1955, pp. 40–42; BLACKWELL, *Galileo, Bellarmine, and the Bible*, pp. 66–69; ROSSI, "Galileo e il *Libro dei Salmi*," pp. 71–72; Annibale FANTOLI, *Galileo: For Copernicanism*

concerned with, the letter can be divided into two parts. The first part of the letter is devoted to "some general questions about the use of the Holy Scripture in disputes involving physical conclusions"[11] and the second part to the examination of the Joshua passage.

In the first part of the letter Galileo makes several points on the relationship between Holy Scripture and natural knowledge or, in different words, he formulates several exegetical principles concerning the interpretation of the Bible as far as the natural world is concerned. These are, in Ernan McMullin's terminology,[12] the following:

1) the principle of accommodation (PA);
2) the principle of the priority of demonstration (PPD);
3) the principle of scriptural limitation (PSL);
4) the principle of consistency (PC);
5) and the principle of prudence (PP).

Galileo begins with an examination of the nature of the truth of Holy Scripture and he immediately stresses that what is at stake is not the truth of the Bible, but its language and its interpreters.[13] He concedes and agrees with the Grand Duchess Christina that the Bible is "absolutely and inviolably true", it "can never lie or err";[14] but – he adds quickly – some of "its interpreters and expositors"[15] sometimes can err in various ways.

and for the Church. 3rd edition. Vatican: Vatican Observatory Publications 2003, pp. 129–131. For a more detailed examination of the letter, see Michaele CAMEROTA, *Galileo Galilei e la cultura scientifica nell'età della controriforma*. Rome: Salerno 2004, pp. 266–272; McMULLIN, "Galileo's Theological Venture," pp. 92–102. See also his earlier text: Ernan McMULLIN, "Galileo on Science and Scripture." In: MACHAMER, P. (ed.), *The Cambridge Companion to Galileo*. Cambridge: Cambridge University Press 1998, pp. 271–347; Giorgio STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei. Dalla *Istoria* sulle macchie solari alle lettere copernicane." *Nuncius*, vol. 9, 1994, no. 1, pp. 37–64. See also the very useful introduction and notes in the Italian edition of the letter by BUCCIANTINI – CAMEROTA, *Galileo Galilei: Sienza e religione*, pp. 3–16.

[11] GALILEI, "Letter to Castelli, 21 December 1613," p. 49 (49–54).

[12] See McMULLIN, "Galileo's Theological Venture," pp. 92–102. McMullin shows nicely that all these principles can be traced back to Augustine's *De Genesi ad Literam*. Compare also with Pietro REDONDI, "From Galileo to Augustine." In: MACHAMER, *The Cambridge Companion to Galileo*, pp. 175–210.

[13] See also STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," p. 52.

[14] GALILEI, "Letter to Castelli, 21 December 1613," p. 49.

[15] *Ibid*.

(1) One of the errors they very often make is that they stick to "the literal meaning of the words".[16] To stick to this hermeneutic principle, to understand the words of the Bible in their literal meaning, would result in the emergence of "various contradictions"[17] and even "serious heresies and blasphemies".[18] It would mean that God really has a human body (feet, hands, eyes), for example,[19] and that He also has the characteristics of human emotions (anger, regret, hate, forgetfulness, etc.). According to Galileo, there are many propositions in the Bible that are not true if one looks only at the literal meaning of the words. But these are expressed in this manner "only *to accommodate* the incapacity of common people".[20] Those who deserve to be separated from the masses must find a wise interpreter "to produce their true meaning"[21] and "indicate the particular reasons why they have been expressed by the means of such words".[22] Since the Holy Spirit accommodated his language to deliver his message according to the capacity of the common men on the street, "in many places the Scripture is not only capable but *necessarily* in need of interpretation different from the apparent meaning of the words".[23] Here we have the principle of accommodation (PA): the Bible should not be read literally, because its language is accommodated to the capacity of common people.

(2) This conclusion has consequences for the use of Holy Scripture in disputes about natural phenomena. If there is *a necessity* for a non-literal interpretation of the Bible, it follows that "in disputes about natural phenomena, it [i.e. the Bible] should be reserved to the last place". Why is that so?

According to Galileo, "Holy Scripture and nature both equally derive from the divine Word".[24] There are, in other words, two orders, two

[16] *Ibid*.
[17] *Ibid*., p. 50.
[18] *Ibid*.
[19] See also C. VASOLI, "Tradizione e nuova scienza. Note alle Lettere a Christina di Lorena e al P. Castelli." In: GALLUZZI, P. (ed.), *Novità celesti e crisi del sapere. Atti del convegno internazionale di studi galileiani*. Florence: Giunti Barbèra 1984, pp. 79–81 (73–94). Vasoli has brought to attention the fact that there are similar statements in DANTE, *Il paradiso*, IV, 43–45, and in Thomas AQUINAS, *Summa theologiae* I, q. 1, a. 10, 3, ad 3.
[20] GALILEI, "Letter to Castelli, 21 December 1613," p. 49 (emphasis added).
[21] *Ibid*.
[22] Compare also with Thomas AQUINAS, *Summa theologiae*, I, q. 1, a. 9, 3.
[23] GALILEI, "Letter to Castelli, 21 December 1613," p. 49 (emphasis added).
[24] *Ibid*., p. 50.

languages,[25] "two books", two registers of the truth, established by the same divine Word (*Logos*): there is the Bible, which is "the dictation of the Holy Spirit",[26] and there is nature, which is "the most obedient executrix of God's commands".[27] But there is a huge difference between the two, equally true languages and equally true truths.

Holy Scripture is accommodated to "the understanding of *all people* (*intendimento dell'universale*)".[28] The result of this accommodation is that Holy Scripture says many things "which are *different from the absolute truth*, in appearance and in regard to the meaning of the words".[29] This means that the Bible, although being absolutely true, differs from the absolute truth as far as its language (words) is concerned. The appearance and the meaning of the words of the Bible are not simply equal to the absolute truth, which allows and necessitates the intervention of "the wise interpreter" to discover the absolute truth, hidden behind the appearance and the literal meaning of the words.

Nature, on the other hand, is "inexorable (*inesorabile*) and immutable",[30] "she does not care at all whether her recondite reasons are revealed to human understanding and *she never transgresses the terms of the laws imposed on her*".[31] Nature as the most obedient executioner of God's commands is inalterable and *inesorabile*,[32] she does not respond to human prayers, wishes, and demands. In his *Lettere solari,* Galileo formulated this postulate of his in this manner:

[25] See also STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," pp. 53–56.
[26] GALILEI, "Letter to Castelli, 21 December 1613," p. 50.
[27] *Ibid*.
[28] *Ibid*. (emphasis added).
[29] *Ibid*.
[30] See also *The Assayer* (*Il saggiatore*). In: Galileo GALILEI – Horatio GRASSI – Mario GUIDUCCI – Johann KEPLER, *The Controversy on the Comets of 1618*. Philadelphia: University of Pennsylvania Press 1960, p. 298 (151–336): "In this way you will find out how great is the force of human authority upon the facts of nature, deaf and inexorable as she is to our wishes."
[31] GALILEI, "Letter to Castelli, 21 December 1613," p. 50 (emphasis added).
[32] See also BUCCIANTINI – CAMEROTA, *Galileo Galilei*, p. 8, 11. On Galileo's understanding of the term *inesorabile* (Lat. *inexorabilis*), see Giorgio STABILE, "Lo statuto di *inesorable* in Galileo Galilei." In: HAMESSE, J. – FATTORI, M. (eds.), *Lexiques et glossaires philosophiques de la Renaissance*. Luvain-La-Neuve: Fédération Internationale des Instituts d'Etudes Médiévales 2003, pp. 269–285; Maurizio TORRINI, "La natura della nuova szienza." *Nuncius*, vol. 17, 2002, no. 2, pp. 409–422; and Philippe HAMOU, "La nature est inexorable." *Galileana*, vol. 5, 2008, pp. 149–177.

> We must remember that Nature, unheeding of and indifferent [or inexorable] to our entreaties (*sorda e inesorabile*), will neither alter nor change the course of her effects, and that those things that we endeavor to investigate now and later to promote to others did not exist but once and then vanish, but rather still subsist and will continue to subsist in this fashion for a long time, such that they will be seen and observed by a great many people.[33]

In other words: nature is also absolute truth. The divine word (*Logos*), absolute truth, has become divine world. Nature is, in Giorgio Stabile's words: "a language verbally expressed but ontologically reified (*un linguaggio verbalmente profferito ma ontologicametne reificato*)".[34] Nature "*never* transgresses the terms of the laws imposed on her"[35] and does not reveal her secrets (the reasons or causes of nature's effects) immediately, she also needs – one can infer from Galileo's reasoning – "a wise interpreter" who should explain the reasons and causes of nature's effects. But this interpreter should, instead of being capable of reading and interpreting the language accommodated to all people (human language), be capable of reading and interpreting the language in which nature is written, that is, mathematical language. While the Bible speaks in the language of words, nature speaks in the language of mathematics. As Galileo wrote a few years after his *Letter to Castelli* in a famous passage from *Il Saggiatore* (*The Assayer*):

> Philosophy is written in this grand book – I mean the universe – which stands continually open to our gaze, but it cannot be understood unless one first learns to comprehend the language and interpret the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometrical figures, without which it is humanly impossible to understand a single world of it; without these, one is wandering about in a dark labyrinth.[36]

Leaving aside *exactly* what Galileo has in mind when he speaks about "the language of mathematics", it is absolutely clear that two languages, the biblical and the natural, differ fundamentally and that this difference concerns *the strictness of the expression*: on the one hand, the natural language is under the eternal command of natural laws, it cannot change in order to be comprehended by the common people, on the other, the biblical language

[33] GALILEI – SCHEINER, *On Sunspots*, p. 281.
[34] STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," p. 56.
[35] GALILEI, "Letter to Castelli, 21 December 1613," p. 50.
[36] GALILEO, *The Assayer*, pp. 183–184.

has been accommodated to the capacity of the understanding of common men. And this, according to Galileo, means that when investigating nature one should not start with the biblical language but with the natural language.

Galileo expressed the same conviction in slightly different words twenty years later in one of his letters to Elia Diodati.[37] There are "two books", reflects Galileo, which equally derive from the same God: the world, "the sun, the Moon, the earth, the stars, their arrangement, and their motions",[38] which are "the works of God",[39] and the Bible, which "comes from the Holy Spirit, namely again God".[40] This means that "the world is the works, and the Scripture is the words, of the same God".[41] There is a crucial difference between the words and works of God. The Holy Spirit used, spoke and pronounced "words which, in appearance, are very contrary to the truth"[42] in order "to accommodate the capacity of the people, who are for the most part very uncouth and incompetent".[43] For this reason, Scripture puts forth "in hundreds of passages"[44] propositions "which, taken in the literal meaning of the words, would be no mere heresies, but very serious blasphemies".[45] On the other hand, God has never changed his work in order "to accommodate the capacity and belief of the same people".[46] Nature is "God's inexorable minister"[47] and "is deaf to human opinions and desires, and has always conserved and continues to conserve her way regarding the motions, shapes, and locations of the parts of the universe".[48] Galileo illustrates this point with the spherical shape of the Moon. The Moon "has always been spherical, although for a long time common people thought it was flat".[49] In sum: "Nothing has ever changed by nature to accommodate her works to the wishes and opinions of men."[50] Now, since this is so, asks Galileo, "why should we, in order to learn

[37] See Galileo's "Letter to Diodati, 15 January 1633." In: FINOCHIARO, *The Galileo Affair*, p. 224 (223–226).
[38] *Ibid*.
[39] *Ibid*.
[40] *Ibid*.
[41] *Ibid*.
[42] *Ibid*.
[43] *Ibid*.
[44] *Ibid*.
[45] *Ibid*.
[46] *Ibid*.
[47] *Ibid*.
[48] *Ibid*., pp. 224–225.
[49] *Ibid*., p. 225.
[50] *Ibid*.

about the parts of the world, begin our investigation from the words rather from the works of God?"[51]

The natural world is always within the terms of the natural laws imposed on it by God through His divine world (during the creation, one presumes). Nature always conserves its ways regarding the motions, shapes, and locations of the parts of the universe, it is under *more strict obligations* in comparison to the Bible, which means that in investigating the reasons and causes of its effects one should start with the works (i.e. the world) of God instead of words of God (i.e. the Bible). The interpreter of the natural effects (written in the language of mathematics) must rely on sensory experiences and necessary demonstrations to reveal the natural truth. In Galileo's words from *Letter to Castelli*:

> whatever *sensory experience* (*la sensata esperienza*) places before our eyes or *necessary demonstrations* (*le necessarie dimostrazioni*) prove to us concerning natural effects should not in any way be called into question on account of scriptural passages, whose words appear to have a different meaning, since not every statement of the Scripture is bound to obligations as severely (*obblighi cosi severi*) as each effect of nature.[52]

Because of this difference in strictness between the words of the Bible and the works of God, that is, natural effects, one needs to start with the ontologically reified things, the world, and not with the word of God. The things, the works of God come first, and the names, the words second.[53] The Bible must therefore be interpreted on the basis of the truth discovered by sensory experiences and necessary demonstrations and not nature on the basis of the Bible. Here Galileo establishes the principle of the priority of demonstration (PPD): in matters of interpretation of natural effects, sensory experiences and necessary demonstration have precedence over the words of the Bible.

But there is more. Galileo formulates three additional exegetical principles: the principle of scriptural limitation (PSL), the principle of the consistency of two truths (PC), and the principle of prudence (PP).

[51] *Ibid*.
[52] GALILEI, "Letter to Castelli, 21 December 1613," p. 50.
[53] Compare with GALILEO – SCHEINER, *On Sunspots*, p. 91: "Names and attributes must accommodate themselves to the essence of things, and not the essence to the names, because things come first and names afterwards." See also CAMEROTA, *Galileo Galilei e la cultura scientifica nell'età della controriforma*, p. 268.

(3) The aim of the Bible is to adapt "itself to the capacity of unrefined and undisciplined peoples" and therefore has to conceal its most basic dogmas, attributing to God properties that are contrary to His essence. Why would the Bible abandon this aim when it speaks about the earth and the sun? Why would the Bible in this case limit itself to the narrow meaning of the words? According to Galileo, this would be especially problematic when the Bible affirms such things about the sun and other similar creatures that are "very far from the primary function of the Holy Writ",[54] which is, as he will later affirm, to lead to human salvation. If the Bible were to speak naked and unadorned truth about the earth and the sun, it would more likely harm its primary intention than help it. Here we have the principle of scriptural limitation (PSL): the Bible is an authority only in matters of faith and morals.

(4) Galileo opens the next passage, probably with reference to Benito Pereira's *Commentarium in Genesim*,[55] with a very important principle: two truths are always in harmony. Since

> two truths can never contradict each other, the task of wise interpreters is to strive to find the true meaning of scriptural passages agreeing with those physical conclusions of which *we are already certain* and sure from *clear sensory experiences* (*il senso manifesto*) or from *necessary demonstrations* (*le dimonstrazioni necessarie*).[56]

The revealed truth and the natural truth are consistent, but the Bible needs to be interpreted on the basis of certain physical, natural truths, and not vice versa. Galileo establishes the principle of consistency (PC) and combines it with the principle of the priority of demonstration (PPD).

[54] GALILEI, "Letter to Castelli, 21 December 1613," p. 50.

[55] Some scholars see in this principle Galileo's allusion to one of the determinations of the Fifth Lateran Council, eighth session, 19 December 1513: "Cumque verum vero minime contradicat, omnem assertionem veritati illuminatae fidei contrariam, omnino falsam esse definitum." As cited in BUCCIANTINI – CAMEROTA, *Galileo Galilei: Sienza e religione*, p. 10, 15. As noted by Bucciantini and Camerota, Galileo in his *Letter to the Grand Duchess Christina* quoted (in Latin) a passage from Benedetto Pereira that contains the same principle. *Ibid.* See also Finochiaro, *The Galileo Affair*, p. 97 (87–118): "Near the beginning of his work On Genesis, Pererius asserts: 'In treating of Moses's doctrine, one must take diligent care to completely avoid holding and saying positively and categorically anything which contradicts the decisive observation and reasons of philosophy or other disciplines; in fact, since all truths always agree with one another, the truth of Holy Scripture cannot be contrary to the true reasons and observations of human doctrines.'"

[56] GALILEI, "Letter to Castelli, 21 December 1613," p. 51 (emphasis added).

(5) The Bible was dictated by the Holy Spirit. For the above-mentioned reasons (an anthropomorphic God, for example), many passages admit of different interpretation far from the literal meaning. And since it is also possible that many interpreters do not speak by divine inspiration, Galileo continues,

> I should think it would be prudent not to allow anyone to oblige scriptural passages to maintain the truth of any physical conclusion whose contrary could *ever* be proved to us by the senses and demonstrative and necessary reasons (*il senso e le ragioni demonstrative e necessarie*).[57]

This is the principle of prudence (PP) in combination with, again, the principle of the priority of demonstration (PPD): as far as natural conclusions are concerned, one must be careful not to interpret the Bible in a definite manner *whenever* there is a possibility that the contrary of the physical conclusion the interpreter of the Bible established from its words could be proved by natural investigation.

To summarize, according to Galileo, the Bible is absolutely true, it can never err. The Bible is a result of divine word (*Logos*). Its interpreters can err in various ways. One of the most common mistakes the biblical interpreters commit is that they stick to the literal meaning of the words of the Bible. To stick to this principle in the interpretation of the Bible would lead to serious heresies and blasphemies. The language of the Bible is accommodated to the capacity of the understanding of the common people; therefor it had to hide some of the basic dogmas of the Christian faith. It needs a wise interpreter. The wise interpreter will go behind the literal meaning of its language to find the message that leads to human salvation. And the wise interpreter should not interpret the Bible in matters physical, since it is possible that a different natural truth could be established in the future.

On the other hand, nature is also a result of the divine word; it is also true, but its language is different from that of Holy Scripture. Its language is under severe obligations, it cannot change. Therefore the primacy in the interpretation of things natural must be on the side of the interpreters of nature. The interpretation of the Bible should follow upon the *certainties* provided by natural philosophy through sensory experience and necessary demonstration. Even more: Galileo again underlines that the aim of the Bible is to lead to human salvation and its domain is beyond rational reflec-

[57] *Ibid*. (emphasis added).

tion. The authority of the Bible is limited only to those spheres that surpass all human reasoning, all rational reflection, that is, to

> the aim of persuading men of those articles and propositions which are *necessary for their salvation* and *surpass all human reason*, and so could not become credible through some other science or any other means except the mouth of the Holy Spirit itself.[58]

The interpreter of the Bible should interpret its language according to its primary aim, which is to lead to human salvation; therefore it should not be evoked in questions pertaining to the natural matters.

It is very unlikely that God would want to speak through the Holy Spirit about the natural truth. Since God himself provided us with the senses, language, and intellect, it is hardly believable that He would want us to bypass their use and the information we can obtain thereby, especially in those sciences that are treated in the Bible very sporadically and only in very limited manner:

> This applies especially to those sciences about which one can read only very small phrases and scattered conclusions in the Scripture, as is particularly the case for astronomy, of which it contains such a small portion that one does not even find in it the names of all planets.[59]

Galileo concludes the first part of the letter with a general reflection on the issue of who is wrong and who is right in the question of how to proceed "in disputes of natural phenomena that do not directly involve the Faith":[60] those who give the first place to the Bible or those who give the first place to experiences and necessary demonstrations. Those who are absolutely sure to possess "the true meaning of a particular scriptural passage"[61] and are therefore also "sure of possessing the absolute truth on the question they intend to dispute about",[62] that is, questions of physical matters, will be – in the event that the other one is right in the scientific dispute – at a great disadvantage. The person who is right in a scientific dispute "will be able to provide a thousand experiments and a thousand necessary demonstrations

[58] *Ibid*. (emphasis added).
[59] *Ibid*.
[60] *Ibid*., p. 52.
[61] *Ibid*.
[62] *Ibid*.

(*mille esperienze e mille dimostrazioni*) for his side, whereas the other person can have nothing but sophisms, paralogisms, and fallacies".[63]

Finally, in the last part of the letter, Galileo examines a specific passage from Holy Scripture, the *Book of Joshua* 10, 12–13:

> Then Josue [or Joshua] spoke to the Lord, in the day that he delivered the Amorrhite in the sight of the children of Israel, and he said before them: Move not, O sun, toward Gabaon, nor thou, O moon, toward the valley of Ajalon. And the sun and the moon stood still, till the people revenged themselves of their enemies. Is not this written in the book of the just? So the sun stood still in the midst of heaven, and hasted not to go down the space of one day.[64]

I would like to point to Galileo's carefulness in formulating his approach. Let us assume and concede to the opponents – he says – that the words of the Holy Spirit should be taken at their literal meaning: God answered Joshua's prayers by stopping the sun and lengthening the day. Now, *if this* hermeneutical principle is to be applied, then this passage does not show the impossibility of the Copernican system, but on the contrary, the impossibility of the Aristotelian and Ptolemaic world system. Moreover, this passage agrees very well with the Copernican, heliocentric system:

> Let us then assume and concede to the opponent that the words of the sacred text should be taken precisely in their literal meaning, namely that in answer to Joshua's prayers God made the sun stop and lengthened the day, so that as a result he achieved victory; but I request that the same rule should apply to both [...]. Given this, I say that this passage shows clearly the falsity and impossibility of the Aristotelian and Ptolemaic world system, and on the other hand agrees well with the Copernican one.[65]

How is this possible? In the Aristotelian-Ptolemaic cosmos, the sun is a planet that moves with two movements. It moves with its daily motion with the rest of the planets and the stars from the east to the west, but it also moves with the annual motion from the west to the east. This second, annual motion is the sun's proper motion; it has a specific period of one year. But the daily motion from east to the west is not its own, it belongs to the highest heaven, that is, to *Primum Mobile* – in Italian, *il primo mobile*, and in English, *Prime Mobile* – (see Figure 1).

[63] *Ibid*.
[64] *Joshua* (Josue) 10, 12–13. Quoted from Douay-Rheims 1899 American Edition.
[65] GALILEI, "Letter to Castelli, 21 December 1613," pp. 52–53.

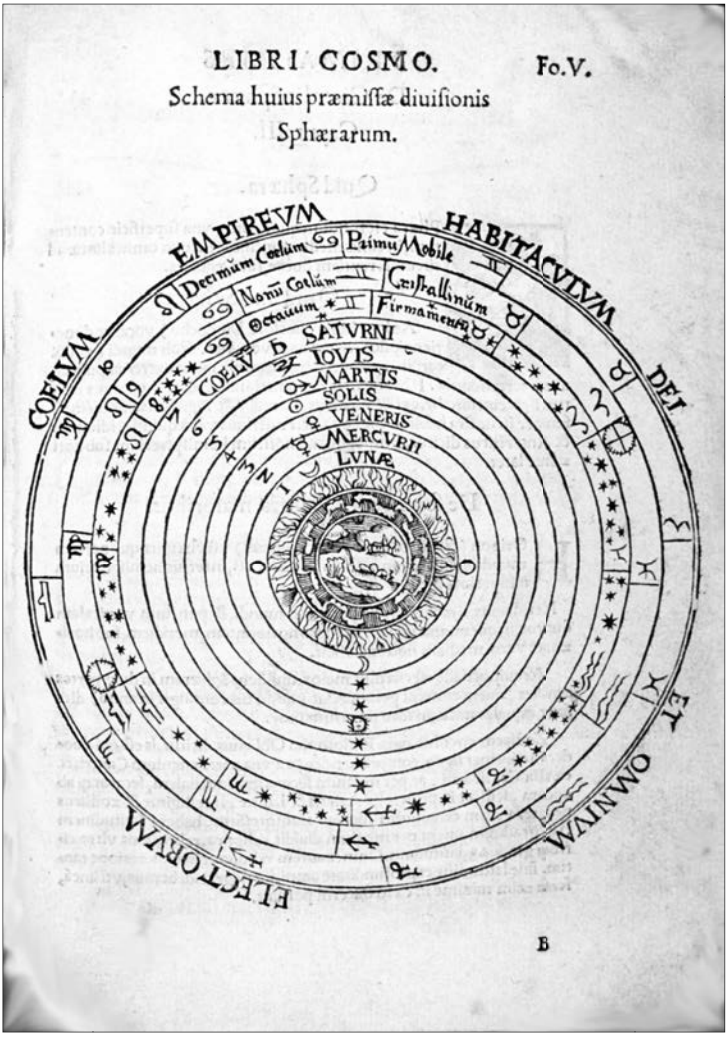

Figure 1: *Aristotelian Cosmos by Peter Apian,* Cosmographicus liber*, Antwerp 1584.* Source: Courtesy of the History of Science Collections, University of Oklahoma Libraries.

Primum Mobile makes the sun, other planets, and the stellar sphere make a revolution in 24 hours. Since it is obvious that daily motion, which is a result of the activity of the *Primum Mobile*, produces day and night, it follows that in order to lengthen the day, God should not stop the sun, but the *Primum Mobile*. If God were to stop the sun, He would cut and shorten the day and not lengthen it. Why? Because the sun's proper motion, its annual motion, is contrary to its daily motion. The more it moves from west to east, the more its progression towards the west is slowed down. If it were to stop moving from the west to the east, it would set sooner in the west. It follows that if God were to stop the proper motion of the sun, that is, its annual motion from the west to the east, it would shorten the day. The conclusion of Galileo's explanation is obvious: in the Aristotelian-Ptolemaic universe it is absolutely impossible to stop the sun and lengthen the day.

Now, this creates a dilemma: either the Aristotelian-Ptolemaic system is wrong or the words of the Bible must not be understood literally. In the event one decides on the second option, then he or she must admit that Bible says that God stopped the sun, it actually says that God stopped the *Primum Mobile*. This would also mean that the Bible accommodated to the capacity of those who are barely capable of understanding the rising and setting of the sun. If the Bible were to speak to the educated, it would have said that God stopped the *Primum Mobile*.

Another argument against God stopping the sun is that He could not stop only the sun and let the other spheres (those of the planets and of the fixed stars) proceed. This would bring complete chaos into the universe: the order, appearances, and arrangements of the relations of the other stars in relation to the sun would be disturbed. On the other hand, if God were to stop the *Primum Mobile* and thus the whole system, there would not be any disturbances therein.

But this non-literal interpretation is out of the question. It was agreed that we should understand the words of the Bible literally, not change them. What remains is the first option, i.e. that the Aristotelian-Ptolemaic system is wrong and that "it is necessary to resort to another arrangement of the parts of the world and to see whether the literal meaning of the words flows directly and without obstacle from its point of view".[66] And yes – what a surprise – this is the case.

[66] *Ibid*., p. 54.

Galileo has "discovered and conclusively *demonstrated*"[67] that the solar globe revolves.[68] According to Galileo – and this is not a result of his telescopic observations but purely natural philosophical speculation – in the Copernican system the sun is "the chief instrument and minister of nature and almost the heart of the world".[69] It is therefore "very probable and reasonable"[70] that the sun does not give only light "but also motion to all the planets that revolve around it".[71] Since in the Copernican system the earth has a diurnal rotary motion, it is manifest that this is the way how "by stopping the sun one can lengthen the day on the earth, without introducing any confusion among the parts of the world and without altering the words of the Scripture".[72]

2. What is Galileo's argumentation in *Letter to Castelli*?

What exactly is Galileo's point in his *Letter to Castelli*? On the one hand, he establishes very strong hermeneutical principles that seem to exclude the Bible almost entirely from natural philosophy, but on the other hand, he evokes the Joshua passage and interprets it *literally* in support of the Copernican system, which gives the impression that he contradicts his own precepts.

McMullin, for example, claims that Galileo ends the letter with "an ingenious ad hominem argument, which has puzzled some of his commentators who have not realized that he is arguing ad hominem".[73] And he comments – referring to Galileo's telescopic observations regarding the sun's rotation – that Galileo "cannot resist adding a further gloss that is a little *too* clever".[74] According to him, Galileo's evocation of the sun's rotation as the cause of the motion of the planets (which means that God stopped the sun, as the Bible has it) "is incompatible with what he has just argued about the irrelevance of Scripture in matters physical".[75] And he adds, Galileo "intended this postscript as an extension of the ad hominem argument: if you insist on

[67] *Ibid*.
[68] *Ibid*. (emphasis added).
[69] *Ibid*. Galileo developed this line of reasoning also in his "Letter to Dini, 23 March 1615," and in his "Letter to the Grand Duchess Christina."
[70] GALILEI, "Letter to Castelli, 21 December 1613," p. 54.
[71] *Ibid*.
[72] *Ibid*.
[73] McMULLIN, "Galileo's Theological Venture," p. 101.
[74] *Ibid*.
[75] *Ibid*.

literal interpretation here, he was saying to the Aristotelians, I will come out ahead."[76]

I agree with McMullin that Galileo's argument is *ad hominem*, but, in my view, he does not do complete justice to Galileo's argumentative strategy. What exactly is Galileo's logic here? Is he really being "incompatible with what he has just argued about the irrelevance of Scripture in matters physical"?[77]

It seems to me that to correctly understand Galileo's argumentative strategy we should take into consideration the wider historical context, which is not limited only to matters theological, that is, to the domain of constant theological attacks on the motion of the earth, Copernicus, and Galileo, but extends also into the domain of Galileo's observations, discoveries, and conclusions. For a proper understanding of Galileo's *Letter to Castelli*, we should take into consideration *both perspectives* at the same time.

2.1 The theological context

There is, as is well known, more than enough evidence that supports the general thesis that Galileo's was in a way forced to address the theological issue of the compatibility of Copernicanism with Holy Scripture because he was under consistent and continuous theologically motivated attacks. From 1610 on, he was aware of several instances of evocations of biblical passages that, according to his opponents, prove that Copernicus and Galileo, in arguing that the motion of the earth is a natural truth, are wrong.[78]

Already in 1610, Lodovico della Colombe, the leader of the so-called "pigeon league" (*Lega delle Colombe*) in his manuscript *Trattato contro moto della Terra (A Treatise against the Movement of the Earth)*, which circulated in Florence, affirmed that the movement of the earth is not in contradiction only with Aristotelian philosophy, but also with Christian theology, that is, it contradicts the revealed truth of the Bible. Delle Colombe quoted several sentences that according to him spoke clearly against Copernicus and Galileo.[79]

[76] *Ibid*., pp. 101–102.
[77] *Ibid*., p. 102.
[78] For a broader historical context and an overview of theological concerns, *a propos* Galileo and his Copernicanism, see, for instance, CAMEROTA, *Galileo Galilei*, pp. 260–265; Paolo PONZIO, *Copernicanesimo e Teologia. Scrittura e Natura in Campanella, Galilei e Foscarini*. Bari: Levante editori 1998, pp. 45–60; Luigi GUERRINI, *Galileo e la polemica anticopernicana a Firence*. Firenze: Edizioni Polistampa 2009.
[79] Lodovico DELLE COLOMBE, *Trattato contro moto della Terra*. In: *OGG*, III, pp. 289–290 (253–290).

Against the motion of the earth, he quoted Psalms 103, 5: "Fundasti terram super stabilitatem suam [Who hast founded the earth upon its own bases]."[80] That the earth is situated at the center of the universe is, according to him, supported by Job, 26, 7: "Qui appendit Terram super nihilum [and hangeth the earth upon nothing]", which means, according to Delle Colombe, "*super centrum*." We are told that the earth is heavy and cannot move by Proverbs, 8, 25: "Necdum montes gravi mole constiterant [The mountains with their huge bulk had not as yet been established]"; Isaiah, 40, 12: "Quis liberavit in pondere montes? quis appendis tribus digitis molem Terrae? [Who hath poised with three fingers the bulk of the earth, and weighed the mountains in scales?]", and Proverbs, 27, 3: "Grave est saxum et onerosa arena [A stone is heavy, and sand weighty]." Another instance of the biblical text supporting the central position of the earth is Proverbs, 25, 3: "Caelum sursum et terra deorsum [the heaven above and the earth beneath]."[81] In favor of the sun's mobility, Delle Colombe referred to Ecclesiastes, 1, 5–6: "Oritur sol, et occidit et ad locum suum reveritur, ibique renascens girat per meridiem, et flectitur ad aquilonem [The sun riseth, and goeth down, and returneth to his place: and there rising again, Maketh his round by the south, and turneth again to the north]." Another passage in support of sun's mobility is the *Book of Joshua* 10, 12–13. And against specifically Galileo's claim that the Moon is another earth, he found support in Genesis, 16: "Fecit Deus duo luminaria, idest luminare maius, et luminare minus et stellas ut lucerent super Terram [And God made two great lights: a greater light to rule the day; and a lesser light to rule the night: and the stars]." Delle Colombe also warned against a non-literal interpretation of the Bible, referring to "all the theologians" which who say that when the Bible can be understood literally, it should never be interpreted differently.

The following year, in December of 1611, Galileo was informed by his friend Lodovico Cardi da Cigoli of the schemes of some persons who gathered in the house of the Archbishop of Florence, Alessandro Marci Medici.[82]

[80] I am quoting from Delle Colombe (see the note above). The English translations are taken from Douay-Rheims 1899 American Edition.
[81] Delle Colombe wrongly refers to *Proverbs* 30.
[82] See Lodovico Cardi DA CIGOLI, "Letter to Galileo, 16 December 1611." In: *OGG*, XI, pp. 241–242.

During the next couple of years Galileo was occupied with the observation of sunspots, an exchange of letters with Christopher Scheiner regarding these phenomena, and with the preparation of these letters for publication. One of Galileo's conclusions was that sunspots are constantly generated and vanishing on the sun itself, which has profound philosophical consequences. This discovery proves that the heavens (in Aristotelian natural philosophy the superlunary region) are – against the belief of Thomists and Aristotelians – not perfect and unchangeable, but corruptible. For this reason and because of the theological concerns of the compatibility between the heliocentric system and the Bible, Galileo wrote in the summer of 1612 to his personal acquaintance Cardinal Carlo Conti, at the time the prefect of the congregation of the Sacred Office,[83] and asked him for his opinion on the compatibility of the Aristotelian system with the Bible.

Conti responded on 7 June 1612 that "there is no doubt whatsoever that Scripture does not support Aristotle, but rather, it even supports the contrary judgement, such that it was commonly believed by the Church Fathers that the heavens were corruptible."[84] As far as the circular motion of the earth is concerned, it seems, according to Conti,

> less in conformity with Scripture. For although those passages that say that the earth is stable and firm can be understood as referring to the eternity of the earth [...], nevertheless, where it says that the sun goes around and the heavens move, Scripture can only be interpreted as speaking according to the common manner of the people, and that mode of interpretation is not to be admitted unless absolutely necessary.[85]

[83] He became acquainted with Cardinal Conti during the spring of 1611, when he visited Rome.
[84] Carlo CONTI, "Letter to Galileo, 7 July 1612." In: GALILEI – SCHEINER, *On Sunspots*, Appendix 3, p. 349 (349–351). Conti wrote a second letter, 18 August 1612. See Carlo CONTI, "Letter to Galileo, 18 August 1612," In: GALILEI – SCHEINER, *On Sunspots*, Appendix 3, pp. 351–352. On this, see Antonino POPPI, "La lettera del cardinale Carlo Conti a Galileo su cosmologia aristotelica e Bibbia (7 Iuglio 1612): l'approdo galileiano alla nuova ermeneutica biblica." In: Antonino POPPI, *Richerce sulla teologia e la scienza nella Scuola padovana del Cinque e Seicento*. Soveria Mannelli: Rubbettino 2001, pp. 189–217. See also PONZIO, *Copernicanesimo e teologia*, pp. 50–52.
[85] CONTI, "Letter to Galileo, 7 July 1612," pp. 350–351. For consistency reason capitalized "Sun" and "Earth" in Reeves' and Van Helden's translation are changed into "sun" and "earth".

Conti also mentioned the *In Iob commentaria* (*Commentary on Job*) of the Spanish theologian Diego de Zúñiga, according to whom "it is more in conformity with Scripture to say that the earth moves",[86] but Conti also added that "this interpretation is not generally followed".[87]

The next important development on the theological front occurred during the revision of *Lettere solari*.[88] In the draft of the second letter, Galileo, obviously relying on Conti's clarifications, wrote the following on the perfection of heaven and the Biblical truth:

> Who is it that, after having seen, observed, and considered these matters, would want to persist in a belief that it is not only false, but erroneous and *repugnant to the indubitable truths of the Sacred Scripture* as well? For Scripture tells us that the heavens and the entire world are not only generable and corruptible, but also generated and dissoluble and transitory. Notice how Divine Goodness, in order to retrieve us from such an immense error, inspires some people with the necessary approaches.[89]

The censors were not satisfied with Galileo's evocation of Sacred Scripture and Galileo rephrased the first formulation.[90] But the censors were still not satisfied and Federico Cesi, who in Rome was in charge of overseeing the publication process, asked Galileo what to do in the case of his statement at the end of the second letter, where he wrote that "the corruptibility of the

[86] *Ibid*., p. 351. Diego DE ZÚÑIGA (Lat. Didacus À STUNICA) published *In Iob commentaria* in 1584 in Toledo. The commentary was reprinted in 1591 in Rome. For more on him, see Navarro BROTÒNS, "The Reception of Copernicus in Sixteenth-Century Spain: The Case of Diego de Zúñiga." *Isis*, vol. 86, 1995, no. 1, pp. 52–78; Irving A. KELTER, "The Refusal to Accommodate: Jesuit Exegetes and the Copernican System." *The Sixteenth Century Journal*, vol. 26, 1995, no. 2, pp. 273–283; PONZIO, *Copernicanesimo e Teologia*, pp. 39–43.
[87] CONTI, "Letter to Galileo, 7 July 1612," p. 351.
[88] *Ibid*. For the prelude and the question of the corruptibility of heaven, see also GUERRINI, *Galileo e la polemica anticopernicana a Firenze*, pp. 52–55. For the intervention of the censors, see ROSSI, "Galileo e il *Libro dei Salmi*," pp. 69–70; STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," pp. 38–47; PONZIO, *Copernicanesimo e teologia*, pp. 25–60; Pietro REDONDI, "Fede lincea e teologia tridentina." *Galilaeana,* vol. 1, 2004, pp. 120–124 (117–141).
[89] As cited in GALILEI – SCHEINER, *On Sunspots*, p. 240 (emphasis added). For an analysis of the distinction between falsity (*falsità*) and error (*erroneità*), see STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," pp. 41–43.
[90] For the second formulation, see GALILEI – SCHEINER, *On Sunspots*, pp. 240–241.

heavens conforms to Scripture and is indicated by it".[91] And he added that "they don't want you to say anything about the Scripture in that passage".[92]

In the meantime, on 1 November 1612, the theological question of Copernicanism gained new impetus. The Florentine Dominican Niccolò Lorini attacked the movement of the earth and Copernicus in a private conversation, saying that it contradicts the Holy Bible. When Galileo found out about the event he wrote a protest letter (now lost) to Lorini. Lorini responded, expressing his surprise at being accused of disputing philosophical questions. He admitted to referring to the "opinion of that Ipernicus, or whatever his name is"[93] and added that his opinion seems to be against the Holy Bible. A month after this, Galileo dismissed Lorini with irony in a letter to Federico Cesi, by stating that in Florence, there is "an incompetent conversationalist who has decided to oppose the mobility of the earth. But this good fellow is so unfamiliar with the founder of that doctrine that he calls him 'Ipernicus'. Now your Excellency can see how and from whom poor philosophy is jolted."[94]

And in November 1613 Benedetto Castelli, who had just started to teach mathematical arts at the University of Pisa, informed Galileo that he was warned not to teach about the motion of the earth.[95]

Those theological concerns and attacks on Copernicus and Galileo would probably have been relegated to oblivion if Galileo's foes had not organized a sophisticated attack on him and his opinions – mentioned at the beginning of the article – at the heart of Tuscan power, in the circle of the Medici family. One month after the warning to Castelli to not teach about the motion of the earth, that is, in December 1613, Castelli was invited to

[91] Federico CESI, "Letter to Galileo, 10 November 1612." In: GALILEI – SCHEINER, *On Sunspots*, p. 241.
[92] *Ibid*. The beginning of the quoted passage reads: "[I]n sum, one can only dislodge the Peripatetics little by little. I wrote according to the law [*in jure*] (so to speak) on the basis of the evidence, adducing ten passages in Scripture and as many from the patristic writers that confirm what you say, that the corruptibility of the heavens conforms to Scripture and is indicated by it. It was not enough, and they replied that those same passages had been very thoroughly interpreted by others in a Peripatetic way; so you must have patience." See also STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," p. 39.
[93] Niccolò LORINI, "Letter to Galileo, 5 November 1612." In: *OGG*, XI, p. 427. The translation is taken from Stillman DRAKE, *Galileo at Work: His Scientific Biography*. New York: Dover Publications 1995, p. 197.
[94] Galileo GALILEI, "Letter to Cesi, 5 January 1613." In: *OGG*, XI, p. 641. The translation is taken from: FANTOLI, *Galileo for Copernicanism and for the Church*, p. 128.
[95] See Benedetto CASTELLI, "Letter to Galileo, 6 November 1613." In: *OGG*, XI, p. 606.

a meal at the Medici court in Pisa. Besides him the following were present: the young Grand Duke, Cosimo II de'Medici, ruler of the Grand Duchy of Tuscany, his wife Maria Magdalena of Austria, Cosimo's mother the Grand Duchess Christine of Lorraine, his uncle Antonio de' Medici, a relative of the ducal family Don Paolo Giordano Orsini, and professor of philosophy at the University of Pisa Cosimo Boscaglia. The discussion was about the activities at the University. Castelli also told Cosimo II that he had a telescope and began to talk about his observation of the Medicean planets (the satellites of Jupiter) made on the previous day.[96] During the meal Boscaglia had been whispering for a long time into the ear of the Grand Duchess Christine of Lorraine. He admitted as true all the novelties discovered by Galileo with the telescope, but also said that "the earth's motion was incredible and could not happen, especially since the Holy Scripture was clearly contrary to this claim".[97] After the meal, Castelli was called back and summoned to the chambers of Christine of Lorraine, and the Grand Duchess evoked a passage from the *Book of Joshua* where it is said that Joshua commanded the sun and the Moon to stand still over the valley of Ayalon to allow the Israelites to defeat their enemies:

> Her Ladyship began to argue against me by means of the Holy Scripture. I first expressed the appropriate disclaimers, but then I began to play a theologian with such finesse and authority that you would have been especially pleased to hear. Don Antonio helped and encouraged me so much that I behaved like a champion, despite the fact that the majesty of their Highness was enough to frighten me. The Grand Duke and the Archduchess were on my side, and Don Paolo Giordano came to my defense with a very appropriate passage from the Holy Scripture. Only Her Ladyship contradicted me, but in such a way that I thought she was doing it in order to hear me. Mr Boscaglia remained silent.[98]

This context of constant evocations of the Bible in matters physical, and especially the discussion in the circle of the rulers of Tuscany explains why Galileo had to take the theological dimension of Copernicanism seriously and why he had to address the problem of how to explain the Joshua passage mentioned by the Grand Duchess Christine. It should be noted that those who discussed the Bible/natural philosophy issue (especially the heliocen-

[96] See Benedetto CASTELLI, "Letter to Galileo, 14 December 1613." In: FINOCCHIARO, *The Galileo Affair*, p. 47.
[97] *Ibid*., p. 48.
[98] *Ibid*.

tric world system) were not unanimous. Some attacked the movement of the earth and Galileo's commitment to it on grounds that it contradicts the Bible, which they read literally (Delle Colombe, Lorini, Boscaglia), some did not want any reference to the Bible (the censors of the *Istoria*), and some were – some more and other less – on his side (Cardinal Conti, who informed Galileo about Diego de Zúñiga, Cesi, Castelli, and others from the circle of Galileo's friends and supporters, and, most important, the Medici family and the Grand Duchess Christine of Lorraine herself). This context of constant attacks against Galileo's Copernican conclusions on theological grounds, some of them directed directly against Galileo (Delle Colombe, Lorini) explain *why* he was forced – *volens nolens* – to delve into the theological dispute. But it still does not does not explain his pro-Copernican literal reading of the Joshua passage in *Letter to Castelli*.

For a comprehensive understanding of his position, one also needs to examine the other side of the coin; one needs to look at the issue from Galileo's perspective as a mathematician and philosopher who discovered numerous things, (more or less) all of which were in Galileo's eyes new and constant proofs against the Aristotelian-Ptolemaic cosmos and in favor of the Copernican system.

2.2 The natural context

Let us briefly revive Galileo's celestial discoveries, or what he calls in *Letter to Castelli* "a thousand experiments and a thousand necessary demonstrations", and his Copernican interpretations of them.[99]

It is – I believe generally – known what Galileo's observations, discoveries, and conclusions were. Galileo claimed that there are mountains and valleys on the Moon (the Moon is like the earth and the earth is like the Moon); that the Milky Way is composed of an unaccountable number of stars; that Jupiter has four companions; that Venus displays phases just like the Moon; that Saturn is composed of three bodies, three stars; and finally,

[99] For an in-depth analysis of Galileo's telescopic discoveries and their relevance as proofs for the Copernican world system, see, for example, Noel M. SWERDLOW, "Galileo's Discoveries with the Telescope and Their Evidence for the Copernican Theory." In: MACHAMER, *The Cambridge Companion to Galileo*, pp. 244–270; William SHEA, "Galileo's Copernicanism: The Science and the Rhetoric." In: MACHAMER, *The Cambridge Companion to Galileo*, pp. 211–243; and Philippe HAMOU, *La mutation du visible. Essai sur la portée épistémologique des instruments d'optique au XVIIe siècle. Vol I: Du Sidereus nuncius de Galilée à la Dioptrique cartésienne*. Villaneuve d'Ascq (Nord): Presses universitaires du Septentrion 1999, pp. 29–79.

that there are spots on the surface of the sun or very near the sun and that the sun rotates.

There are several epistemological questions that need to be addressed with regard to these observation, discoveries, and conclusions: How much were they influenced by Galileo's prior Copernican convictions?[100] Do they really constitute a decisive proof for the Copernican cosmology?[101] But for my purpose here, I shall be satisfied with the fact that Galileo himself believed that what he had discovered constitutes demonstrative proof of the Copernican cosmos. I cannot go into all the details of how Galileo himself fashioned his "discoveries"[102] and conclusions in a Copernican manner, but there is a clear and progressive conviction in his formulations as far as the absolute truth of the Copernican system is concerned and consequently of his commitment to this system. Galileo's Copernican interpretation of his newly obtained observations and conclusions went from relatively cautious in *Sidereus nuncius* to completely clear in some of his (semi-)private letters and especially in *Lattere solari*.

In *Sidereus nuncius* Galileo is still relatively cautious in expressing his Copernican commitment. Here are some passages where he (more or less) clearly affirms the truth of the Copernican system of the world.

The first passage comes already in the Dedication to Cosimo II de' Medici. Galileo explains the four satellites of Jupiter, dedicated to the Medicean family, and says:

> Behold, therefore, four stars reserved for your famous name. They do not belong to the common and less distinguished multitude of fixed stars but to the illustrious rank of the planets. Moving at different rates around Jupiter, the noblest of the planets, as if they were his own children, they trace out their orbits with marvelous speed while, at the same time, with one harmonious accord, they go round the centre of the world, namely the sun itself, and complete their great revolution in twelve years.[103]

[100] Especially intriguing is Galileo's reasoning in the case of the mountains and valleys on the Moon.

[101] I will briefly address this issue below.

[102] Some of these were – as Kepler made clear to Galileo in his *Dissertatio cum Nuncio Sidereo* (*Conversation with the Sidereal Messenger*) – not exactly news, but confirmations of old theses and philosophical speculations.

[103] Galileo GALILEI, *Galileo's Sidereus Nuncius or A Sidereal Message*. Sagamore Beach: Science History Publications 2009, p. 52. For consistency reason capitalized "Sun" and "Earth" in William R. Shea's translation are changed into "sun" and "earth".

This seems to be a very straightforward affirmation of Galileo's commitment to the Copernican system of the world, or, as William Shea states, "Galileo's first public commitment to the view that the centre of the world is not the earth, as Aristotle and Ptolemy believed, but the sun."[104] This is true, but Galileo also clearly avoids any mention of the motion of the earth and the obvious analogy between Jupiter with its four satellites and the earth and its satellite Moon must be made by the reader him/herself.

In the next Copernican passage in *Sidereus nuncius* Galileo compares the movement of Jupiter's satellites with the movement of Venus and Mercury around the sun. The first time already in the dedication, where he says:

> [W]hat is even more admirable, and what we mainly want to let astronomers and philosophers know, is that we have found four wandering stars that no one before us had heard about or observed, and that these revolve around one of the conspicuous planets. Like Venus and Mercury, which go around the sun, they have their own periods of revolutions so that they sometimes precede, sometimes follow their planet but in such a way that they never stray beyond certain limits.[105]

This is again a relatively indirect reference to the Copernican system. The reader must again divine which system Galileo has in mind when he mentions the movement of Venus and Mercury around the sun. There are (at least) three possibilities. The Copernican system, but in his system not only Venus and Mercury circle the sun but other planets as well. The second is the system mentioned by Copernicus in *De revolutionibus*,[106] according to which only Venus and Mercury circle the sun, while they all make a revolution around the stationary earth, and the geo-heliocentric system of Tycho Brahe in which the earth is motionless in the center of the universe, and all the planets go around the sun and all together around the earth.

The fact that four satellites circle Jupiter proves that there are several centers of motion in the universe, not just one, and Galileo comments on this as follows:

> Furthermore, we have a particularly strong argument to remove the scruples of those who are willing to examine dispassionately the revolution of the planets about the sun in the Copernican system, yet are so troubled by the fact that

[104] *Ibid*., p. 97, 18.
[105] *Ibid*., p. 56.
[106] See Nicholas COPERNICUS, *On the Revolutions*. Baltimore – London: Johns Hopkins University Press 1992, p. 20.

> our one and only Moon should go around the earth while at the same time both carry out an annual revolution around the sun, that they consider that this theory about the constitution of the universe should be rejected as impossible. But now we have not only one planet revolving about another one, while the both trace out an annual circle around the sun, but our own eyes show us four stars travelling around Jupiter as the Moon travels around the earth while, at the same time, they make a grand revolution around the sun.[107]

Again, this is less a direct argument for the Copernican system of the universe – although Galileo implicitly clearly endorses it with the movement of the satellites –, but in its formulation this is more a solution to an objection against the Copernican system. Those who believed in Tycho Brahe's geo-heliocentric system argued that in the Copernican system the planet earth cannot move with the speed that is required for its revolution around the sun and take with itself also the Moon. This objection to the Copernican system is disabled by the discovery of the four satellites that circle Jupiter, while they all circle the sun. There are many centers of the movement and if one accepts the Copernican system, then there is not just a satellite Moon that circles the sun with earth, but also Jupiter's four satellites. The Moon is no longer an anomaly in the Copernican system.

In *Sidereus nuncius*, arguably Galileo's most manifest declaration of his commitment to the motion of the earth and to the Copernican system of the world comes in a description of the Moon, when he is discussing the Moon's secondary light, therefore something not related to his telescopic discoveries. This is according to Galileo a proof that, like the Moon, the earth also is a planet and that it shines with borrowed light:

> Let these few words suffice here. The matter will be considered more fully in our System of the World, where it will be shown by means of numerous arguments and experiments that the reflection of the sunlight from the earth is indeed very strong. This for the benefit of those who claim that the earth must be removed from the round of stars, chiefly for the reason that it has neither motion nor light. We shall demonstrate that it is in the motion, that it surpasses the moon in brightness, and that there is not the bilge where the rubbish and the refuse of the world have settled down. Furthermore, we shall confirm this with a thousand physical arguments.[108]

[107] GALILEI, *Galileo's Sidereus nuncius or A Sidereal Message*, p. 70.
[108] *Ibid*.

This is the only passage where Galileo talks specifically about the motion of the earth. In sum: Galileo's telescopic observations and discoveries published in *Sidereus nuncius* determinately confirmed his previous Copernican convictions. As of *Sidereus nuncius*, Copernicanism becomes, as Philip Hamous affirms, "*un thème moteur dans la carrière scientifique et publique de Galilée*".[109] Galileo's further work with the telescope made his belief in the truth of the Copernican worlds system even stronger.

When Galileo discovered that Venus, just like the Moon, completes all the phases, he wrote to Guliano de' Medici and explained to him how the phases of Venus prove that it circles:

> [A]round the sun, as do Mercury and all other planets – something indeed believed by the Pythagorean, Copernicus, Kepler, and myself, but not sensibly proved as it now is by Venus and Mercury. Hence Kepler and other Copernicans may glory in having believed and philosophized well, though this is but a prelude, and will continue a prelude, to our being reputed by the generality of bookish philosophers as men of little understanding and practically as fools.[110]

In comparison with the *Sidereus nuncius*, Galileo made a huge epistemological step forward with the publication of *Istoria e dimostrazioni intorno alle macchie solari e loro accidenti comprese in tre lettere.* As noted already by Massimo Bucciantini,[111] the epistemological difference between the two books is evident already from their respective titles. While *Sidereus nuncius* is about the astronomical news (in his letters Galileo calls *Sidereus nuncius* "*aviso astronomico*"), *Lettere solari* are about *istorie* (news) and *dimostrazioni,* demonstrations, compelling and necessary reasons that reveal the true system of the world. *Lettere solari* are the first text of Galileo's philosophy and his first completely clear declaration of his Copernican commitment to the general public.

Galileo's observations of the constantly changing spots on the sun and conclusions made from these observations can be summarized in three, completely non-traditional, points:

[109] HAMOU, *La mutation du visible,* p. 36.
[110] The translation is taken from DRAKE, *Galileo at Work*, p. 164. See also Galileo GALILEI, "Letter to Clavius, 30 December 1610." In: *OGG*, X, pp. 499–501, and Galileo GALILEI, "Letter to Benedetto Castelli, 30 December 1610." In: *OGG*, X, pp. 502–504.
[111] See Massimo BUCCIANTINI, *Galileo e Keplero. Filosofia, cosmologia e teologia nell'Età della Controriforma*. Torino: Einaudi 2007, p. 217.

a) the observed spots on the sun are constantly being generated and disappearing;

b) it appears that they are very close the sun; they may be contiguous to the sun's surface or close to it (like clouds to the earth) which is yet another argument against the Aristotelian belief in the incorruptibility of the superlunary universe. This discovery is, as Galileo said, "the final judgment" of the peripatetic philosophy;[112]

c) the sun rotates about its own axis and the spots participate in the rotation of the sun:

> We are informed by the particular characteristic of this motion [i.e. the sun's motion], first, that the body of the sun is absolutely spherical, and second, that it moves of itself and about its own center, carrying the said spots with it in parallel circles, and finishing an entire turn in about one lunar month, with a revolution similar to that of the orbs of the planets, that is, from west to east.[113]

In *Lettere solari* Galileo did not treat just the sunspots but also the appearance and behavior of other celestial bodies, that is, the form of Saturn and the phases of Venus and interpreted them consistently as proofs in favor of a heliocentric universe. Thus, in his first letter he claims that the phases of Venus

> will not leave room for anyone to be in doubt about the revolutions of Venus; they will lead with absolute necessity to the conclusion – one consistent with the positions of the Pythagoreans and of Copernicus – that its revolution is about the sun, around which, as the center of their revolutions, all the other planets turn.[114]

And in the third letter he wrote:

> But whether these things [i.e. the movement of the "Saturnine 'stars'"] take place precisely in this fashion or in another, I say to Your Lordship that this star, too, and perhaps no less than the emergence of horned Venus, agrees in a wondrous

[112] Galileo GALILEI, "Letter to Cardinal Maffeo Barberini, 2 June 1612." In: *OGG,* XI, p. 311.
[113] GALLIEI – SCHEINER, *On Sunspots*, p. 109 (emphasis added). For other authors (Plato, Telesio, Campanella, Giordano Bruno, Kepler) who also affirmed the rotation of the sun, see Michel-Pierre LERNER, "*Sicut nodus in tabula:* de la rotation propre du soleil au seizième siècle." *Journal for the History of Astronomy*, vol. 11, 1980, no. 2, pp. 114–125; see also BUCCIANTINI – CAMEROTA, *Galileo Galilei: Sienza e religione*, p. 15, n. 28.
[114] GALILEI – SCHEINER, *On Sunspots*, p. 93.

> manner with the harmony of the great Copernican system, to whose universal revelation we see such favorable breezes and bright escorts directing us, that we now have little to fear from darkness and cross-winds.[115]

3. *Letter to Castelli* in the light of Galileo's discoveries

What does all this mean for the interpretation of Galileo's *Letter to Castelli*? Galileo's observations and conclusions are, obviously, "sensory experiences" and "necessary demonstrations", "demonstrative and necessary reasons", "a thousand experiments and a thousand necessary demonstrations", from *Letter to Castelli*, which should support one who is right "in disputes of natural phenomena that do not directly involve the Faith". But the question is – as I have already stated – whether Galileo's discoveries with the telescope constitute a necessary truth (absolute truth) of the heliocentric constitution of the universe.

Noel Swerdlow is, in my view, basically right in affirming that "Galileo's discoveries with the telescope do not *by themselves* prove the heliocentric theory"[116] and that Galileo "never quite claimed that they do, although he certainly believed they came very close".[117] Galileo's discoveries by themselves and taken separately show that the Ptolemaic-Aristotelian cosmos is no longer plausible and remove many objections to the Copernican cosmos, but I would go a little bit further than Swerdlow and claim that *taken together*, that is, as *a whole*, they led Galileo not only to believe that he "came very close" to a proof of the heliocentric and geokinetic system, but also to proving it in an absolute manner. In short, in my opinion, Galileo was convinced that he had discovered "the absolute truth" of the (Copernican) universe. And I believe one could go even further: it was not just Galileo's *perception* of his own work that led him to believe he had discovered and demonstratively proved the "absolute truth". He was able to prove it by "necessary demonstrations", "demonstrative and necessary reasons" by the standards of 17th century "epistemology". All one needs to do is to accept Galileo's "scientific" methodology and his own demonstrations.[118]

[115] *Ibid*., p. 296.
[116] SWERDLOW, p. 247 (emphasis in the original). See also *ibid*., pp. 265–267.
[117] *Ibid*., p. 247.
[118] The question is, of course, what exactly his method consists of. What is "demonstrated truth" for him? Or, what exactly does he understand as "necessary demonstration"? On Galileo's method, see, for instance, Nicholas JARDINE, "Galileo's Road to Truth and the Demonstrative Regress." *Studies in the History and Philosophy of Science*, vol. 7, 1976, no. 4,

But the last issue is rather irrelevant for an understanding of Galileo's position in his *Letter to Castelli*. All that suffices is the fact that Galileo was certain that he was able to provide "sensory experiences" and "demonstrative and necessary reasons", "a thousand experiments and a thousand necessary demonstrations" in favor of the Copernican universe. But how does all this explain his position in *Letter to Castelli*? Does it explain Galileo's supposed contradiction with his own principles in reading and interpreting the Joshua passage in matters physical, and even more, his *literal* interpretation of the passage?

In *Letter to Castelli* Galileo established – let me summarize them once again – five hermeneutical principles regarding the interpretation of the Bible in natural matters:

1) the principle of accommodation (PA): The Bible should not be read and understood literally, it uses metaphorical language in order to accommodate the capabilities of the common people;

2) the principle of the priority of demonstration (PPD): the true meaning of scriptural passages must agree with physical conclusions of which *we are already certain* and sure from clear sensory experiences or from necessary demonstrations;

3) the principle of scriptural limitation (PSL): the Bible is an authority only in matters of faith and morals;

4) the principle of consistency (PC): two truths – that is, the revealed truth and the truth of nature – can never contradict each other; and

5) the principle of prudence (PP): one should be prudent and not require that scriptural passages maintain the truth of any physical conclusion whose contrary could *ever* be proved.

It appears that Galileo contradicts those very principles while reading and interpreting the Joshua passage literally and as a confirmation of the heliocentric world system. First, Galileo appears to contradict the principle of accommodation, since he reads the Bible literally. Second, he also seems

pp. 277–318; Enrico BERTI, "Differenza tra il metodo risolutivo degli aristotelici e la *resolutio* dei matemaci." In: OLIVIERI, L. (ed.), *Aristotelismo veneto e scienza moderna. Atti del 25º anno accademico del Centro per la storia della tradizione Aristotelica nel Veneto*. Padua: Antenore 1983, pp. 435–457. In my view, Galileo himself showed how to prove the truth of the Copernican world system in "Considerations on the Copernican Opinion" and in *Dialogue Concerning the Two Chief World Systems*.

to contradict the principle of the priority of demonstration, since he tries to prove the natural fact on the basis of the Bible. Third, he also seems to contradict the principle of scriptural limitation, since he clearly reads the Bible not just as a means to the salvation of the human soul, but takes it as having relevance in natural-philosophical questions. Fourth, he also appears to contradict the principle of prudence. The only principle that seems not to be in contradiction is the principle of the consistency of two truths.

In my view, this contradiction is mere appearance, caused by the wrong perspective. In my opinion, Galileo does not contradict himself at all, but to see that we need to change our perspective. Instead of looking at his position solely and primarily from the theological perspective, one should take a look at his position from his own perspective, which clearly is not theological. In my view, the right interpretation should start with the other side of the coin, that is, with "a thousand experiences and a thousand necessary demonstrations", which *taken together* provide a proof of the heliocentric cosmos.

The most fundamental thesis of Galileo is, in my opinion, the principle of the priority of demonstration (PPD), which he repeats several times in *Letter to Castelli*: in natural matters one should start with certainties obtained from "clear sensory experiences" and from "necessary demonstrations". One should first discover the truth of the universe, and then, after the truth is established, one can go forward and interpret the Bible accordingly. The true meaning of scriptural passages must agree with physical conclusions of which *we are already certain*. And Galileo is, in my view at least, *absolutely certain* that he had achieved the required certainty. In the domain of matters physical (the domain of reason) the Bible should be interpreted according to the truth discovered in the natural sciences. Since Galileo discovered (or came very close to) the absolute truth of the universe, he, as a "wise interpreter", can interpret the Bible.

From this fundamental assumption follows the rest. The Bible is about what surpasses reason. Its aim is human salvation. Therefore, it is an authority only in matters of morals and faith, which clearly limits the relevance of Scripture for matters physical (PSL). For this reason, its language has been accommodated to the common man. Therefore, the Bible should not be understood according to its literal meaning (PA), which also means that the Bible should not be interpreted as supporting physical conclusion whose contrary could *ever* be proved (PP).

This seems to exclude the Bible almost entirely from natural philosophy. But this is the ideal situation. This should, according to Galileo, be accepted by everyone. But it is not. There are constant evocations of the Bible, read

literally, as an authority in matters physical. The Grand Duchess's evocation of the Joshua passage was the last in the line of theological concerns about the compatibility of Copernicus and the Bible. Therefore Galileo is forced to address the theological question and find a way to explain the Joshua passage. Since the Bible is absolutely true and since two truths, the revealed truth of the Bible and the natural truth, two languages, "two books" cannot contradict each other, it is not just possible but *necessary* to find a way to show their consistency (PC). But this should be done on the basis of the discovered and proved natural truth, not *vice versa* (PPD). Circle closed.

Now, what about Galileo's *literal* interpretation of the Joshua passage? How does it fit into this scheme? From established truths (based on "sensory experiences" and "necessary demonstrations") – which at least for Galileo reveal clearly *the absolute truth* of the Copernican system – one can proceed to interpret the Bible in two ways: one is non-literal, which Galileo would prefer. The non-literal interpretation of the Bible is necessary in order to avoid blasphemies and heresies and to avoid eventual future changes in the domain of natural truth. The second one is literal, which should not be taken into account, but since there are many who interpret the Bible in a literal manner, Galileo is obliged to show that this is a big mistake which leads them into a trap favorable to him and Copernicus. "Let us then assume and concede to the opponent", says Galileo, "that the words of the sacred text should be taken precisely in their literal meaning".[119] In this case, in the case of a literal reading of the Bible, the Joshua passage "shows clearly the falsity and impossibility of the Aristotelian and Ptolemaic world system, and on the other hand agrees well with the Copernican one."[120]

Galileo's literal interpretation has only one goal: to show that a literal interpretation of the Bible, specifically the Joshua passage, does not confirm the Aristotelian universe, but the opposite one, the Copernican. He does not introduce the Joshua passage in order *to confirm* the Copernican system (he has already confirmed it by "a thousand experiments and necessary demonstrations"), but in order to show that those who read the Bible literally achieve exactly the opposite of what they wanted and pretended to achieve. They are certain that the Joshua passage confirms or proves the Aristotelian system and disproves the Copernican. But the result of a literal reading of the Joshua passage is that

[119] GALILEI, "Letter to Castelli, 21 December 1613," p. 52.
[120] *Ibid*., p. 53.

> it is absolutely impossible to stop the sun and lengthen the day in the system of Ptolemy and Aristotle, and therefore either *the motions must not be arranged as Ptolemy says* or *we must modify the meaning of the words of the Scripture*; we would have to claim that, when it says that God stopped the sun, it meant to say He stopped the Prime Mobile, and that it said contrary of what it would have said if speaking to educated men in order to adapt itself to the capacity of those who are barely able to understand the rising and setting of the sun.[121]

Thus, for Galileo the literal meaning should not be admitted. But since in this argumentation it has been agreed to not change "the meaning of the words in the [Joshua] text",[122] it is necessary "to resort to another arrangement of the parts of the world, and see whether the literal meaning of the words flows directly and without obstacle from its point of view". And this is exactly what happens. But Galileo does not continue by starting with the words of God (the Bible), but with the works of God (the universe), the truth of which he has discovered:

> For I have discovered and *conclusively demonstrated* that the solar globe turns on itself, completing an entire rotation in about one lunar month, in exactly the same direction as all the other heavenly revolutions; moreover, it is very probable and reasonable that, as the chief instrument and minister of nature and almost the heart of the world", the sun gives not only light (as it obviously does) but also motion to all the planets that revolve around it; hence, if in conformity with Copernicus's position the diurnal motion is attributed to the earth, anyone can see that it sufficed stopping the sun to stop the whole system, and thus to lengthen the period of the diurnal illumination without altering in any way the rest of the mutual relationships of the planets; and that is exactly how the words of the sacred text sound. Here then is the manner in which by stopping the sun one can lengthen the day on the earth, without introducing any confusion among the parts of the world and without altering the words of the Scripture.[123]

With this explanation – how the literal meaning of the Bible conforms to "another arrangement of the parts of the world" – Galileo clearly does not contradict his own hermeneutical principles. Galileo starts with experiences and demonstrations, with rational reasoning (the sun rotates around its axis and is like heart of the universe; it gives motion to the planets) and

[121] *Ibid*., pp. 53–54 (emphasis added).
[122] *Ibid*., p. 54.
[123] *Ibid*.

– since it was agreed that he should stick to the literal understanding of the Bible – shows that the Bible read literally agrees with his discoveries. Galileo has first, independently, discovered the truth that the Bible confirms if read literally – but it should not be.[124]

Thus he is not contradicting PPD: one should start with necessary demonstrations; PSL: the Bible should not be taken as an authority in matters physical; PA: the language of the Bible is accommodated to the common man; no literal reading is allowed; PC: two truths are in conformity with each other. The only principle which could still be seen in contradiction with Galileo's literal (or non-literal) reading of Joshua passage is Galileo's very strongly formulated principle of prudence (PP): "I should think it would be prudent not to allow anyone to oblige scriptural passages to maintain the truth of any physical conclusion whose contrary could *ever* be proved to us by the senses and demonstrative and necessary reasons".[125] This principle implies, as McMullin says, "that where natural knowledge is concerned, interpreters of Scripture should *always* hold back, whether the claim to natural knowledge is demonstrated or not".[126] Since Galileo interprets the Bible in a definite, Copernican manner, he seems to contradict this principle, which says that the Bible should *never* be interpreted in any definite manner as far "the truth of any physical conclusion" is concerned. But this is not Galileo's major point. Galileo's major point in interpreting the Joshua passage literally and in conformity with the Copernican system is that the Bible *should not be read literally* at all. In matters of "the truth of any physical conclusion", the first place is *always* reserved for sensory experiences and necessary demonstrations. Galileo makes the same point in his already quoted letter to Diodati. If someone

> had established that it is heretical to say the earth moves, and that demonstrations, observations, and necessary correspondences show it to move, in what sort of plot would he have gotten himself and the Holy Church? On the contrary, were we to give second place to Scripture, if the works [of God] were shown to be necessarily different from the literal meaning of the words [of God], then this would in no way be prejudicial to Scripture; and if to accommodate popular abilities the latter has many times attributed the most false characteristics to God himself, why should it be required to limit itself to a very strict law when

[124] See also CAMEROTA, *Galileo Galilei e la cultura scientifica nell'età della controriforma*, p. 272; STABILE, "Linguaggio della natura e linguaggio della scrittura in Galilei," pp. 63–64.
[125] GALILEI, "Letter to Castelli, 21 December 1613," p. 51.
[126] McMULLIN, "Galileo's Theological Venture," p. 101 (emphasis in the original).

> speaking of the sun and the earth, thus disregarding popular incapacity and refraining from attributing to these bodies properties contrary to those that exist in reality? If it were true that the motion belongs to the earth and rest to the sun, no harm is done to Scripture, which speaks in accordance with what appears to the popular masses.[127]

The works of God (the universe) come first and his words (the Bible) second. Always! And although I am of the opinion that Galileo believed he had discovered "the absolute truth" of the universe, and interpreted the Bible accordingly, this principle remains intact. Even in the event that (on the basis of sensory experiences and necessary demonstrations) somebody proves in the future that the parts of the universe are not arranged in a Copernican manner (and subsequently somebody else discovers yet another, different truth about the universe), this principle demands fundamentally that the Bible should not be read literally, but is to be interpreted on the basis of demonstrated natural truth.

But perhaps the most important point Galileo makes in *Letter to Castelli* is his call for freedom of research and speech, instead of being persecuted in advance because his research has brought him to an apparent contradiction with a literally interpreted Bible:

> However, consider that, as I just said, whoever has truth on his side has a great, indeed the greatest, advantage over the opponent, and that it is impossible for the two truths to contradict each other; it follows therefore that we must not fear any assaults launched against us by anyone, *as long as we are allowed to speak* and *to be heard by competent persons* who are not excessively upset by their own emotions and interests.[128]

[127] GALILEI, "Letter to Diodati, 15 January 1633," pp. 224–225.
[128] GALILEI, "Letter to Castelli, 21 December 1613," p. 52 (emphasis added).