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M. J. McE...

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STUDI GALILEIANI

VOL. 1 - N° 2

The Louvain Lectures (Lectiones Lovanienses)
of Bellarmine and the
Autograph Copy of his 1616
Declaration to Galileo

Texts in the Original Latin (Italian)
with
English Translation, Introduction, Commentary and Notes

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STUDI GALILEIANI

RESEARCH STUDIES PROMOTED BY THE STUDY GROUP
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The initiative for this series, *Studi Galileiani*, originates with the desire expressed by John Paul II on the occasion of the commemoration of the 100th anniversary of the birth of Albert Einstein, 10 November 1979, "that theologians, scholars and historians, animated by a spirit of sincere collaboration, will study the Galileo case more deeply . . ." This desire has been concretized in the constitution by the Pope of a Study Group to explore the history of the Copernican-Ptolemaic controversy of the XVI and XVII centuries and, in particular, the role of Galileo in that controversy. This series is promoted by that Study Group.

PREFACE

It is a pleasure to present the second article in this special series of publications sponsored by the Vatican Observatory: *Studi Galileiani, Research Studies Promoted by the Study Group Constituted by John Paul II*. The initiative for this series originates with the desire expressed by His Holiness John Paul II on the occasion of the commemoration of the 100th anniversary of the birth of Albert Einstein, "that theologians, scholars and historians, animated by a spirit of sincere collaboration, will study the Galileo case more deeply..." This desire has been concretized in the constitution by the Pope of a Study Group consisting of four sections: exegetical, cultural, scientific-epistemological and historical-juridical. Each section is taking its own initiatives in stimulating scholarly research. The present series represents an initiative of the section for scientific-epistemological questions.

In order that this series may reach a wider readership (The *Vatican Observatory Publications* are distributed almost exclusively to research institutes in the physical sciences) the papers are being published simultaneously in the *Journal for the History of Astronomy*, in cases where the material is suitable for that journal, or in other appropriate journals.

An expression of gratitude must be extended to the eminent group of editors (list on the inside front cover) who, by accepting the invitation to serve on the editorial board for this series, have assured that the series will be characterized by a scholarly approach to the many interesting unresolved issues posed by the "Galileo affair".

George V. Coyne, S. J.
Director, Vatican Observatory

INTRODUCTION: A NON-ARISTOTELIAN COSMOLOGY

Between 1626 and 1630 the Jesuit Cristopher Scheiner published at Bracciano the *Rosa Ursina*, a work recognized by historians both as an important element in the development of solar physics and as a contribution to the polemic between the author and Galileo¹. The final part of the book, however, takes on a more general character as it passes from specific phenomena to consider the ideas of the universe which are proposed to explain those phenomena. Thus Scheiner clearly divorces himself from the Aristotelian theory of the heavens. He shows that there exists an alternative theory, acceptable theologically and compatible with the strange phenomena which had been observed during the previous decades, beginning with the appearance of the Nova of 1572.

He first deduces certain physical implications from the observed phenomena, he then expounds on non-Aristotelian ideas of the Greek philosophers and astronomers, and finally he presents texts from the Scriptures and the Fathers which contrasted with Aristotle². Previous scripture exegesis by the Jesuits had always explained these texts in a vague or metaphorical way, thus minimizing their contrast with Aristotelian concepts³. But Scheiner, by breaking down the separation which existed in the Society of Jesus between mathematicians, philosophers and theologians in the areas of both research and teaching, affirmed the literal meaning of the texts and their agreement with the entire Patristic tradition and the most recent astronomical discoveries. He implicitly affirmed that the acceptance of Aristotelian cosmology in scholastic theology had been inopportune and that it had glossed over realities whose truth was clear on the basis of both scientific and scriptural considerations. These realities included: the existence of only one heaven, its material is not solid but fluid, it is immobile (the heavenly bodies move through heaven not with it) heavenly matter and early matter are from the beginning equal, the igneous nature of heaven and heavenly bodies. From these realities Scheiner was led to the possibility of changes in the heavens (including the formation and dissolution of heavenly bodies) and he interpreted some of the most controversial astronomical phenomena of the recent past as a manifestation of this possibility. To avoid having his position too far outside the current of Catholic thought and that of the Society of Jesus, he added to the list of Patristic opinions, a certain number of those of recent theologians, some of them Jesuits⁴, among whom was Robert Bellarmine, cited by him more than once. Scheiner attributed to Bellarmine, who had died only a few years before (1621), cosmological ideas that were decidedly non-Aristotelian⁵. These ideas of the Cardinal, as will be seen, implied abandoning certain points of the Ptolemaic System, although not geocentrism itself.

Historical studies concerning Bellarmine and the part he played in the events of 1615-1616 have almost completely ignored this aspect of his

thought. From Duhem onward his contribution to the thought on the subject has been identified with the epistemological ideas he expounded in his letter to Father Foscarini, which have been interpreted as an assertion of the cognitive limits of scientific theories⁶, an assertion directed specifically at a denial of the physical truth of the hypothesis of Copernicus. However, the new information from Scheiner shows that Bellarmine opposed certain postulates of physics (in part common to Greek thought in general, in part specifically Aristotelian) which, accepted into the Ptolemaic system, had led to a particular analysis of astronomical data. Thus for the history of astronomy, and of the early relationship between the Church and Science, Bellarmine's thought takes on an importance which has to do not only with methodology but with content⁷.

From these considerations certain questions arise. What were the sources of Scheiner's information? What is the source of Bellarmine's posture toward certain points of Aristotelian physics? What exactly were his ideas in cosmology and in astronomy?

In order to show that such unconventional assertions were nonetheless well founded, Scheiner mentioned his sources: besides two insignificant citations from *De Ascensione mentis in Deum*,⁸ he referred to letters of Bellarmine to the Jesuits, J. R. Ziegler (editor of the *Opera Mathematica* of Clavius) and S. Heiss, and to an item contained in a work of J. N. Smogulecki⁹. His principal documentation, however, was the correspondence between the Cardinal and the Prince Federico Cesi, which, learning of through J. Faber, he published in its entirety¹⁰. In response to a long letter of Cesi of 4 August 1618, where the Prince expounds on what seemed to him to be Scripture proofs of the fluidity of the heavens, the Cardinal wrote on the 25th of August:

"But that which I wished from Your Excellency is not to know that the Sacred Scripture and the Fathers held that the heavens are fixed and the stars move and also that the heavens are not hard and impenetrable like iron but rather soft and very easy to penetrate like air; these things I knew already; but what I wished to learn from Your Excellency is how to save the motions of the Sun and of the Stars, and especially of those which are fixed... When I was young, I tried to save the motion of the planets from West to East... by saying that their motion from East to West was not in twenty four hours for all of them but for the Sun it was twenty-four hours, for the moon it was twenty-four and a quarter, making it appear that the moon in its own motion had turned somewhat backwards, so that little by little it went away from and then approached the Sun. As for the motion of the planets from the south to the north, I tried to explain it by saying that the motion of the planets was not a perfect circle but a spiral, and so little by little they would pass from the south to the north and then would return by the same route..."

Scheiner did not examine in depth this application of the Cardinal's ideas to the planets and all evidence indicates that he knew of it only by means of this letter, while, as we shall see, the mathematicians of the Roman College had already discussed it about the year 1616. It is, however, evident that the letter not only expressed a belief in certain non-Aristotelian characteristics of the cosmos but also contains a sketch of a *theorica planetarum* which, although not developed mathematically, is nonetheless certainly not Ptolemaic. None of the edited works of Bellarmine mentions this sketch but, through an extended

search in numerous unedited works¹², it has been possible to establish that the phrases with which in 1618 he described the ideas of his youth to Cesi were not just chance meditative recollections but the almost literal citation of an insert on astronomy in the *Lectiones Lovanienses*, the greatest of his youthful works and perhaps the most important of his unpublished ones¹³.

The *Lectiones Lovanienses*

Historians have used indifferently the titles *Lectiones Lovanienses* and *Praelectiones Lovanienses* to designate the manuscripts of the theological lectures which Bellarmine gave at Louvain beginning in October 1570. Both titles are the result of sheer convention, because each of the four volumes which comprise the autograph manuscript of the work give at the beginning the simple indication of the part of the *Summa* which is being treated¹⁴. There exist an unknown number of copies of the *Lectiones*¹⁵. The autograph manuscript is obviously the essential reference and the texts published here are taken from it. In principle, however, we cannot exclude that there are copies written by a participant in the course, which contain variations and additions¹⁶. Among the four volumes of the original only the first contains material of interest to astronomy and cosmology, because Bellarmine (following the Thomistic order, as was always done in the Society of Jesus) discusses there the question placed by Aquinas in the *Summa Theologica* I. 1 concerning the description of the creation in Genesis. Some dates written in the volumes permit us to determine the schedule of the lectures. As mentioned above, the course began in October, 1570. By Easter of 1572 the lessons on questions I to LXXIV had been written and explained. The draft of the first volume terminates at the end of August 1572. As indicated in the Notes, this fact is of some interest because it proves that the arguments of that volume (all before question number LXX), in which Bellarmine criticizes the Aristotelian physics of the heavens and certain aspects of spherical astronomy, were written, and the respective lectures given, before the appearance of the Nova of 1572 which promoted the criticism of the Aristotelian cosmology even in some Jesuit commentaries. We know that the Nova was first observed only in November of that year¹⁷.

The Declaration Released to Galileo

The interventions of Bellarmine in what has been described as the first process against Galileo may be placed in four historical periods. The first comprises the time from the first exchange of ideas of the Cardinal with Galileo (Rome, 1611) up to the letter of 1615 to P. A. Foscarini. It includes the noted letter to the mathematicians of the Roman College inquiring about the exactness of the telescopic observations of Galileo. The second period corresponds to the activity of the Cardinal within the Congregation of the Index, up until the decree condemning Copernicanism (from late 1615 to February 1616). Obviously this was the period most removed from the public

eye and is, therefore, the least documented. Then there is the communication at the end of February 1616 to Galileo from Bellarmine of the contents of the decree. Finally, there is the presentation to Galileo at his request of the noted declaration from Bellarmine concerning the fact that he had not been asked to abjure nor had he been subjected to any other provision of ecclesiastical authorities (26 May 1616).

Each of these periods is only known through the documents printed by Favaro in his edition of the *Opere* of Galileo. This means that no substantial data have been added for eighty years. Thus the numerous reconstructions of these events have varied a great deal more in interpretation than in documentation, while a definitive judgement remains impossible because there is no completely adequate documentation for any of the periods considered¹⁸. The papers of Bellarmine in the archives of the Jesuits in Rome (*Archivum Romanum Societatis Iesu*; hereafter referred to as ARSI) contain little information for the periods one through three¹⁹ and only one document of interest for the fourth period, the hand-written draft of the Cardinal's declaration to Galileo. At the printing of the declaration in a definitive text, which he found in the codex of the Archivio Segreto Vaticano, containing the documents of the process against Galileo, Favaro gave some information on the draft which he read in a codex then located, as the other documents we are considering here, in the Vatican Archives, but now found in ARSI (*Opera Nostrorum*, 243 I)²⁰. Favaro also noted that in the codex the hand-written declaration of Bellarmine was followed directly by two short excerpts of letters without the author's name but certainly written to Galileo. The one he was able to recognize as an excerpt pertaining to a letter of G. F. Sagredo to Galileo (Venice, 23 April 1616). The complete text of this letter he found among the manuscripts of Galileo in Florence. The second excerpt (dated Pisa, 20 April 1616) did not have a counterpart in the manuscripts of Galileo and Favaro printed it separately in the *Opere*, considering it to be (an almost certain hypothesis) a part of a letter of Benedetto Castelli²¹. The excerpts made it clear that in order to prove to the Cardinal the reality of the rumours that he had been condemned, Galileo showed him the two letters, and that Bellarmine requested that the two important passages be transcribed, probably in order to be able to document the reasons whereby he had consented to write the declaration.

As Favaro had already pointed out, there are two phrases in the manuscript which the Cardinal later on cancelled, and they were not, therefore, transcribed into the copy given to Galileo. In addition there is a sentence added in the margin. Favaro did not, however, discuss the reasons or the significance of the corrections. We shall discuss this in the Notes.

Particulars concerning the edition, the translation and the commentary on the Lectiones:

The manuscript of the *Lectiones* displays Bellarmine's way of working. His text is put together with a whole series of additions, modifications, and cancellations, where the writing is superimposed to such an extent that in some cases it is difficult to read, especially when one also considers the

difficult handwriting of the Cardinal and his frequent use of abbreviations. The style, literary usage and punctuation are partially that of classical Latin and partially that of the scholastics. At times there are hasty and even erroneous expressions which can be explained by the fact that the material was not planned for publication. We faithfully reproduce these characteristics in this publication, even in the very frequent case (common in 16th Century usage) of lower case letters at the beginning of sentences. The one exception is that we have spelled out many abbreviations which would otherwise not have been easily understood.

The selection given here does not include all of the parts of Volume I of the *Lectiones* which have to do with physics, cosmology and astronomy, but only those which either spell out those physical characteristics of the universe which the Cardinal held to be plausible or describe a planetary model derived from those characteristics.

Every translation into modern languages of ancient or medieval astronomical terms encounters difficulties. Since the meaning of a term depends upon the distinct characteristics of the class of objects which it designates, its use varies with time as the ideas on the nature of the designated objects varies. The text of Bellarmine frequently offers a good example of this, as he uses indifferently such terms as *astrum*, *sidus*, *stella*, *planeta*. These terms varied in current Latin and Greek usage²². Usually a general meaning can be attributed to *astrum* and so the translation, "heavenly body"; but there is no systematic norm which one can apply to the other terms, and their meaning has been determined in each particular case and the modern term chosen which best fits a designated class of objects. The notes are intended to provide certain data helpful for the interpretation of the texts and for clarifying certain textual references and the relationship between the texts²³.

LECTURES AT LOUVAIN (1570 - 1572)

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Whether by its nature the sky is corruptible¹.

There are two opinions on this topic. One is that of St. Thomas (I, 1, quest. 9)² shared by many scholastic philosophers and by almost the whole peripatetic school. They affirm that the sky is a fifth kind of body, incorruptible and immutable, in conformity with psalm 148,6 which says: "He has fixed them in their place forever by an unalterable statute"³. According to another opinion held by most of the Church Fathers the sky is either composed of various elements or it is made from one of them, for instance, fire and, therefore, it is corruptible.⁴ Thus Basil claims in his first homily on the six days where it is said that not only is the sky corruptible but it is as a matter of fact destined to corrupt⁵. At the end of the same homily he refers to the thesis of Aristotle about the nature of the fifth essence and he makes fun of it and in the third homily he calls the sky contiguous to the air⁷. Saint Ambrose in his writing on the six days, Book II, chapter 3, says that some philosophers have been so anxious to place in doubt the truth as to unhesitatingly affirm that the sun is not hot nor does it have the nature of fire and in the same text he shows that it is indeed hot⁸. Saint Augustine for many chapters beginning with the first of Book III of his *De genesi ad litteram* and in chapter three and elsewhere in book II constantly gives to the term "sky" the physical meaning of fire by which he means, as he says, that part of the air which is contiguous to the sky⁹. In his ninth homily Saint Chrysostom affirms that the sun is made of fire and he considers the fact that, although it is such, it sends its flames downwards to be a proof of the divine omnipotence. He then proceeds in the tenth homily to argue that all creation like the sky is corruptible¹⁰. Theodoret in his question XI on Genesis affirms that the stars are made of fire¹¹; Damascene in chapter 5 of this Book II declares that the heavens are by their nature corruptible¹². Commenting on the first chapter of Genesis Bede maintains that this thesis is held not only by all the Church Fathers but also by all the philosophers except the Aristotelians¹³. In his work *Timaeus* Plato holds that the sky is by nature corruptible but by divine will and providence it does not come to corruption¹⁴. All the Platonists follow him in this opinion while in the same work Plato says that the sky is made of the most pure fire or a mixture of other elements. All of the Stoics held that the sky was fire according to the testimony of Marcus Tullius in Book II of his *De natura deorum*¹⁵ and of Macrobius in Book II, chapter 10 of his comment on *Somnium*¹⁶. Aristotle in his *De coelo* II, 7 affirms that this is the thinking of all the most ancient authors and that is why they took the name aether from εθεῖν which means to glow¹⁷. Among the peripatetics, however, Philoponus while treating of the chapter on the infinite in Book III of the *Physica*, held that the sky is corruptible¹⁸ and Avicenna, Avencebrol and others thought likewise. Above all the sayings of Scripture support this position and it is strengthened by the argument that the element of fire, if placed in a different place from the sky, does not appear to have a function. As to arguments for the opposite thesis I

LECTIONES LOVANIENSES (1570 - 1572)*

An coelum natura sua sit corruptibile.¹

Duae sunt de hac quaestione sententiae. Una est S. Tho. p. p. q. 9 n. 2² et multorum scholasticorum, et totius ferme scholae peripateticae, qui asserunt coelum esse quintum quoddam corpus incorruptibile, inalterabile, etc. confirmatur haec sententia ps. 148, 6 statuit ea in aeternum, et in saeculum saeculi³. Altera est fere omnium patrum, quod coelum sit corpus vel compositum ex elementis, vel sit unum ex elementis, v. g. ignis, ac proinde corruptibile.⁴ Hoc docet Basiliius hom. I in exam.⁵ dicit coelum non solum corruptibile, sed etiam vere corruptendum, et in fine eiusdem hom. ponit sententiam Aristot. de quinta natura,⁶ et irridet, et hom. 3 dicit esse contiguum aeri.⁷ D. Ambro. lib. 2 exam, cap. 3^o dicit, quosdam philosophos ita fuisse avidos impugnandae veritatis, ut etiam impudentissime assererent, solem non esse calidum, neque igneae naturae, et probat ibi, eum esse vero calidum⁸. D. Aug. lib. 3^o de gen. ad lit. per multa capita a p^o. et lib. 2 cap. 3^o etc. ubique nomine coeli intellegit ignem vel illam partem aeris, quae est, ut ipse dicit, coelo contigua⁹. D. Chrisostomus hom. 9 dicit, solem esse ignem, et in hoc apparere omnipotestatem Dei, quod sol cum sit ignis, tamen deorsum respiciat[?] et hom. 10 docet, et probat, totum mundum esse corruptibile, ut coelum¹⁰. Theodoretus q. XI super genesim docet, luminaria coeli esse ignea¹¹. Damascenus lib. 2 cap. 5^o aperte dicit, coelos natura sua esse corruptibiles.¹² Beda super primun caput genesis vult neque solum esse omnium patrum, sed et omnium philosophorum excepta schola Aristotelis.¹³ Plato in Timaeo docet coelum natura sua esse corruptibilem, sed Dei voluntate, et beneficio nunquam corruptendum¹⁴. Idem docent omnes platonici, et rursus ibidem Plat. dicit, coelum factum esse ex purissimo igne vel ex plur. elementorum. schola stoicorum tota putat coelum esse igneum, ut M. T. docet in 2^o de natura Deorum,¹⁵ et Macrobi. lib. 2^o in somnium cap. 10¹⁶. Omnes veteres idem senserunt, ut docet Arist. 2^o coel. cap. 7 unde vocaverunt aethera ab ethein, idest comburere.¹⁷ Inter peripateticos est Philoponus, qui in 3um phys. cap. de infinito docet, coelum esse corruptibile,¹⁸ idem docuit Avicenna, Avencebrol et alii. Huic sententiae videntur favere testimonia scripturarum. favet et ratio, quia si praeter coelum, adhuc esset elementum ignis, videtur quod esset superfluum. nam nihil agit. Ad rationem pro parte opposita, dico quod coelum [dictum] statuitur in aeternum quia non corrumpetur in totum. nam etiam de

*From Archivum Romanum Societatis Iesu, *Opera Nostrorum* 234; folio page numbers are given in the margin.

58r declare that it has been said "coelum statuitur in aeternum", since it will not come to complete corruption. Infact, Psalm 103 speaks thus of the earth: "You fixed the earth on its foundations, unshakeble forever and ever" and so it is said in chapter I of Ecclesiastes: "shrewd understanding is everlasting."¹⁹

Whether the sky may in fact corrupt.

First conclusion. That there will be in the future a profound change in the sky and in all creation is most certain, as is shown by many expressions in the Scriptures. Job 14: "the heavens will wear away before he wakes."²⁰ Psalm 101: "all will vanish, though you remain, all wear out like a garment, like clothes that need changing you will change them."²¹ Isaiah, 6: "the heavens like an apple will dissolve;"²² and chapter 34: "The heavens are rolled up like a scroll,"²³ and chapter 65: "For now I create new heavens and a new earth, and the past will not be remembered"²⁴. Joel, 3: "heaven and earth tremble"²⁵. Matthew, 24: "heaven and earth will pass away"²⁶ and finally in Matthew: "I am with you always; yes, to the end of time."²⁷ Job, 1 repeats the same phrase: "they will pass away."²⁸ Apocalypse, 6: "the sky disappeared like a scroll rolling up."²⁹ Apocalypse, 21: "Then a saw a new heaven and a new earth; the first heaven and the first earth had disappeared now."³⁰ 2 Peter, 3: "The Day of the Lord will come like a thief, and then with a roar the sky will vanish, the elements will catch fire and fall apart, the earth and all that it contains will be burnt up. Since everything is coming to an end like this, you should be living holy and saintly lives while you wait and long for the Day of God to come, when the sky will dissolve in flames and the elements will melt in heat. What we are waiting for is what he promised: the new heavens and new earth, the place where righteousness will be at home."³¹

The followers of Aristotle interpret texts such as "the heavens will pass on" in the sense that the heavens will stop and no longer move; but certainly "they will perish" does not have this meaning.

Second conclusion. It is uncertain whether the dissolution of the sky is to be taken in a substantial or accidental sense. Saint Gregory in Book 18 of his *Moralia*, chapter 5 says: "the heaven and the earth will change their present appearance but in essence they will go on without end"³²; and further on he interprets "there will be a new heaven and a new earth" not in the sense that others will be formed but in the sense that the actual ones will change their aspect;³³ and St. Jerome affirms the same in his Book 18 on Isaiah, commenting on capter 65.³⁴ Still others, such as Saint Basil in his first homily on the six days³⁵ and Chrysostom on his tenth homily *Ad populum*³⁶, seem to undersand without a doubt that the heavens will cease in a substantial sense.³⁷

223r Q. 68. On the work of the second day. What was made on that day .

224v The third idea is that the name "higher waters" refers to the transparent heaven which they placed above the starry heaven and held to be completely

58r terra dicitur in ps. 103 qui fundasti terram super stabilitatem suam, non inclinabitur in saeculum saeculi. et eccles. I terra autem in aeternum stat.¹⁹

An coelum de facto corrumpetur.

P^a conclusio. magnam immutationem futuram in coelo et toto orbe certissimum est. probatur. nam tota scriptura id demonstrat. Job 14 non resurget homo, donec atteratur coelum.²⁰ ps. 101 ipsi peribunt, tu autem permanes; et omnes sicut vestimentum veterascent. et sicut opertorium mutabis eos, et mutabuntur, etc.²¹. Isaias 6° coeli sicut pomus liquescent,²² et cap. 34 complicabuntur sicut liber coeli²³, et cap. 65 ecce ego creo coelos novos, et terram novam; et non erunt in memoria priora.²⁴ Joel 3° movebuntur coeli, et terra.²⁵ Matt. 24: coelum, et terra transibunt.²⁶ Matt. ult°. vobiscum sum usque ad consummationem saeculi.²⁷ Iob 1 repetit illud ipsi peribunt.²⁸ Apocali. 6° coelum recessit sicut liber involutus.²⁹ Apocali. 21 et vidi coelum novum, et terram novam. Primum enim coelum, et prima terra abiit, et iam non est.³⁰ 2 Petr. 3° adveniet autem dies domini ut fur, in quo coeli magno impetu transient, elementa vero calore solventur, terra autem, et quae in ipsa sunt opera, exurentur. cum igitur haec omnia dissolvenda sint, quales oportet vos esse in sanctis conversationibus, et pietatibus expectantes, et properantes in adventum diei domini, per quem coeli ardentis solventur, et elementa ignis ardore tabescent. novos vero coelos, et novam terram secundum promissa ipsius expectamus in quibus iustitia habitat.³¹ qui sequuntur Aristotelem, dicunt ad ista loca, quod coelum transibit, quod quiescet, et non amplius movebitur, sed certe aliud sonat ipsi peribunt.

2^a conclusio. an secundum substantiam coeli solventur, vel solum accidentaliter ambiguum esse. D. Greg. lib. 18 moral. c. 5° dicit, coelum, et terra per eam, quam nunc habent, imaginem transient sed tamen per essentiam sine fine subsistunt.³² et infra, erit coelum novum et terra nova, [.....] quidem non alia condenda sunt, sed haec ipsa renovanda.³³ Idem docet D. Hieron. lib. 18 in Esaiam exponens caput 65^m.³⁴ Alii tamen, ut B. Basilius hom. I exam.³⁵ et Chrisost. hom. 10 ad pop.³⁶ videntur plane velle secundum substantiam coelos perituros.³⁷

Q. 68. de opere 2^{ae} diei, quid eo die factum sit.

3^a sententia est, nomine aquarum superiorum intellegi coelum crystallinum, quod ipsi ponunt supra coelum sydereum, et volunt esse totum diaphanum,

transparent and devoid of stars, but otherwise identical in nature to that which Aristotle assigned to the other heavens. The main advocate of this idea is Saint Thomas in the present excerpt,³⁸ together with the overwhelming majority of the scholastics; but there exist valid arguments against this opinion.

The third of these arguments is that such a heaven above the firmament is purely imaginary; the existence of a heaven above the eighth sphere has been deduced from the two or three motions which appear to belong to that sphere; but, leaving aside the fact that some of our contemporaries have proven that the eighth sphere has only one motion³⁹, even if we should allow a ninth sphere, how do those people come to know that this is the clear heaven, completely transparent and devoid of stars? As a matter of fact we neither see all the stars nor can anyone claim that all of the stars we do see are in the eighth sphere, unless he were to give a number to each star and follow its orbit.⁴⁰

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Second doubt. What is the firmament? The first opinion is that the firmament is the eighth sphere, formed of a certain quintessence, as is claimed especially by St. Thomas⁴¹ and many of the scholastics. There are three considerations against this opinion. First of all it is not compatible with the sense of Scripture whereby the firmament was made on the second day; in fact if such an eighth sphere existed it would have of necessity been created on the first day, because, as all agree, nothing of substance was created on the second day, but ecc.... The supporters say that it was made on the second day in the sense that it acquired some accidental quality, that it was then endowed with its influence and with proper motion from west to east.⁴² But these considerations are not sufficient to state that the firmament or the heavens were made: just as we cannot say that a man who becomes white or hot, has come in an absolute sense to exist. Secondly, this eighth sphere is not located between the waters nor would it serve to divide them but only to divide one heaven from another. Thirdly, Basil in his first homily on the six days⁴³ and the Church Fathers unanimously reject the notion of quintessence, of the type that Aristotle claimed proper to the heavens. A second opinion is that the firmament is part of the air which extends downwards and on which the clouds form. However, that is inadmissible because God placed the sun, the moon, and the stars in the firmament and certainly these heavenly bodies are not found in the lower zone of the air. Furthermore, in chapter 4 of Genesis one reads: "let birds fly above the earth within the vault of heaven", which in the Hebrew text has the meaning "over the face of the firmament of the heavens"⁴⁴, that is in the presence of the firmament, and in the version of the Septuagint, *κατα στερεωμα*, that is near to the firmament; therefore, the air is not the firmament but is near to it.⁴⁵ A third opinion is expressed by Theodoret in his question 11 on Genesis⁴⁶, by Procopius in his comment on chapter I of Genesis⁴⁷ and by some others. For them the firmament is water become solid by crystallization in ice, approximately like water consolidates into crystals. In refuting this view in his third homily on the six days⁴⁸ St. Basil says that such a manner of philosophizing on the heavens is sheer

absque ulla stella, sed naturae illius qualitate, ciusus sunt reliqui coeli secundum Aristotelem. hanc sententiam praecipue sequitur D. Thoma hoc loco³⁸ et plerique Scholasticorum. sed habent contra se argumenta difficilia.

.....
3^m est, quia est mera imaginatio inveniri talem coelum super firmamentum. nam esse aliquod coelum supra octavam sphaeram collegerunt ex motibus octavae sphaerae duobus, aut tribus, quos vident eam habere. sed praeterquod aliqui nostri temporis demonstrarunt octavam sphaeram non habere, nisi unum motum,³⁹ et si concedamus esse aliam nonam, unde sciunt ipsi eam esse christallinum, totum diaphanum et nullam stellam habere? nam nec omnes stellas videmus, nec est ullus qui dicere possit, omnes quas videmus esse in octava sphaera, nisi forte quis numeraverit stellas, et singularum cursus observaverit.⁴⁰

.....
Dub. 2^m quid sit firmamentum. p^a, sententia est firmamentum esse octavam sphaeram, et esse quintae cuiusdam essentiae. haec praecipue probare conatur D. Thoma⁴¹ et multi scholasticorum. contra hanc sententiam tria sunt; unum, quod non salvat scripturae veritatem, quae asserit, firmamentum factum 2^a die. nam octava illa sphaera si esset, necessario prima die creata fuisset. nam 2^a die nihil factum est quantum ad totam substantiam, ut omnes concedunt, sed etc. Dicunt ipsi esse factum 2^a die quantum ad aliquam accidentalem qualitatem, quod vero tunc recepit vim influendi, vel recepit motum proprium ab occidente in orientem.⁴² caeterum haec non sufficiunt ut dicant factum esse firmamentum, vel coelum: sicut cum homo fiat albus, vel calidus, non possumus dicere simpliciter fieri hominem. Alterum est, quod ista octava sphaera non vero est facta in medio aquarum, neque vero divisit aquas ab aquis, sed solum unum coelum ab alio coelo. 3^m est, quod Basilius hom. I exam.⁴³ et sancti patres ad unum omnes rejiciunt istam quintam essentiam, quam Aristoteles excogitavit in coelo. Altera sententia est firmamentum esse partem istius inferioris aeris, supra quem ascendunt nubes. haec defendi non potest, nam in firmamento Deus posuit solem, lunam, et stellas. certum est autem non esse solem, lunam et stellas in ista inferiori parte aeris. praeterea cap. I gen. dicitur volitant aves super terram sub firmamento coeli,⁴⁴ et secundum hebraeum super faciem firmamenti coeli, idest ante conspectum firmamenti, et ut 70 verterunt *κατα στερεωμα*, idest iuxta firmamentum, quia aer non est firmamentum, sed iuxta firmamentum.⁴⁵ 3^a sententia est Theodoretii q. 11 super genesim,⁴⁶ et Procopii in p^m. cap. gen.⁴⁷ et aliorum quorundam. firmamentum esse aquam, glaciali firmitate solidatam, fere ad eum modum, quo aqua in christallum solidari datur. hanc sententiam rejicit D. Basilius hom. 3 exam.⁴⁸ et dicit esse meras nugas ita de coelo philosophari. et

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nonsense, and he is certainly not wrong. In fact, since these authors assert that sun and stars are true fires, according to what criterion would God have placed these bodies in the firmament, that is, have placed fire in ice? How is it that, over such a long period of time, the water would not have melted thus extinguishing the fire or have been consumed by the fire? Finally, according to a fourth view the firmament is identified with the starry heavens and has the nature of fire which is why in Greek 'aether' is derived from εθειν, that is, to glow.⁴⁹

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This is the thesis of St. Basil in his third homily of the six days where he says that the firmament touches upon and is continuous with the air we breath⁵⁰..... This appears very probable for two reasons. One is that the most authoritative of the Church Fathers agree with it and, although the Aristotelian school protests, the Platonic and the Stoic schools, as well as all the others, agree, just as Aristotle himself admits in *De coelo* II, 7.⁵¹ Another element in its favor is that from this point of view one can easily and directly interpret the scriptural text. The result, in fact is that: 1) the firmament was really made on the second day; in fact fire did not exist on the first day, otherwise there would have also been light; 2) the firmament was not made out of nothing but rather with the matter created on the first day; and in fact, God formed the firmament through the rarefaction of water;⁵² 3) on God's part the location of the heavenly bodies in the firmament was the most suitable: what could be more natural than to place starry fires in the fiery zone?; 4) the firmament alone in the manner of a bulkhead separates the waters; if one indeed believed that it were made up not of fire but of air which reached even to the higher waters, there would not at all be a firmament which separates the higher from the lower waters: every day we see the air being crossed by water, that going up in the form of vapors and that coming down in the form of rain. If furthermore you affirm that the element of fire exists with other bodies above it, then the firmament would serve to divide the higher waters not from the lower waters but from fire.⁵³

It is not our task to decide which is the truer of the above opinions. As St Basil in his third homily on the six days⁵⁴ and Chrysostom in his fourth homily on Genesis⁵⁵ say: with respect to the divine works, we should not conjecture except as allowed; therefore, we know that the firmament exists: what it is and how it is we will know when we have gone up there.⁵⁶

Fourth doubt. How many heavens are there? On this theme there exist and have always existed many, many theses. St. Chrysostom in his fourth homily claims that there is only one and he sharply criticizes those who admit anymore⁵⁷. Nor am I convinced by the reply of St. Thomas who, on the question we are now examining at article four,⁵⁸ claims that by the expression "only one heaven" Chrysostom included all of the bodies, regardless of how many, which are located between earth and water. That is inadmissible since Chrysostom would be inconsistent in reproaching sharply those who allow more heavens when he himself allows them. Theodoret in his question 11 on Genesis⁵⁹ and Procopius in his comment on chapter I of Genesis⁶⁰ hold that there are two heavens, the firmament and the empyreum. John Damascene, l. II c. 6 holds that there are three: that of the air, that of the stars and another

sane non immerito. nam cum iidem dicunt solem, et stellas esse veros ignes, qua prudentia Deus posuisset luminaria in firmamento, hoc est ignem in glacie? et quomodo a tanto tempore vel aqua illa gelata non esset resoluta, et ignem illum non estinxisset, aut ipsa consunta ab igne fuisset? 4^a sententia est, firmamentum esse coelum sydereum et esse igneae naturae, unde etiam a graecis dicitur aether ab εθειν, idest comburere.⁴⁹

Huius sententiae est D. Basilius hom. 3 exam. ubi dicit firmamentum esse connexum, et continuum aeri isti, quem spiramus.⁵⁰

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Hanc sententiam duo sunt, quae valde probabile faciunt; unum, quod in ea conveniant nobiliores patres: et quamquam scholae Aristotelis reclamant: tamen scholae Platoniorum, et Stoicorum, et philosophorum aliorum omnes consentiunt, ipso Aristotele teste l. 2 coeli cap. 7.⁵¹ Alterum est, quod secundum hanc sententiam possumus facillime, et simplicissime intelligere textum scripturae. hinc enim habemus, p^o. vere firmamentum factum esse 2^a die. nam p^a. die non erat ignis. alioquin etiam lux fuisset. habemus 2^o firmamentum non esse factum ex nihilo sed ex materia primo die creata. nam ex ipsa aqua per extensionem fecit Deus firmamentum.⁵² habemus 3^o. In firmamento optime Deum posuisse luminaria: ubi enim naturalius ponerentur ignes stellarum, quam in regione ignis? habemus 4^o unum firmamentum, tanquam parietem separare aquas ab aquis. nam si ponas non esse elementum ignis, sed aerem extendentem se usque ad aquas superiores; tunc nullum erit firmamentum separans aquas ab aquis. Nos per aerem videmus quotidie aquas transire, ascendere in vaporibus, et descendere in pluviis. si vero ponas elementum ignis, et praeterea alia corpora superiora. tunc firmamentum dividet aquas superiores non ab aquis inferioribus, sed ab igne.⁵³

Ex his sententiis, quae sit verior, non est nostrum definire. nam ut ait D. Basilius, hom 3^a exam.⁵⁴ et Chrisost. hom. 4 in genesis⁵⁵ non debemus praesumere de operibus Dei, nisi quantum concessum est. Itaque scimus firmamentum esse, quod autem, et quale sit, postea sciemus quando super illud ascenderimus.⁵⁶

Dubium 4^m. Quot sunt ponendi coeli? sunt ac fuerunt semper de hac re innumerae sententiae. D. Chrisost. hom. 4 condendit esse unum tantum, et acriter reprehendit eos, qui ponunt plures.⁵⁷ neque mihi probat reponsio D. Tho. qui putat in ista quaestione art. 4⁵⁸ Chrisostomum nomine unius coeli intelligere omnia corpora quae sunt intra terram, et aquam, quam multa sunt. hoc dici non potest. nam stultus esset Chrisost. si tam acriter reprehenderet ponentes plures coelos, si ipse etiam poneret. Theodor. q. 11 in gen.⁵⁹ et Procopius in p^m. cap. gen.⁶⁰ contendunt coelos esse duos, nempe firmamentum, et empyreum. I. Damascenus l. 2 c. 6 ponit tres, aereum, sydereum et unum

which more recent authors call the empyraeum⁶¹. St. Augustine, *De genesi*, l. 12, c. 29 makes reference to four theses: one is where it is claimed that the heavens are seven; another where it is said that they are eight (Aristotle, *De coelo*, l. II); a third where there are nine (this is the thesis of Ptolemy in l. 7 of the *Almagest*); yet a fourth says there are ten, a thesis taken up by the astrologers of our day⁶². In addition to these, there is the one of the Basilidian heretics who, according to Augustine, *De haeres*, c. 4⁶³, allow for 365. Finally there have also been some stupid astrologers who claimed as many heavens as there are heavenly bodies⁶⁴. As to our personal opinion, we will put it clearly in three propositions: 1) the term "heaven" in the form in which one finds it in Scripture, does not allow one to settle whether there is one or more; that is clear because the Hebrew word *samaim* has only the plural form, so that at times it is translated "heaven" and at times "heavens"⁶⁵; 2) it is correct to allow at least three heavens, the airy one, the starry one and the empyraeum; the first is completely transparent, the second is partially transparent and partially capable of reflecting light, the third reflects light all over. Scripture speaks of the first when in chapter I of Genesis and in other places it speaks of the "birds of heaven"; the second is also mentioned because in chapter I of Genesis the firmament where God placed the heavenly bodies is called "heaven"; perhaps Psalm 113 refers to the third where it says: "Heaven belongs to Yahweh"⁶⁶. These may also be the three heavens surmounted by the Apostle who says in Cor., II, 12: "I know a man in Christ, etc. ..."⁶⁷ From this two points are derived: the first is that among the heavens we do not number the waters above them, because neither the saints nor the Scriptures so number them: the Scriptures always say "the waters which are above the heaven". Also Chrysostom, Basil and the other Church Fathers, although they do not doubt that there are waters in heaven, never call the waters heaven; otherwise Chrysostom would not hold that there is only one heaven nor Theodoret and Procopius that there are two. The second point is that almost all of the Church Fathers can be brought into conformity with this interpretation. In fact Basil in his second homily admits the empyraeum⁶⁸ and in the third the heavens of air and of the ether, the last of which is also the heaven of the stars;⁶⁹ as for Ambrose, he follows Basil completely. Damascene clearly admits the same three heavens. As for Theodoret and Procopius, even though they admit only two, the sidereal one and the empyraeum, there is still no doubt that they include within the notion of sidereal heaven that of the air. Furthermore, even though Chrysostom admits only one heaven, the sidereal one, there is no doubt that he means to associate with it the heaven of the air and he would perhaps not have denied the empyraeum, had someone proposed the notion of it to him. Augustine in his *De Genesi*, Book II, chapter 5, and in his third book, chapter 3 and 6, clearly affirms the airy and the sidereal heavens and he holds that the latter is igneous; he does not mention the empyraeum but I believe he would not have denied its existence.⁷⁰ 3) If there are other heavens beyond the three mentioned that is something to be examined by the philosophers and the astrologers, more than by the theologian.⁷¹

aliud, quod recentiores vocant empyreum.⁶¹ D. Aug. l. 12 de genesi cap. 29 refert 4^{or} sententias, unam dicentium coelos esse septem; alteram dicentium esse octo (ista est Aristotelis 2^o coeli); 3^{am} dicentium esse novem, ista est Ptolemaei in 7^o Almagesti. 4^{am} dicentium esse decem, istam excitarunt rursus recentes astrologi.⁶² Praeter has opiniones fuerunt etiam haeretici basilidiani, qui posuerunt 365, testis Aug. de haeres. c. 4.⁶³ denique fuerunt stulti quidam astrologi, qui posuerunt tot, quot sunt stellae.⁶⁴ quid nobis videatur tribus propositionibus explicemus; p^a. ex nomine coeli, quod in scripturis reperitur, aperte colligi non potest, an sit unum, vel plures. patet, nam verbum hebraeum *samaim* non habet nisi numerum pluralem, interpretes vero idem verbum modo verterunt coelum, modo coelos.⁶⁵ 2^a. Ut minimum recte poni tres coelos, aereum, sydereum, empyreum: primum totum diaphanum, 2^m partim diaphanum, partim lucidum, 3^m totum lucidum. primum legimus in scripturis, cum cap. I gen. et alibi passim invenimus aves coeli, 2^m etiam legimus, cum cap. I gen. firmamentum, ubi Deus posuit sydera, vocatum est coelum. 3^m fortasse legimus in ps. 113 cum dicitur coelum coeli domino.⁶⁶ fortasse etiam isti sunt tres coeli, quos apostolus trascendit, cum 2 cor. 12 ait, scio hominem in Christo, etc.⁶⁷ Notanda sic duo sunt. p^o nos non ponere aquas, quae super coelum sunt, in numero coelorum, quia nec scriptura, nec sancti eas in numero ponunt. scriptura ubique dicit, aquae, quae super coelos sunt. Chrisostomus quoque, et Basilius, et caeteri patres licet non dubitent aquas esse in coelo, tamen eas coelos nusquam vocant. alioquin Chrisostomus non contenderet esse tantum unum coelum, nec Theodoretus, et Procopius contenderent esse tantum duos. 2^a nota, facile est ad hanc sententiam reducere patres fere omnes. Nam Basil. hom. 2 ponit empyreum,⁶⁸ hom. 3 ponit aereum et aethereum, quod est idem cum sydereo.⁶⁹ Ambrosius in omnibus imitatur Basilium. Damascenus aperte ponit hos tres. Theodoretus, et Procopius licet ponant duos, sydereum, et empyreum: tamen non dubium, quin cum sydereo etiam aereum intellegant. Chrisost. licet ponat unum tantum, nempe sydereum, tamen cum illo coniungit proculdubio aereum, et fortasse non negasset empyreum si quis proposuisset. Aug. l. 2 de gen. c. 5 et 1. c. 3 et 6 aperte ponit aereum, et sydereum, quod igneum esse vult: empyreum non meminit sed puto non negasset.⁷⁰ 3^a propositio, utrum sint plures coeli, quam tres, non tantum ad theologum, quam ad philosophos, et astrologos pertinet considerare.⁷¹

227r Q. 69. On the work of the third day.

231r With respect to the present question there are explicitly the well known words: "Let there be lights in the firmament of heaven, etc." First doubt. What is the nature of the heavenly bodies? I answer that with the sole exception of the peripatetics, both the pagan philosophers and the Christian theologians hold that they are made of fire. In his *Timaeus* Plato maintains that the stars are made of the purest fire⁷² and the opinion of the Stoics is identical as Marcus Tullius recalls in l. II of *De natura deorum*⁷³. Thus also was the opinion of all the Church Fathers, among them Basil in his homily III on the six days;⁷⁴ also St. Ambrose in his writing on the six days (II, 3)⁷⁵; St. Chrysostom in homilies 9 and 10 to the people of Antioch⁷⁶; Augustine, *De Genesi*, l. II, chapter 3;⁷⁷ Theodoret in his question 11 on Genesis⁷⁸; Procopius in his comment on Genesis, I⁷⁹. The principal argument of the Aristotelians is that, while fire moves upwards, the heavenly bodies move in circles. But the argument of the Church Fathers and of the ancient philosophers is the similarity of effects produced by the heavenly bodies and by earthly fire. In fact fire lights up, heats, dries, draws up humidity and the sun does all of this. In *De Coelo*, II, 7 Aristotle answers that the sun does not warm by its own heat but through a rubbing motion and compression of the air,⁸⁰ and St. Basil (third homily on the seven days)⁸¹ rightly derides this theory: to this very day the philosophers, as hard as they have tried, have not been able to establish how the sun could rub and compress the air, since it is so far away. Others answer that the sun is virtually hot as wine and pepper, but this is even more ridiculous because things that are virtually hot heat only those things which bring about some change in them: thus pepper heats the tongue but not the hand, and wine warms the stomach and the head but not rocks; but the sun warms and dries everything and draws up all humidity, that which neither wine nor pepper can do. As to the objection presented above, it has no value: fire goes up because it finds itself out of its region, whereas the stars, located in their proper region, move about in circles to the good of the whole universe and thus they will do until judgement day when they will cease to exist.⁸²

232r Third doubt. Are the sun and the stars fixed in the sky and so move with the motion of the sky, or do they themselves move while the sky remains still?⁸³ St. Augustine (*De Genesi*, II, 10) leaves the question in doubt⁸⁴; but Chrysostom (sixth homily on Genesis)⁸⁵, Procopius (commenting the same text), Diodorus, Eusebius Emesenus and Theodoret, all of them quoted by Luigi Lippomano in his *Catena in Genesim*,⁸⁶ posit as a necessary truth of Scripture that the stars are not fixed. In fact, as it is written that God placed the heavenly bodies in the firmament of heaven, so it is written later on that God placed man in paradise: and it is certain that man was not fixed at one point in paradise.⁸⁷ But be that argument valid or not, if we wish to hold that the heaven of the stars is one only and formed of an igneous or airy substance, an hypothesis which we have declared more than once to be more in accord with the Scriptures, we must then of necessity say that the stars are not transported with the movements of the sky, but they move of themselves

Q. 69. de opere tertiae diei.

227r Circa quaestionem istam sunt explicita illa verba, fiant luminaria in firmamento coeli, etc.

231r 1^m Dub. Cuius naturae sunt luminaria? Respondeo schola peripateticorum philosophorum excepta, omnes tam philosophi prophani, quam christiani theologi luminaria ignea esse volunt. Plato in Timaeo vult stellas esse ex purissimo igne⁷². idem sentiunt stoici, ut M. T. docet in 2° de natura deorum.⁷³ idem omnes patres, sic Basil. hom. 3 exam.⁷⁴ sic B.

Ambrosius l. 2 exam. c. 3.⁷⁵ sic B. Chrisost. hom. 9 et 10 ad pop. antiochenum.⁷⁶ sic Aug. l. 2 de gen. c. 3.⁷⁷ Theod. q.11 in gen.⁷⁸ Procopius in p^m. cap. gen.⁷⁹ Ratio praecipua Aristotelicorum est, quod ignis movetur sursum, stellae autem moventur in circulum. Ratio autem patrum, et veterum philosophorum est similitudo effectus stellarum et nostri ignis; ignis enim illuminat, calefacit, exiccat, attrahit humorem; et haec omnia facit sol. Respondet Aristoteles 2. coeli cap. 7 solem non calefacere suo calore, sed motu, quo videlicet fricat ac terit aerem.⁸⁰ ridet hanc sententiam B. Basilius hom. 3 exam.⁸¹ et vero est ridicula, neque adhuc philosophi, licet multum sudarint, invenire potuerunt quomodo sol fricat aerem cum longissime absit ab aere. Respondent alii solem esse calidum virtualiter, sicut vinum, et piper. Sed hoc est magis ridiculum. nam calida virtualiter non calefaciunt nisi ea, a quibus ipsa antea aliquo modo immutantur, ut piper calefacit linguam non manum, vinum calefacit stomachum, et caput non lapides. at sol omnia calefacit, et exiccat, et attrahit humores, quod neque piper aut vinum facere posset. neque ratio illa opposita aliquid valet. nam ignis movetur sursum, quia est extra suam regionem: in loco autem proprio moventur stellae circulariter pro bono totius universi et movebuntur usque ad diem iudicii et tunc cessabunt.⁸²

3^m Dub. an sol, et stellae sint fixae in coelo, et moveantur ad motum coeli, vel moveantur per se coelo quiescente.⁸³ B. Aug. l. 2 de gen. c. 10 rem sub dubio reliquit.⁸⁴ at Chrisost. hom. 6 in gen.⁸⁵ et Procopius in hunc locum, nec non Diodorus, Eusebius emesenus et Theodoretus, quos citat Aloysius Lipomanus, cathena super genesim,⁸⁶ ponunt necessario scripturarum veritatem, stellas non esse fixas. nam sicut Scriptura ait, posuit Deus luminaria in firmamento coeli: ita postea ait posuit Deus hominem in paradiso. certum est autem hominem non fuisse affixum uni loco paradisi.⁸⁷ Sed quicquam sit de hac ratione, si asserere velimus coelum sydereum non esse nisi unum, et illud igneum, vel aereum: quod saepius conformius scripturis esse diximus: necessario iam dicere debemus, stellas non moveri ad motum coeli, sed motu proprio sicut aves per aerem, et pisces par aquam.⁸⁸ Constat enim planetas

like the birds of the air and the fish of the water⁸⁸. In fact, it is known that the motion of the planets is diverse: one is faster, the other slower, and it is clear to everyone that one same heaven cannot move at the same time with diverse velocities. Against this theory there exists only one argument of any weight. In fact, the one of Aristotle in *De Coelo*. l. II whereby the heavenly bodies do not move of their own accord because they do not have feet,⁸⁹ is laughable: not everything that has autonomous motion makes use of feet, but only those objects which move by taking steps. The serious argument is rather the one whereby the stars appear to us to be endowed with two motions, one from east to west with a period of 24 hours, the other from west to east with different velocities for the different heavenly bodies: the moon completes its orbit in a month, the sun in a year, etc.

In response to this argument first of all I say it is not the task of the theologian to analyze this order of phenomena⁹⁰ especially when the controversies over the explanations are still lively among astrologers. In fact some attribute these phenomenon to the movement of the earth, all of the heavenly bodies being still;⁹¹ others have recourse to the hypothesis of epicycles and eccentrics; others to the autonomous motion of the heavenly bodies. Thus it is possible for us to select among them the one which best corresponds to the Sacred Scriptures.⁹² If then one ascertained with evidence that the motions of the heavenly bodies are not autonomous, but they follow those of the heavens, one would have to consider a way of interpreting the Scriptures which would put them in agreement with the ascertained truth: for it is certain that the true meaning of Scripture cannot be in contrast with any other truth, philosophical or astrological.⁹³ Secondly I say that it appears to me, also based on the Scripture, that the heavenly bodies do not possess other than their own motion, that is the one from east to west and that the other is not real but only apparent. Such an apparent motion comes from the fact that velocity differs from one heavenly body to another. For example, if at the ninth hour, at vesper time, the moon appears in conjunction with another heavenly body, for instance Venus or Mars or some other body, an observation made tomorrow at the same time will show the moon at a distance from the object in the east direction. Some then deduce from this that the moon, while it goes ahead together with that object from east to west, at the same time moves from west to east with a motion of its own. We say instead that it does not have such retrograde motion but that its own motion is simply not so fast as to have it cover an orbit in the same time in which the other object, which is certainly faster, covers it. Thus while some say that in 24 hours the moon completes a retrograde motion of 12 degrees, we say that in 24 hours it comes to lack 12 degrees to the completion of its orbit. While others say that in 24 hours the sun covers a degree of retrograde motion, we say that in 24 hours it comes to lack one degree to the completion of its orbit; the same thing can be said for the other heavenly objects. The fact, then, that the sun and the other planets seem to move on an oblique circle called the zodiac, which at one time seems to lean to the north and another to the south, comes from the circumstance that the sun and the planets do not have an exactly circular motion but one in a spiral.⁹⁴ Thirdly I say that the thesis of the astrologers that the heavenly bodies are moved by

moveri vario motu, unum celerius, alios tardius: nec posse autem fieri, ut idem coelum moveatur simul celerius, et tardius, omnibus notum est. Contra hanc sententiam unum dumtaxat est argumentum alicuius momenti. Nam quod Aristoteles l. 2^o coeli probat stellas non moveri a se, quia pedibus careant,⁸⁹ ridiculum est; non enim omnia, quae moventur a se indigent pedibus, sed solum quae moventur motu progressivo. Argumentum igitur grave est, quod videmus stellas omnes moveri duobus motibus, uno ab oriente in occidentem spatio 24 horarum, altero ab occidente in oriens, atque in hoc motu videmus variari cursus syderum: nam Luna absolvit circulum uno mense, Sol uno anno, etc.

Respondeo primum ad theologum non spectat hoc diligenter investigare.⁹⁰ Et idcirco dum inter astrologos durat lis, sicut vero adhuc durat de modo explicandi huiusmodi apparentias. nam alii explicant per motum terrae, et quietem omnium stellarum,⁹¹ alii per quaedam figmenta epicyclorum, et eccentricorum; alii per motum syderum a se ipsis: possumus nos eligere id quod videtur scripturis sanctis conformius.⁹² Si vero aliquando evidenter constiterit, stellas moveri ad motum coeli, non a se, hoc videndum erit, quod recte intelligantur scripturae, ut cum ea perspecta veritate non pugnent. Certum enim est verum sensum scripturae cum nulla alia veritate sive philosophica, sive astrologica pugnare.⁹³ Dico 2^o: videri mihi probabilius etiam [scriptura], stellas non habere nisi suum motum, eum videlicet, quod est ab oriente in occidentem: alterum vero non esse verum, sed apparentem. Apparentia vero inde existere, quod non aeque celeriter stellae moveantur. V. G. si videas vesperi hora 9^a Lunam coniunctam cum aliqua stella, ut cum stella Veneris vel Martis, vel quacumque alia, si respicias cras eadem hora, videbis Lunam ab ea stella recessisse versus orientem. Hinc igitur aliqui deducunt, Lunam dum pergeret cum ea stella ab oriente in occidentem simul proprio motu paulatim etiam retrocessisse ab occidente in oriens. nos vero dicimus non retrocessisse, sed non tam celeriter concurrisse, ut eodem tempore absolvere posset circulum, quo illa alia stella, quae celerior procul dubio movebatur, absolvebat. Itaque quod alii dicunt Lunam spatio 24 horarum retrocedere 12 gradibus: nos dicimus Lunam spatio 24 horarum deficere a perfecta circulatione 12 gradibus. quod alii dicunt solem in 24 horis retrocedere unum gradum: dicimus eum deficere a perfecta circulatione in 24 horis uno gradu, et sic pro aliis dici potest. quod vero sol, et caeteri planetae videantur procedere per circulum obliquum, quem vocant Zodiacum, et modo sit propinquior aquiloni, modo austro, id nascitur ex eo, quod sol, et planetae, non proprio suo motu circulos, sed spiras describunt.⁹⁴ dico 3^o sententiam astrologorum, quae vult stellas moveri ad motum coeli, non a se, non esse

the heavens, does not appear to be valid at present because many laughable and incredible consequences come from it: 1) would be necessary to say that some stars have orbits with periods of 36,000 or 49,000 years; but the world will not last that long;⁹⁵ 2) it would be necessary to say that one and the same star describes contrary movements, a notion difficult to clarify and even more so to uphold;⁹⁶ 3) it would be necessary to say that one heaven brings about the rotation of two others, and this is incomprehensible because considered in themselves the heavens are contiguous, not continuous, and there does not exist in them any supports or glue whereby they would adhere to one another;⁹⁷ 4) such complex and extraordinary structures as epicycles and eccentrics are dreamed up so that even the astrologers are reticent to speak about them.⁹⁸

Fourth doubt. Whether, the sun apart, the moon is the largest of the heavenly bodies. My response is that this is the thing which appeared most probable to the Holy Fathers of the Church, both because the Scripture called these two bodies "luminaria magna" and because the moon appears to our senses incomparably larger than any of the other heavenly bodies. Augustine in *De Genesi*, II, 16 is of this opinion;⁹⁹ Basil (sixth homily on the six days)¹⁰⁰ and Ambrose (l. 4 of the six days, chapter 6)¹⁰¹ do not especially support it but they seem to suppose it as most certain; in fact they say that the sun and the moon are called "luminaria magna" not so much in comparison with the other heavenly bodies..... but as the sea is absolutely large, and the heavens large, etc. The astrologers have a different opinion because they believe that the sun is the largest of the heavenly bodies and, with the exception of Mercury, that the moon is the smallest.¹⁰² The basis of their argument is that they suppose the existence of huge intervals between the moon and the other heavenly bodies. But this can be easily denied, especially if one assumes the existence of a single sidereal heaven.¹⁰³

usque adeo probabilem; nam cum illa multa ridicula, et incredibilia necessario affirmanda sunt. p° est asserendum aliquas stellas non absolvere cursum nisi spatium 36 millium, vel 49 millium annorum. mundus autem non tam diu durabit.⁹⁵ 2° asserendum est, unam et eandem stellam moveri motibus contrariis, quod aegre explicari, et difficilius defendi potest.⁹⁶ 3° est asserendum unum coelum trahere secum duos alios, quod est inintelligibile, cum coeli secundum ipsos sint contigui, non continui, et non sint ibi claviculi, vel ansae, vel gluten, quo unum adhaereat alteri.⁹⁷ 4° sunt ponendae tot machinae, et tam mirabiles epicyclorum, et eccentricorum circularum, ut etiam astrologos pudeat eas commemorare.⁹⁸

Dubium 4^m. Utrum Luna sit maior omnibus stellis, sole excepto. Respondeo sanctis patribus id videtur probabilius, tum quod scriptura haec appellet duo luminaria magna, tum quod ad sensum appareat sine comparatione omnibus stellis maior. Ita docet Augustinus l. 2 de gen. c. 16.⁹⁹ Basil. hom. 6 exam.¹⁰⁰ et Ambr. l. 4 exam. c. 6¹⁰¹ hoc aperte non dicunt sed videntur tamquam certissimum presupponere. dicunt enim solem, et Lunam vocata esse luminaria magna non tantum comparatione stellarum caeterarum, sed..... sicut mare absolute est magnum, et coelum magnum, etc.

Astrologi sunt in alia sententia, putant enim solem esse maximum omnium stellarum, lunam vero minimam, una stella mercurii excepta.¹⁰² fundamentum astrologorum est, quod imaginantur esse inter lunam, et alias stellas immensa quaedam intervalla, quod sine ullo periculo negari potest, praesertim si dicamus, non esse nisi unum coelum sydereum.¹⁰³

243r Declaration of 1616 from Robert Cardinal Bellarmine to Galileo Galilei¹

Noi Roberto Card.^{le} Bellarmino, havendo inteso, che il Sig.^{or} Galileo Galilei sia calunniato, o imputato, di havere abiurato in mano nostra [la dottrina del Copernico circa la mobilità della terra, et immobilità del Sole]^A et anco di esser stato per ciò penitentiato di penitenze salutari: et essendo ricercati della verità, diciamo, che il suddetto sig.^{or} Galileo né ha abiurato in mano nostra, né d'altri [che noi sappiamo, la dottrina del Copernico]^A [qua in Roma, né in altro luogo che noi sappiamo, alcuna sua opinione, o dottrina]^B ne meno ha ricevuto penitenza salutare, né d'altra sorte: ma solo gl'è stata denunciata la dichiarazione fatta da N. S. et pubblicata dalla Sacra Congregazione dell'Indice, nella quale si contiene, che la dottrina, attribuita al Copernico, che la terra si muove intorno al sole, et che il sole stia nel centro del mondo senza muoversi da oriente ad occidente, sia contraria alla Sacra Scrittura, et però non si possa defendere, ne tenere et in fede di ciò habbiamo scritta, et sotto scritta la presente di nostra propria mano, questo dì 26 maggio 1616.

Idem qui supra, Roberto Card.^{le} Bellarmino

We, Robert Cardinal Bellarmine, having understood that Galileo Galilei has been calumniated and that is has been imputed to him that he abjured into our hands [the doctrine of Copernicus concerning the mobility of the earth and the immobility of the sun]^A and that also on that account he has been given a salutary penance: and having been asked about the truth of the matter, we declare that the above mentioned Galileo has ^{not} abjured into ^{our} hands nor into the hands of others [as far as we know, the doctrine of Copernicus]^A [here in Rome nor in any other place, as far as we know, any of his opinions or doctrines]^B nor has he received a salutary penance nor anything of the sort; all that happened is that an announcement was made to him of the statement made by N. S. and published by the Sacred Congregation of the Index whereby it is held that the doctrine attributed to Copernicus that the earth moves about the sun and that the sun is at the center of the world without moving itself from east to west, is contrary to Scripture and, therefore, it cannot be defended or held. And we have written this as a pledge of the truth and we sign this present document with our own hand, this 26th day of May 1616.

The same party mentioned above, Robert Cardinal Bellarmine.

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Noi Roberto Card.^{le} Bellarmino, havendo inteso, che
 il sig.^{or} Galileo Galilei sia calunniato, o imputato di
 havere abiurato in mano nostra ~~la dottrina del Copernico~~
~~sulla la mobilità della terra, et immobilità del sole, et anco~~
~~di esser stato per ciò penitentiato di penitenze salutari:~~
 et essendo ricercati della verità, diciamo, che il suddetto
 sig.^{or} Galileo né ha abiurato in mano nostra, né d'altri
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 sente di nostra propria mano, questo dì 26. di maggio 1616.
 Idem qui supra, Roberto Card.^{le} Bellarmino.

In qua in Roma, ne in alio
 luogo et non offriamo,
 alcuna sua opinione, o dot-
 trina

¹ Note to declaration: Taken from Archivum Romanum Societatis Iesu, *Opera Nostrorum*, 243 I, folio 243r. The two phrases placed in parentheses and designated with a superscript "A" were cancelled by a pen stroke in the manuscript while the phrase in parenthesis designated with a superscript "B" was added in the left hand margin of the manuscript. Thus the definitive text presented to Galileo, reflecting the corrections in the manuscript, does not contain the cancelled phrases but does contain the one written in the margin. This definitive text is the one shown to his inquisitors at the 1633 process and published by Favaro in the *Opere* (XIX, 348). The manuscript and the addition in the margin are in Bellarmine's hand. As to the reasons for Bellarmine's emendations we have no clear information. It would, for instance, be most interesting to know whether Bellarmine himself spontaneously introduced the corrections or whether Galileo requested him to do so. It appears that the least prejudicial and, at any rate, an obvious way to proceed is to determine his motives by the change in meaning resulting from the corrections. Furthermore, we may suppose that the added phrase is of primary significance and determined the two cancellations. The Declaration is clearly intended as a defense of Galileo. The added sentence widens the area of that defense, in fact, it removes all limits geographical as well as thematic. With this in mind let us examine the two phrases cancelled in the manuscript. In the whole manuscript they are the only phrases which identify Galileo as a follower of Copernicus and, furthermore, involve him in the condemnation of the teaching of Copernicus. In cancelling them Bellarmine went as far as he could in his denials. Galileo's position with respect to Copernicanism had, in fact, been considered in the course of the proceedings and the Declaration is formulated in such a way as not to exclude that this happened. By his addition to the Declaration Bellarmine eliminated any interpretation that Galileo had been sanctioned for opinions other than Copernican heliocentrism. Bellarmine was aware of information supplied to the Congregation and of certain investigations carried out concerning Galileo's years in Padua and especially his relationship with Cremonini and Sarpi. He was also aware of certain reservations concerning Galileo's ideas on biblical exegesis. By his changes to the manuscript he apparently wished to exclude any possibility that these matters could be considered to have been formally treated in the proceedings of the Congregation and included in the Declaration.

NOTES TO INTRODUCTION AND TEXTS

In these notes the name of an author followed by a date refers to writings listed with that index reference in the Bibliography at the end. In the notes to the *Lectiones Lovanienses* there are many references to the *Patrologiae Cursus Completus* (Lutetiae Parisiorum 1844 and ff.) of J. E. Migne. In such cases P. L. and P. G. refer to *Patrologia Latina* and to *Patrologia Graeca*. Roman numerals indicate the volume and arabic numerals the column.

Notes to the Introduction: A Non-Aristotelian Cosmology

1. Scheiner, C. 1626-1630.
2. Book IV, part II: c. XII ('Ad physiologiam caelestem plurimae Veritates panduntur e Phaenomeno solari'); XXIII ('Pro natura Solis ignea insinuantur auctoritates philosophicae'); XXVIII ('Pro caelo liquido antiquorum Philosophorum auctoritates'); XVII ('Pro Natura Solis, Astrorum et Caeli ignea, Auctoritates Sanctorum Patrum'); XXII ('Pro Natura Solis ignea auctoritates e Sacris litteris'); XXIV ('De Caeli et siderum naturali corruptibilitate, auctoritates ex sacra Scriptura'); XXV ('Pro natura caelorum corruptibili sancti Petri epistola affertur'); XXVI ('Pro liquida caeli substantia... Auctoritates ex sacra Scriptura... Auctoritates Sanctorum Patrum').
3. This attitude will be considered further on in Pereira.
4. Book IV, Part II, c. XIX ('Pro Natura Solis, astrorum et Caeli ignea, auctoritates Doctorum recentium'); XXVII ('Pro natura caeli vel liquida vel ignea, vel utraque auctoritates Theologorum Neotericorum, Philosophorum et Physiologorum'); XXIX ('Pro caelo liquido auctoritates astronomorum').
5. Scheiner, C., 1626-1630, 644 (Bellarmine, following the Scriptures and not Aristotle, has admitted the existence of water in the heavens, the future disintegration of the heavens, the igneous nature of heavenly material); pp. 731-733 (a letter of the Prince F. Cesi to J. Faber in which the founder of the Accademia dei Lincei confirms that the Cardinal had expressed these ideas to him many times). As a comment Scheiner (p. 733) added that Bellarmine had based his thesis "not on human understanding but on the divine word, not on his personal opinion but on the common thought of the Fathers, not on a sudden impulse but on the experience of a life of study carried out for many years; and he did this fully aware that he was acting against that torrent of the teaching of the Schools which dragged along with itself into error the mathematicians, who seek to resist since they are inclined to a judgement altogether the opposite". In fact Cesi wrote to Faber (p. 731) that Bellarmine had told him that he had not divulged his astronomical ideas "because of the opposition which the Schools usually raised".
6. Historiography has commonly accepted Duhem's (1908) interpretation of the topics of the letter, although not necessarily his positive evaluation of them. For a different opinion see Baldini (1984).
7. From this point of view Bellarmine's thought has remained practically unknown to historians. This can be explained by the fact that *Rosa Ursina* has been studied only by specialists for its technical content, which is concentrated in the first part of the work (see, for example, Schreiber 1898). Thus it has happened that, even such a standard work on the process of Galileo as that of De Santillana

- (1960, 195-197) presents Bellarmine as incompetent in astronomy and more rigid than St. Thomas himself in defending Aristotelean cosmology. In the same book (pp. 205-206) it is assumed as established that, of the *De Revolutionibus* of Copernicus, Bellarmine knew only the preface of Osiander, adding that it would have been enough for him to read the dedication of Copernicus to Paul III in order to change his judgement on the work. In a subsequent note it will be shown that Bellarmine recorded a passage precisely from the dedication. For Bellarmine's knowledge of Copernicus' ideas see Baldini (1984).
8. Bellarmine R., 1615.
 9. Scheiner, C., 1626-1630. On Ziegler see Burke-Gaffney (1944, 23, 36, 107); for his teaching career see Fischer (1978, 75, 224); for his works see Sommervogel (1890, VIII, 144). On Heiss see Sommervogel (1890, IV, 225-232). The letter of Bellarmine was written by 1614 because Heiss died on 20 July of that year (Fejer 1982, I, 118). For the writing of Smogulecz see Schönberger (1626), who was probably the true author of it (Sommervogel 1890, VII, 848). In 1629 Smogulecz gave some conferences at the Roman College (Villoslada 1954, 269) and it could be that Scheiner came to know his ideas on these occasions.
 10. Scheiner, C., 1626-1630, 777-784.
 11. *Ibid.*, 783 (there follows on p. 784 a Latin translation of the letter).
 12. Almost all the extant manuscripts of Bellarmine are found in two collections, both in Rome. One is in the Archives of the Pontifical Gregorian University (APUG) where there are about 35 codices (a list is given in Kristeller 1963, II, 136-7). The other is in the codices of *Opera Nostrorum* of the Archivum Romanum Societatis Jesu (ARSI), numbers 230-239 and 249-251. A collection of letters is found in 240-248. A discussion of these collections is in Le Bachelet (1911) together with an indication of the parts that are published (up to about 1910).
 13. Compare the text of the letter from "when I was a youth..." with the text of the *Lectioes* located at the end of folio 232.
 14. Thus at the beginning of Volume I (ARSI, *Opera Nostrorum* 234, Ir) Bellarmine wrote: *In Primam partem D. Tho. Lectiones*. For information on the work see Tromp (1933). For unknown reasons Bellarmine always refused to publish it and at his death, by his last will, the manuscript together with his books and letters went to the library of the Roman College. At the time of the suppression of the Society the manuscript went to the Archivio Segreto Vaticano and in recent times to ARSI where it is located in *Opera Nostrorum*, 234-237.
 15. Sommervogel (1890 I, 1252-3) mentions at the Letter D a copy listed in the catalog of 1832 of the Van de Velde library of Gand, at the letter K a copy in the University of Cologne library, at the letter P the autograph presently in ARSI. The copy in Cologne, consisting also of four volumes (MSS. 149 I - IV) is described in Vennebusch (1976, 117-121).
 16. The original manuscript has frequent annotations, references and quotations to be developed more fully. Bellarmine probably made these during the lectures.
 17. See Cecchini-Gratton, (1942) and Clark-Stephenson (1977). Further on we will recall the mention of the Nova by Clavius and Pereira. M. Vitelleschi, future General of the Society of Jesus, also speaks of it in his physics lectures at the Roman College (1589-1590). See Wallace (1977, 269).
 18. So the activity of Bellarmine within the Congregation of the Index has been reconstructed on conjectures and judged in contradictory ways. To some it appears that Bellarmine provided a moderating influence, since Copernicus' work was not completely prohibited but only suspended until corrected, and the

use of his teaching for purposes of calculation was allowed. Others, however, see his position as being that of the intransigent conservatives. In reality we simply do not have sufficient historical material to substantiate these interpretations.

19. These elements are: (A) ARSI, *Opera Nostrorum* 243, II, 258r. The handwritten draft of Bellarmine's letter to the mathematicians of the Roman College (29 April 1611), asking their opinion about the telescopic observations of Galileo. The text is identical to that of a copy given to Galileo and printed by Favaro in the *Opere*; (B) ARSI, *Opera Nostrorum* 245, 43r. Two brief excerpts from two of the works included in the decree of 1616: the commentary on the Book of Job by Diego de Zuñiga and the book of Copernicus. "Ex Didacto Stunica. In caput nonum Job, n. 6. Quod autem hoc capite Ecclesiastes, et multis aliis Scriptura Sacra Solis motum commemorat, quem centro universi immotum stare vult Copernicus, nihil eius placito adversatur. Num motus terrae in sermonibus soli assignatur, sic ut terrae cursum saepe solis cursum appellent". "Ex epistola Nicolai Copernici dedicatoria ad Paulum III in fine. Si fortasse erunt ματαιολογοι qui cum omnium mathematicum ignari sint, tamen de illis iudicium assumunt, propter aliquem locum Scripturae male ad suum propositum detortum, ausi fuerint hoc meum institutum reprehendere, ac insectari, illos nihil moror, adeo ut etiam illorum iudicium, tamque temerarium contemniam". The two excerpts certainly go back to the time when the Congregation of the Index was discussing these works. The second excerpt, in particular, shows that Bellarmine was aware that Copernicus had attributed physical reality to his mathematical model.
20. Favaro, A., 1890-1909, XIX, 348, n. 1
21. *Ibid.* XII (the letter of Sagredo) and 254 (a fragment of the letter attributed to Castelli).
22. Consult, for example, the word *ASTRUM* in the *Thesaurus Linguae Latinae*, II, 968.
23. For a fuller discussion of some of these points see Baldini (1984).

Notes to the Lectiones Lovanienses

The English Transtation of quotations from Scripture are taken from the *Jerusalem Bible* (1966, Darton, Longman and Todd Limited, London) and the enumeration of the *Jerusalem Bible* (which does not always coincide with that given by Bellarmine) is cited in these notes.

1. Bellarmine is discussing the *Summa Theologica*, I, q. 12 "How God may be known by us."

2. *Summa*, I, q. 5, art.2.

3. Ps. CIII, 5-6.

4. Further on it will become clear that this is the thesis of Bellarmine. This was exceptional in the 16th century for a theologian of the Society of Jesus, whose Constitutions prescribed fidelity to Thomism and proposed Aristotle as a model in philosophy. In a less decisive manner the thesis was also accepted by Pereira (see note 40) but only after the appearance of the Nova of 1572 which accelerated the crisis of the Aristotelian conception of the heavens.

On the other hand, as we have noted in the Preface, the text of Bellarmine is dated before the Nova occurrence, a fact which reinforces its originality. The Cardinal will return to this thesis many times in his later works as, for instance, in *De Ascensione* (Bellarmine 1615, 164-165). At this point the manuscript has an addition in the margin:

"Ita Iustinus in oratione parenetica ad gentes, ubi etiam dicit, Platonem ex prophetis hausisse coeli dissolutionem et in lib. de reprehensione decretorum Aristotelis maxime immoratur in confutatione libror. de coelo. D. Irenaeus lib. 4 cap. 6 proponit questionem gentilicio, qui dicebat, si coelum est sedes Dei, ut coelum procumbit, et Deus. Respondet quod coeli revera transibunt, tametsi ipsi hoc non credant, tamen Deus non cadet, quod dum sedet in coelo, non continetur, sed continet coelum" ("so also Justin in his *Oratio parenetica ad gentes*, where he also says that Plato drew from the prophets the notion of the dissolution of heaven. And in his book *De reprehensione decretorum Aristotelis* he is very insistent in refuting the books *De Coelo*. St. Irenaeus in his Book IV, Chapter 6, argues with a pagan who maintains that, if God resides in heaven, he will also be involved in its collapse. His response is that the heavens will cease even if the pagans do not believe it, but God will not cease because he is in heaven in such wise that he contains it and is not contained by it." Here Bellarmine cites *S. Iustini... cohortatio ad Graecos*, XX-XXII (P. G., VI, 275-282); *S. Iustini... Quorundam Aristotelis dogmatum confutatio*, XIII-XIV, XLVI-LXV (P. G., VI 1518, 1539-1563); *Sancti Irenaei... Detectionis et eversiois false cognominatae agnitionis seu contra haereses libri quinque*, IV, 3 (Bellarmine mistakenly wrote IV, 6; P. G., VII, 979-980).

5 *S. P. N. Basilii... Homiliae IX in Hexaemeron*, I, 3 (P. G., XXIX, 10-11). In I, 9-10 St. Basil discusses in detail the possible physical causes of the immobility of the earth and the arguments to prove it given by the Greek tradition in physics. The discussion provides a good part of the Scriptural citations and of

the considerations in mechanics employed later on by those who opposed Copernicus and it was used, perhaps, by Bellarmine himself as a source of information.

6 P. G., XXIX, 26-27.

7 *Hom.* III, 3-8 (P. G., XXIX, 55-74).

8 *Sancti Ambrosii Hexaemeron*, II, 3, 14 (P. L., XIV, 151-152).

9 *S. Aurelii Augustini... De genesi ad litteram*, III, I-6 e II, 3 (P. L., XXXIV 279-282, 265).

10 The texts cited do not support these judgements. See *S. P. N. Joannis Chrysostomi Homiliae in Genesim*, IX and X (P. G., LIII, 76-81, 81-90).

11 *Beati Theodoret... in loca difficiliora Scripturae Sacrae quaestiones Selectae*, XI (P. G., LXXX, 91).

12 *Sancti Joannis Damasceni Expositio fidei orthodoxae*, II, 5-6 (P. G., XCIV, 879). The thesis, however, is not affirmed here but there is only a reference to the thought St. Basil expressed in his first homily (See note 5).

13 None of the writings of Bede on Genesis contain these affirmations (P. L., XCI, XCIII).

14 Perhaps Bellarmine has *Timaeus*, 38 b-c in mind.

15 *De natura deorum*, II, 15.

16 Bellarmine quotes inaccurately. The exact quotations would be: *Commentarius in Somnium Scipionis*, I, 19, 9 and I, 20, 7.

17 *De Coelo*, II, 7 (285a 17-19). The erroneous etymology of *aether* proposed again further on (225v) is not found in Aristotle.

18 This quotation of the comment of Philopon on the *Physica* of Aristotle is interesting, because in that work Bellarmine could find ample discussion of the kinematics and dynamics of Aristotle, which later on became crucial for the debate on whether the Copernican System was physically admissible. Bellarmine probably knew of this comment from his student days during the year when he studied physics at the Roman College of the Society of Jesus. This was the second of his three years of philosophy studies (1561-1562), when he had Father Parra as teacher (Le Bachelet 1911, Villoslada 1954). His notes from that year and the following one show that he also followed the lectures of Toledo (*Physica et metaphysica secundum dictata P. Parra and F. Toleti*, Roma, Archives of PUG, ms. 375). It has been noted that Philopon proposes a concept of *natura* of a body as something internal to it, capable of originating certain of its activities. This concept at the time of Bellarmine influenced certain philosophers of the Roman College from whom the concept of cause began to evolve into the concept of force (see Wallace 1981, 110-111). One could imagine an analogous influence on Bellarmine. As will be seen, his astronomical ideas implied the existence for every heavenly body of an irregular motion, not apparent but real, whose origins were internal to the object. It is surprising that, in this context, he does not indicate explicitly the angelic intelligences as the cause of this motion, since they were commonly cited as the cause of the motion of the spheres in the contemporary commentaries on physics at the Roman College (Wallace 1977, 276).

19 Ps. CIV 5; Eccl. I, 4 These are two of the biblical passages upon which arguments against Copernicus were founded. Bellarmine, of course, did not understand the sense given by the *Jerusalem Bible* English translation of the passage from *Ecclesiastes*. For consistency, we, nonetheless, give that translation. Here it is of interest to note that in the argument the verbs *fundare and stare* were understood by the anti-Copernicans as having a unique and evident meaning, that is, static. Bellarmine will also be converted to this interpretation, although in this text from his youth he interprets those verbs as excluding not motion but change. Even if in Aristotelian metaphysics motion is a particular kind of change the question arises as to why later on Bellarmine will resolutely refuse to attribute to these or other biblical words any meaning that is not mechanical. Such other meanings, one might note, would have corresponded to his fundamentalist requirement to defend the literal truth of scriptural statements, while at the same time not linking (or linking less stringently) Scripture to a particular cosmological thesis. We will indicate later on the possible causes of this stance.

20 Job. XIV, 12.

21 Ps. CII, 26, 27.

22 This phrase is not found in Isaiah.

23 Isaiah XXXIV, 4.

24 Isaiah LXV, 17.

25 Joel IV, 16.

26 Matthew XXIV, 35.

27 Matthew XXVIII, 20.

28 The literal phrase is not found in Job where, however, there are other phrases which have an analogous meaning.

29 Apocal. VI, 14.

30 Apocal. XXI, I (where however it says: "... et prima terra abiit, et mare iam non est").

31 Epist. II, 10-13

32 See note 33.

33 The quotations are erroneous; they are not found in Book XVIII of *Moralia*. See P. L. LXXXVI, 38-96.

34 *S. Eusebii Hieronymi... Commentariorum in Isaiam Prophetam libri duodeviginti*, XVIII, 65 (P. L., XXIV, 644).

35 *Hom.* I, 3 (P. G., XXIX, 10-11)

36 This reference to Chrysostom is also inaccurate (see note 10).

37 Here Bellarmine adds in the margin: "in his *Octavius* Minucius Felix says clearly that the heavens will cease". See *Marci Minucii Felicis Octavius*, XXIV (P. L., III, 344-345).

38 *Summa*, I, q. LXVII, art. 2: "Utrum aquae sint supra firmamentum".

39 The first reason for interest in this passage is Bellarmine's reference,

implicit but clearly negative, to an unchallenged principle in astronomical tradition: the resolution of the apparent motion of every heavenly body (including that of the fixed stars) into several uniform circular motions, understood as the rotation of material spheres. Secondly, he also appears sceptical about the number of motions and, therefore, about the number of spheres needed. He thus appears to dissociate himself from the tenets of Aristotle and Ptolemy on the rotation of fixed spheres, although his position remains geocentric. The attitude of Bellarmine towards the Ptolemaic-Aristotelian tradition is, therefore, the contrary of that of Copernicus who accepts the multiplicity of uniform circular motions but rejects geocentrism. Thus it is patently wrong to claim that Bellarmine rejected Copernicanism because of a sheer blind Aristotelian orthodoxy.

The reference in the text to an astronomy of eight spheres (or heavens) is to the original Aristotelian system, while that of ten spheres corresponds to the Ptolemaic system with the changes made by Thabit ibn Qurrah or the Alphonsines. It should be remembered that, by the logic of the Ptolemaic system, a new sphere was usually introduced to explain the variations in a motion previously considered to be uniform. Therefore, chronologically a model with more spheres came after those with fewer spheres. During the years in which Bellarmine was writing, this reasoning had already produced models of eleven spheres, like the one of J. Werner, well known to the mathematicians of the Roman College (Werner 1522). A few years later another notable class of eleven-sphered systems (the best known example is Magini 1589) came from an attempt to transfer into spherical astronomy the four Copernican motions of the earth.

Finally, it is difficult to identify the "some of our contemporaries who have proven that the eighth sphere has only one motion", because this phrase could refer to anyone of three different positions, all held at that time: (1) assignment to the eighth sphere of the precessional motion alone, attributing the diurnal motion to the ninth outside sphere. (2) exclusion of precessional motion and assignment of diurnal motion to the eighth sphere of the stars; (3) exclusion of a special sphere for the daily motion, attributing to each heaven a peculiar motion with a period slightly different from 24 hours. Variations in the period will produce in time a constant anticipation of the equinox and the appearance of an orbital motion. Position (2) was not common because it contrasted with the historical evidence of the shifting of the equinox and the changes of stellar longitudes with respect to the measurements of the Greeks; it was, nonetheless, known to Bellarmine because it was held tenaciously by his maternal grandfather, Riccardo Cervini (Baldini 1984), but the future Cardinal did not defend it. Position (1) is Ptolemy's and it still had some supporters in 16th century Italy (for example, Raimondo 1589). Bellarmine had the opportunity to know this position, but it happens that Clavius convinced him of the precessional variation, so that he had no choice but to point to position (3). At this time in Italy this position was supported in various ways by orthodox Aristotelians. They held that the geometric variations introduced by the followers of Ptolemy into the Aristotelian model for the planets were physically impossible. In a letter of 1579 to his cousin, E. Cervini, Bellarmine will recall that during his stay at Mondovì (about 1564)

the philosopher, F. Vimercati, had defended in discussions with him the Aristotelian number of the heavens (Le Bachelet 1911, 107-108). He probably had in mind systems of homocentric spheres such as those of Fracastoro or G. B. Amici.

40. Implicit here is the discussion as to whether the number of stars in existence is the same as the number of stars that we see. In the *Lectiones*, in a text not given here (f. 219v), Bellarmine wrote: "the stars are so densely situated that they almost touch one another and, even though, because of moonlight and vapours which rise from the earth, it is rare to observe this, I recall having seen sometimes at night from high elevations in Italy where the air is very clear and pure stars so crowded that they left hardly any empty space". The text upon which we are commenting, besides implying that the actual number of stars may be greater than those we see, also notes that the distance may not be the same for all the stars. So Pereira, when discussing the Nova of 1572, considered three possibilities: a continuous process of star formation, the existence of heavenly bodies not usually observable, that the stars are not really fixed, so that by moving about they change the configuration of a constellation (Pereira 1603, 187-188; this work was first printed in 1591). In another work, recalling that the Scriptures often refer to the stars as "innumerable", he quotes Augustine's opinion (*De Civitate Dei*, XVI, 23) whereby: "don't believe that all of them are visible, in fact the more acute one's vision, the more stars one sees". Furthermore Pereira adds that Augustine was not referring "to the stars which are large and easily seen, that is those which the astrologers have counted, but generally to all the stars in heaven, whether visible or invisible to men. The astrologers do not refuse to admit that the number exceeds human capabilities; in fact who could know the number of them given that neither by looking nor by any other means does one have certain knowledge of them?" (Pereira 1599, 155-157). Also Clavius, who usually defended Ptolemaic orthodoxy and in his *Commentarius* to Sacrobosco repeats the traditional number of 1022 for the fixed stars, admitted that there could be an undetermined number of other stars less than sixth magnitude, that is, whose brightness was less than the threshold of visibility (Clavius 1581, 148-150).

41. Summa I, q. 68, art. 4: "Utrum sit unum caelum tantum".

42. Rather than an exact quotation, this should be considered an interpretation of Thomas' thought on the matter.

43. *Hom.*, I, 11, (P. G., XXIX, 26-27).

44. Genesis I, 20: "Dixit etiam Deus: producant aquae reptile animae viventis, et volatile super terram sub firmamento caeli".

45. Translating Genesis, I, 20 (*Septuaginta Vetus Testamentum Graecum*, p. 79)

46. See note 11.

47. *Procopii Gazaeci sophistae christiani Commentarii in Genesim*, I, 6 (P. G., LXXXVII, I, 63-74).

48. *Hom.* III, 4 (P. G., 59-63).

49. See note 17.

50. See note 6.

51. See note 17.

52. At f. 225 v in an excerpt here omitted Bellarmine had written: "dicunt igitur authores huius opinionis, Deum ex aqua per extensionem idest rarefactionem elementum ignis effecisse, ut hoc esset firmamentum, quod positum est inter aquas, et aquas" ("Thus the authors who are of this opinion say that it is from water, by its dilution and rarefaction, that God formed the element of fire in order to make from it the firmament about which it is said that it has been placed amidst the waters"). The "authors" under consideration are Saint Basil and others. Even though archaic and strange to modern thinking, the hypothesis developed by Bellarmine in order to give physical coherence to the Biblical passage corresponds to the thinking of some proponents of the new science. Considering, for instance, the corpuscular theory of matter, Galileo assumes that light corresponds to a state of maximum division of particles and that such was the primordial state of matter (Baldini 1976, 132-7, 142-7).

53. The excerpt which precedes is a comment on Genesis I, 6-8: "Dixit quoque Deus: Fiat firmatum in medio aquarum: et dividat aquas ab aquis. Et fecit Deus firmamentum, divisitque aquas, quae erant sub firmamento, ab his, quae erant super firmamentum. Et factum est ita. Vocavitque Deus firmamentum, Caelum". As is well known, one is dealing here with an assertion of Genesis whose physical interpretation is not very clear, so that it has become a classical text for exegetes. Bellarmine's particular interest in this text is explained by the fact that it is one of the most difficult to bring into agreement with Aristotelian natural philosophy and specifically with the teaching on "natural places". Pereira, whose interpretations are much closer than Bellarmine's to orthodox Thomism, in commenting on this passage, finds it necessary to write that the phrase was metaphorical or that the phenomenon described was a miracle (Pereira 1599, 57-71). This work of the Spanish Jesuit, among the greatest of the century in the field of biblical exegesis, can be used as a basis for judging the originality of the cosmological ideas of Bellarmine. Pereira is familiar with and quotes the authors and the theses on which Bellarmine establishes his position, but he always ends his analysis by denying their credibility and by proposing once again the Thomistic thesis of the agreement between Biblical cosmology and Aristotelian physical cosmology. In his *Quaestio Quarta de Numero Coelorum* (145-147), after having mentioned authors for whom the thesis of Aristotle on the plurality of the heavens contrasts with the Bible, Pereira concludes that: "Even though a precise number of heavens is never indicated in Sacred Scripture, since philosophers and mathematicians with obvious and conclusive arguments prove that there are eight, nine or even more heavens, the theologian or Scriptural exegete who would condemn or refute their opinion as contrary or extraneous to Sacred Scripture would be without foresight, not to say foolish."

Thus, completely unaware of his condemnation (the *Lectiones* of Bellarmine were not known to him and there is no proof that they were circulated at the Roman College during these years), Pereira described the

greatest expounder of doctrine within his religious order, a man who was now a Cardinal, as "inconsciens" and "stultus".

54. *Hom.* III, 4 (P. G., XXIX, 62-63).
55. *Hom.* IV, 3-5 (P. G., LIII, 42-44).
56. Bellarmine will repeat this profession of scepticism about cosmology in *De Ascensione* (Bellarmine 1615, 174-175): "Even if the stars of the firmament travel together and with the same velocity in complete circles in heaven, the seven bodies so called wanderers show different motions. But these realities are beyond us and their harmony can only be heard by those who, because they are in heaven, understand the rational order of those motions". It is to such phrases as these that one should perhaps look for the psychological roots of Bellarmine's caution with respect to Copernicanism, and, indeed, with respect to any other astronomical system which would handle perceptual data in a very abstract way, such as the Ptolemaic astronomy. This caution is seen in texts such as his letter to Foscarini. It is a different question as to whether such formulations are equivalent to what we call today positivism.
57. *Hom.* IV, 3 (P. G., LIII, 42).
58. *Summa.*, I, q. 68, art. 4.
59. See n. 11.
60. P. G., LXXXVII, I, 63-65.
61. *S. Ioannis Damasceni Expositio accurata fidei orthodoxae*, II, 6 (P. G., XCIV, 879).
62. P. L. XXXIV, 478-479. Here, however, the four theses are listed without naming their authors. The fact that Bellarmine is familiar with them, proves, among other things, that he knew, at least superficially, the *Almagest* (on the astronomical learning of the Cardinal see Baldini 1984).
63. *S. Aurelii Augustini... De Haeresibus ad Quodvultdeum liber unus* (P. L., XLII, 26).
64. The history of astronomy does not appear to present a theory which clearly corresponds to that of the stupid astrologers. One must note here that the term *stellae* includes the planets, the Sun and the fixed stars. There arises a difficulty for Bellarmine in not accepting the presuppositions of spherical astronomy. Logically a refusal to accept the uniformity and regularity of planetary motions should have applied also to the fixed stars. If one excludes their equidistance from the Earth and their positioning on a solid spherical surface it becomes difficult to explain an apparent fixed position between stars at different latitudes. A mathematical model which excludes both the sphere of the stars and the mobility of the earth cannot be simple. For instance, one has to suppose that the absolute velocity of stars placed at various distances from the earth decreases from the celestial equator towards the poles in such wise as to produce a constant angular velocity. The letter to F. Cesi of 25 August 1618 appears to show that this was why he did not develop and publicize his own model. He says: "But this invention of mine was not satisfactory, not even for the stars of the firmament, which while making their longest motion

in the meridian appear, it is evident, to be carried by the heavens, and in the intermediate regions they make the longest circles, at the extremes, the shortest". (Scheiner 1626-1630, 783).

65. This consideration is dear to Bellarmine. He repeated it many times up to the time of the *Explanatio in psalmos* (Bellarmine 1611, 96). It was probably not original because it could have been read by him in some of the Fathers quoted in the *Lectiones* (for example, Theodoreth, P. G. LXXX, 91 and Chrysostom, P. G. VIII, 43). Aquinas had already taken it from Chrysostom in the same place of the *Summa* (I, 78, 4) on which Bellarmine is commenting.
66. Genesis, I, 20, 22, 26; I, 6 ("Vocavitque Deus Firmamentum, Caelum"). Ps. CXV, B, 16.
67. Cor. II, 12, 2: "Scio hominem in Christo ante annos quattuordicim, sive in corpore nescio, sive extra corpus nescio, Deus scit, raptum huiusmodi usque ad tertium caelum".
68. *Hom.*, II, 8 (P. G., XXIX, 47-51).
69. *Hom.*, III, 8 (P. G., XXIX, 71-74).
70. P. L., XXXIV, 266-267, 281, 282.
71. The analysis with certain precision fixes upon the following points: (1) the existence of distinct heavens, atmospheric, sidereal and empyraeal is accepted, mainly on the basis of Scripture; (2) the distinction between the first two heavens, justified a little before in terms of optics, would also have a physical content: the first consists of air, the second of fire; (3) the *empyraeum* does not seem to be considered as a non-place in which matter and physical space cease (as often in Scholasticism). Bellarmine follows a pre-scholastic tradition which attributes to the *empyraeum* both a spatial nature and at least one physical property, that of reflecting light (*luciditas*); (4) having admitted the existence of both the first and the third heaven, the one through sensory evidence, the other through Scriptural evidence, the second heaven is defined as an intermediate region with a thickness and an internal structure not further specified; (5) the question, *quot sunt ponendi coeli*, arises, therefore, and properly so, as a question about the internal state of the second heaven or the astronomical heaven. The question, according to Bellarmine has not yet received from philosophers and astronomers a definitive and convincing answer. Such an answer cannot be deduced from truths about God, but only from an analysis of important phenomena. The implication seems to be that the content of the answer is essential from a technical point of view, but not from a theological point of view. Thus the religious connection between God and the world would be conceptually unrelated to the structure of the world. Consistent with this point of view, Bellarmine will discuss a little further along in the *Lectiones*, in purely astronomical terms, the structure of the second heaven, by delineating those hypotheses which years later, in the letter to Cesi, he will recognize as technically inadequate.
72. *Timaeus*, 40 a.
73. See note 15.
74. See note 7.

75. See note 8.
76. *S. P. N. Joannis Chrysostomi... Homiliae XXI de statuis ad populum antiochnum habitae*, IX, 4 (P. G., XLIX, 108) e X, 2 (XLIX, 112).
77. See note 9.
78. See note 11.
79. See note 47.
80. *De coelo*, II, 4, 20-25 (289a).
81. *Hom.* III, 7 (P. G., XXIX, 67-71).
82. The religious conviction about the end of the world implies in Bellarmine's thought a rather specific and characteristic chronology and as such it becomes a criterion for choosing between various analyses of celestial phenomena. See note 95.
83. A widely accepted historical thesis holds that the problem *a quo moventur planetae*, fundamental after Kepler, had little importance in Ptolemaic astronomy, because there the rotation of the spheres, by definition continuous and uniform, was considered to be a sufficient explanation. The position of Bellarmine shows, however, that there are three issues implicit in the problem: (a) the mathematical composition of the orbits; (b) the kinematical composition of irregular motions with uniform circular motions; (c) the dynamical origin of circular motions or, if these are rejected, of the acceleration of the planets in their apparent orbits. Bellarmine admitted (a) as a logical possibility but not as a physical reality. Therefore (b) has no interest for him while (c) has a considerable interest. This conceptual situation, in its general lines, is closer to that of Kepler than to that of Galileo.
84. *P. L.*, XXXIV, 271-272.
85. *Hom.* VI, 5 (P. G., LIII, 59).
86. Lippomano 1546, 30r.
87. This linguistic argument is taken from Chrysostom, *Hom. VI, 5* (P. G., LIII, 59), a text already cited in the *Lectiones*. Lippomanus had already presented it in the same citation as in note 86.
88. This image is not a chance one. In those years Jesuit philosophers and mathematicians often used it ironically to discredit the thesis which Bellarmine supports. Pereira (1599, 13) presented the thesis that: "moveri stellas per caelum, ut pisces per aquam, et aves per aerem" (for the stars to move through the heavens as fish in water or birds in the air) is something which "repugnat manifestis experimentis et rationibus philosophiae" (contradicts manifest experiments and philosophical conclusions). Clavius wrote in the *Commentarius to Sacrobosco* (1581, 41): "astra non per se moventur, ut pisces in aqua, vel aves in aere" (Stars do not move by themselves, like fish in water or birds in the air). To deny that the surroundings had a dynamic role in the motions of the stars implied that they were at rest and that they were not solid nor subdivided into spherical regions. These aspects are logically connected and it is difficult to establish which was primary in driving the young author of the *Lectiones* to his unorthodox reflections.

89. The reference is to *De Coelo* II (B), 8, 290 a30 - 290 b8. Bellarmine's intention to be ironic forces the text, which does not consider 'feet' of the heavenly bodies. Aristotle's argument is that, excluding traction, the motion of the stars could still be locomotion or projection. The second possibility is excluded because it always produces a motion limited in time; the first cannot exist in spherical bodies which nature "has deprived of any means by which they might be able to go forward by themselves and has kept them as far away as possible from beings endowed with organs of motion."

90. It is known that a distinction between theological discourse and philosophy was received into scholasticism; from there it passed into the tradition of the universities and then into the doctrinal and instructional usage of the Society of Jesus. It should be noted, however, that St. Ignatius, in the Constitutions, and later numerous documents of the Congregations of the Society made a choice for Thomism in theology. This implied the adoption of a particular relationship between philosophy and theology as presented by Aquinas, according to whom the distinction between the two areas of discourse is not so radical as it is, for example, in Occam. Therefore, the criterion here enunciated by Bellarmine seems to indicate that, considering that the scope of theology is the clarification and conceptual ordering of the truths of the faith, while that of natural philosophy and of applied mathematics is factual verification, the area of the first (supposed *a priori* to agree with the second, as Bellarmine will shortly say) includes only a certain number of general enunciations which the positive sciences ought to have in common with the Christian vision of creation as deducible from Genesis. We shall see later on that this limited acceptance of the autonomy of research is the only explanation for certain assertions of the *Lectiones* and for the position taken by Bellarmine towards the Copernicanism of 1615-1616, while a more radical position would have been inconsistent with them.

91. Almost certainly we are not dealing here with the Copernican hypothesis. A few lines before the term *stellae* refers to all the heavenly objects, and no reader of Copernicus could hold that his model put the planets also at rest. Besides it is very improbable that, already in his Louvain years, Bellarmine would have known the *De revolutionibus orbium caelestium*. Before 1570 in Italy it was exceptional to have known this work and it is improbable that he would have been able to examine it during his years of study in Venice. Thus the text refers to classical ideas. Among the works quoted in the *Lectiones*, and others surely known to Bellarmine, at least three refer to hypotheses of the Greeks on the motion of the earth in terms so vague as to lead one to believe that the motion of the earth could substitute every apparent heavenly motion. These are: the *Homilia* I of Saint Basil, the book II *De Coelo* of Aristotle, and the *Della Sfera del mondo* di A. Piccolomini, which Bellarmine used during his brief period as a teacher of mathematics and astronomy at Florence and Mondovì (in 1564-65, Baldini 1984).

92. Among hypotheses technically equivalent scriptural assertions, according to Bellarmine, determine a limited area of acceptable hypotheses. Here the meaning of "acceptable" becomes decisive. The criterion could be historical-philological, equivalent thus to the affirmation that the Scriptures

reveal, in the one who wrote them, a certain sequence of cosmological belief and not others. In this regard, we note that Bellarmine's evaluation of Biblical cosmology was without doubt more adequate than the common interpretation of Genesis by the scholastics (for cosmological ideas in the Bible see Schiaparelli 1903). But one must be careful not to apply strict philology to those times when scriptural expressions were sensed to be much more closely connected to divine inspiration than to human mediation.

The ideas of Bellarmine on scriptural exegesis are given principally in his *Controversiae* and specifically in *Controversia Generalis de Verbo Dei* (Bellarmine 1721, v. 1, Book III, chapters 1 and 3). He distinguishes the form and the content of the text and for each he lists the difficulties for interpretation. Following tradition he allows a literal and a spiritual or mystical sense of the text and the literal sense may be either simple ("simplex") or figurative ("figuratus"). He notes that in the Bible are found "orationes figuratae plurimae, Tropi, Metaphorae, Allegoriae, Hyperbata, Ironiae... sine ullo numero", and, therefore in general for him the figurative sense is not contrary to the exegetical approach later championed by Galileo but already given by the Church Fathers (Bellarmine 1721, v. I, 64). He makes clear, however, that while every Biblical passage has a literal sense, not every one has a spiritual sense and he leans towards the belief that Mosaic books of the Old Testament have an historical sense and, therefore, a simple ("simplex") literal sense (Bellarmine 1721, v. I, 64-71). In the *Prima Controversia Generalis de Conciliis, et Ecclesia Militante* he writes that: "in Scriptura nullus potest esse error, sive agatur de fide, sive de moribus, et sive affirmatur aliquid generale... sive aliquid particulare", because in it: "non solum sententiae, sed verba omnia, et singula ad fidem pertinent. Credimus enim nullum esse verbum in Scriptura frustra, aut non recte positum" (Bellarmine 1721, II 43). All of those affirmations together appear to show that Bellarmine was convinced that at least some of the passages implying geocentrism had a simple ("simplex") literal sense and where, therefore, explicit divine teachings. This conviction was strengthened by the fact that the symmetry of a geocentric cosmos was in perfect agreement with the belief in the separation in space of heaven and hell: "consentaneum est rationi ut locus Daemonum et hominum impiorum et reprobatorum longissime distet ab eo loco, in quo Angelos et beatos homines perpetue futuros non dubitamus: locus autem beatorum... coelum est; a coelo vere nihil abest longius, quam terrae centrum"; "si locus beatorum est in summo coelo, locus damnatorum (est) in loco remotissimo a coelo, nihil autem remotius centro terrae" (Bellarmine 1721, I, 222; II, 319).

At times in the *Lectiones*, when Bellarmine uses Biblical statements to deny scholastic cosmology, he takes the literal sense of the text to be the correct interpretation and, therefore, the one that corresponds to natural truth. Thus, when Galileo reproposed the Copernican hypothesis, the principle of equivalence of hypotheses came to be subordinated to the principle of conformity with the Bible.

This explains perhaps the changing attitude of Bellarmine in the years 1611 to 1616 and above all his tenacity in assigning a purely hypothetical value to Copernicanism. If this is correct, the usual judgement of the reasons

for the first process against Galileo, namely an alienation of scholasticism from the new science, requires some correction. The decisive factor was rather something less specific and much less susceptible to reform, that is, a traditional way of understanding revelation. One might add, as emphasized recently by Pedersen (1983), that the Copernican crisis broke out at an historical moment when the scholastic systematizing of theology had become rigid as a consequence of the Protestant question. Thus anything that even remotely threatened scholasticism was seen as a challenge to the faith.

93. This principle, already given by Aquinas, is the theological counterpart to the familiar scholastic axiom: One truth cannot contradict another. In theology this could be broadly applied, including the requirement of conformity to Scripture which we have discussed in note 92. We know that Galileo also drew from traditional exegesis, almost certainly from Pereira, the principle of the agreement of Scripture and nature, but he proposed to treat the cases where they apparently differed by means of a Patristic concept, that of the metaphorical and simplifying character of certain biblical assertions. But Galileo, desirous to show that the "Mosaic physics" was compatible with heliocentrism, was forced to employ it for statements whose geocentric and geostatic meaning had always appeared beyond doubt. Furthermore, another well established exegetical practice was that of attributing an historical character to Genesis considering it to be a narration of real events which occurred in the manner and time sequence given therein (Pereira 1599, 11). This historical character was threatened by the proposal of Galileo on the metaphorical and simplifying character of certain Biblical statements. The general religious culture of the time, and not only the Catholic culture, would not admit such an overall metaphorical interpretation. Proof is given by the writings of Bellarmine after 1616 which assert more explicitly than the *Lectiones* that the Earth is static (*Explanatio in Psalmos* 99, 701, 775-6; *De Ascensione* 55-6, 156-8). In the letter to Foscarini he reaffirms the requirement that "recte intelligantur Scripture, ut cum... perspecta veritate non pugnent", but he denies outright that Copernicanism is physically a *veritas perspecta*.

94. Since previous arguments were based on Scripture, the refusal to interpret the apparent motions as resulting from many uniform circular motions could still be considered a theological thesis. Now, however, Bellarmine goes to the terrain of astronomy, for which there had been for a long time an interest in his family (Baldini 1984). Having renounced the hypothesis of the spheres but keeping the Earth immobile, he was forced to deny the distinction between daily and annual motion and to interpret these two motions as coming from an erroneous analysis of one complex motion which each heavenly body followed about the earth with common East-West turns, but with different periods and orbits. The small difference of each period with respect to that of the fixed stars, when summed up over time, produces that which has been traditionally interpreted as a second revolution contrary in sense to the first. The joining together of the successive positions of the heavenly body with respect to the stars and the time which it employed to return to its initial position are what have been called the orbit

of that body and the period of the orbit. This model produces a complex real motion for the sun and much more complex ones in the case of the planets. The sun would describe a spiral alternating about the earth's axis and contained between the latitudes of the solstices. It was precisely this motion which the Ptolemaic system and the Copernican system considered to be only apparent and not real.

As for the planets, Bellarmine seems to think that the irregular motions which they have in his model are physically possible through the fluidity of the matter which fills space. Still it is clear that they could not be explained by him in terms of a constant motive force and they required postulating something like a continuous miracle. Even though it may have provided a certain fascination for biblical fundamentalism and the mystical tendency of Bellarmine, its physical plausibility was minimum and so too was the possibility of a mathematical model being developed. Besides the structure of the fixed stars appeared to show the existence of a sphere (see note 64) and this, as Bellarmine will write many years later to Cesi, convinced him not to develop his ideas.

But there are proofs that he still held the convictions of the *Lectiones*. Besides the letter to Cesi and the evidence referred to by Scheiner in *Rosa Ursina* there is a document which shows that he manifested these convictions to the mathematicians of the Roman College in the years of crisis, 1611-1616. In 1616 the successor to Clavius, C. Grienberger, examined a book not yet published, written by another Jesuit, G. Biancani, professor of mathematics at college of Parma, where only one heavenly sphere, that of the stars was allowed. He wrote: "Id... mihi semper visum est probabilissimum, et sc̄io communiter omnibus placere. Imprimisque illustrissimo card. Bellarminis, qui etiam a motu planetarum extra orbis reales, et solidos nequaquam abhorret et corruptibilitatem in coelis ultro admittit, putatque opinionem hanc conformiorem esse sacris litteris, earumque expositoribus". ("This always seemed most probable to me and I know that it is a thesis which has general approval. Among its most decisive supporters there is the illustrious Cardinal Bellarmine, who moreover is not at all against admitting that the planets move independently of material spheres and even admits that heavenly objects might be corruptible, maintaining that this point of view is more in keeping with Sacred Scripture and those who interpret it"). Grienberger added that, instead of supposing so many spheres for each heavenly body: "nulla ratio suadere vel saltem convincere videtur astra non posse immediate per se vel per intelligentiam eas lineas in coelo percurrere, quas re ipsa describerent si ad motum plurium orbium circumduci putentur: nam etiam hic nulla ratione dici potest re vera astrum pluribus simul motibus moveri, sed uno tantum eoque irregulari ex omnibus illis vel composito vel potius resultante: qualis est motus spiralis in Sole" (no argument seems to make plausible much less to prove, that the heavenly bodies could not, by their own power or by the intervention of heavenly intelligences travel those same orbits in heaven which they would in fact trace out under the hypothesis that they were moved by the rotation of more than one sphere. In this case no argument proves that the heavenly bodies are subject at the same time to more than one motion, it being irregular put together from or rather

resulting from all the motions. Such a motion is the spiral one of the Sun.) [ARSI, F. G. 655, 115r] The concept of *unus motus irregularis* and the use of the Sun as an example are identical to what Bellarmine held.

Thanks to Grienberger and Biancani the thesis of Bellarmine survived even after his death at the two principal scientific centers of the Society of Jesus in Italy, the Roman College and the College of Parma. In general the mathematicians at these colleges continued to propose the Ptolemaic model and the one of Brahe, but they presented them only as hypotheses and justified them only on the basis of their mathematical simplicity and their usefulness for making predictions. On the other hand, in the writings of the philosophers and in the theses of their students these mathematical models were seen as simply abstract analyses of a physical reality identical to that given by Bellarmine, although he was not explicitly mentioned. For the Roman College see Giattini (1653, 616-621), Caprini (1653, 167-168), Polizzi (1676, 451; he did not teach at Rome but followed Giattini); for the College of Parma see Rocca (1627, 39-40) and Cabeo (1646, 218-222).

These two traditions, which might be called mathematical-astronomical and physical, converged in the work of the best Italian Jesuit astronomer of the 17th century, G. B. Riccioli, a student of Biancani and Cabeo. He followed completely the mathematical tradition as to the composition of the planetary orbits with uniform circular motions and, as a matter of fact, his model is a modification of that of Brahe (Riccioli 1651, v. I, 2, 288-289). Although this is well known, historians have paid little attention to his theory or the motion of the sun (Riccioli 1665, v. I, 65-69). By placing the earth immobile at the center and supposing the orbits of the inferior planets to be circles with the sun at the center, he is forced to have the sun move in a spiral, just as hypothesized by Bellarmine. Riccioli was the last to discuss this spiral motion and after the middle of the century the ideas of Bellarmine were abandoned.

95. The *aliquae stellae* are the fixed stars, distinct from the planets. Their *cursus* is precession, for which Bellarmine recalls the Ptolemaic period (one degree per century giving 36,000 years) and the Alphonsine period (one degree in 136 years giving 49,000 years). It is very characteristic that as a theologian he considered the *cursus* to be *ridiculus* and *incredibilis* solely because of its duration. That opinion comes from both a calculation, based on the Bible, of the years since the creation and from a prediction of the future duration of the world, inspired by the traditions of millenarism. The implied logical step appears to be that God would not have created a cyclic motion which could not complete its course because its period would have been much longer than the duration of the universe itself. How much greater? Bellarmine discusses the age of the universe in several of his writings. Already in the *Lectiones* (in a passage not given here, 239v in the margin) he cites favorably the thesis of the Fathers of the Church and theologians that *mundum duraturum sex millibus annorum* after Adam, and in his edited works he presents that opinion as plausible, but he does not say certain. His biblical chronology is arranged by computing about 4000 years from the creation to the birth of Christ (Bellarmine 1613; Ryan 1936, 70-71).

Thus if the precession were real then during the whole age of the world the equinoctial point would travel at most 60 degrees along the ecliptic, that is, only one sixth of its predicted course. This estimation of the age of the world was not personal to Bellarmine but was rather due to the fusion of two elements of which at least the first (the number of years from Adam to Christ) had been handed down with small variations from the Patristic to the Scholastic period and to the theologians of the Roman College, Pereira among them (Wallace 1977, 258-9; 1981, 221-3). It is worth noting that the estimate of 4000 years from Adam to Christ, later confirmed by the chronology of the 17th century, from J. Deckers and Kepler to Newton, did not agree with the tradition of the *Tabulae Alphonsinae*, in which the number of years from Adam to Alphonse X of Castille (about 1250) was said to be 6984. This second value appears to have been accepted by the mathematicians of the Roman College, while the former was accepted by the theologians and philosophers. In the correspondence with Biancani, to show that the age of the Universe did not exclude the possibility of changes in heaven, Grienberger recalled that the world "had not yet reached 8000 years old" (ARSI, F. G. 655, 114r)

96. This objection concerns the possibility that a heavenly body could follow many movements simultaneously. Naturally for Bellarmine, as for all philosophers of the Society of Jesus in those years, mechanics meant Aristotelian mechanics, in which the principle of *simplicitas* of motion was dominant, whereby astronomers attributed one motion only to each heavenly body, a motion relative to the medium in which it moved. The medium itself could move with respect to another medium and so on, but Bellarmine excluded this possibility.

97. The transmission of the motion of the outer spheres to the inner ones had been a presupposition in all the variants of spherical astronomy. But it had never been spelled out in terms compatible with the exact parameters of each sphere's motion, nor had it really been justified, as Bellarmine points out, by the material characteristics of the spheres themselves. It is strange that Bellarmine does not recall here the thesis of the medieval theologians that there were angelic intelligences associated with each sphere.

It may be that Bellarmine shared the idea of Grienberger (see the letter to Biancani, note 94) that if one admits angelic intelligences it is more proper to put them in each heavenly body rather than in the respective spheres. Also in the letter of Cesi to the Cardinal (Scheiner 1626-1630, 781) the motion of the planets in a fluid medium was attributed to angelic intelligences in each body. The fact that in his response Bellarmine did not object to this may indicate that he shared the hypothesis.

98. It is the common consensus of historians that between the end of the 16th century and the first decades of the 17th astronomical theory had become artificial and incoherent, and this is cited as the incentive to search for a more comprehensive interpretation of celestial phenomena (Kuhn 1957, chapter 5). While this judgement is common in Clavius, Grienberger and the mathematicians of the period, it is rather exceptional to see it expressed by philosophers and theologians such as Bellarmine, since they were more

occupied with the acceptability of the metaphysics rather than the technical adequacy of the models.

99. P. L., XXXIV, 227.

100. *Hom.*, VI, 10-11 (P. G., XXIX, 141-148).

101. *Hexaemeron* IV, VI 25 (P. L., XIV, 200-201).

102. In 16th century Italy a wide-spread series of the measured diameters of the planets (expressed in earth diameters) was the one of F. Maurolico, reproduced by Clavius (1581, 187): Saturn 4.5, Jupiter 4.6, Mars 1.2, Sun 5.5, Venus 0.33, Mercury 0.035, the Moon 0.29.

103. In other works Bellarmine frequently uses astronomical measurements as a means to a mystical feeling of wonder for the infinite divine power. Here, however, he is offering a critique of astronomical models. Up until the work of Brahe the estimate of the diameters of the heavenly bodies was almost completely conjectural. This was due in part to inexact data and methods and in part to the adopted theories. Bellarmine presupposes that the elimination of the multiplicity of the spheres will substantially reduce the estimated distances to the stars. In the absence of an observable parallax and excluding the existence of empty spaces between the spheres, this distance is equivalent to the sum of the thickness of all the *orbes*, from the moon to Saturn. In this way the distance of the stars from the earth was calculated by Al Farghani to be 22612.5 earth radii and this was accepted by Clavius (1581, 211). Bellarmine shows a certain scepticism about the traditional measurements of distances and astronomical sizes as indicated by his critique of astronomical models, even in his late works. In the *Conciones* (Bellarmine 1617, 461) he wrote: "Neque obieceris mihi Astrologorum decreta, qui Lunam pene minimam stellarum esse volunt. Primum enim neque ipsi id facile demonstrabant, neque nos, si negare id voluerimus, propterea Haeretici erimus, praesertim cum Moyses tam aperte dicat, fecisse Deum duo luminaria magna: lunare maius, videlicet Solem, ut praesentet diei, et lunare minus hoc est Lunam, ut praesentet nocti (here Bellarmine cites Genesis, 1, 16). Deinde D. Augustinus cap. 16 lib. 21 super Genesim nonne apertissime docet, multo esse melius scripturae divinae de Lunae magnitudine, quam Astrologis credere, cum ipsi non solum Luna, sed etiam Sole stellas aliquas maiores esse contendunt. Quod, ut eo loco idem Augustinus ait, nisi absurdissime dici non potest... Verum quicquid de hac controversia statuendum sit, neque enim Astrologorum inimicitias gerendas mihi esse unquam putavi..." (Do not claim that the judgement of the astrologers is in contrast to mine. They hold that the moon is the smallest of the heavenly bodies. First of all it would not be easy for them to demonstrate this nor would one be a heretic for denying it, especially since Moses said quite explicitly: "God made two great luminaries, the greater to look over the day, the lesser the night." Besides did not St. Augustine (*De Genesi ad litteram* XXI, 16) say that it is much better to believe the scriptures than the astrologers with respect to the size of the moon, since the astrologers hold that certain stars are not only larger than the moon but also larger than the Sun? As St. Augustine says on that point: you can only consider it most absurd. But whatever the truth is on this unresolved question, I have never wanted to enter into hostilities with the astrologers.)

Two comments are in order. First, it confirms what we have said about the characteristic points of his critique of traditional astronomy. He notes that the methods of measuring depend upon hypothetical models which partially contradict the phenomena. He wishes to substitute these dubiously constructed models with one, not divorced necessarily from the phenomena, but based upon Scripture rather than upon science. Secondly, the contrast between Biblical expressions and astronomical measurements, which Bellarmine resolves in favor of the former, is treated differently in the more scholastic exegesis of Pereira, who quotes exegetes for whom the Biblical phrase means that the Sun and Moon are the largest bodies. He writes however (Pereira, 1599, 93-95) that such is denied by the *necessariae rationes mathematicorum* by which: the first magnitude stars have volumes equal to 107 earth volumes; the volume of the sun is equal to 166 earth volumes and 6539 moon volumes; the moon is the smallest planet, except for Mercury. Pereira found these measurements in Clavius (1581, 188) who had taken them from Maurolico. The contrast between the two Jesuit theologians, colleagues at the Roman College, reveals a complex situation. Philologically Bellarmine was closer to the truth and some of his criticisms of the physics of the Ptolemaic system are acute. His concept, however, of the relation between revelation and human investigation, while it left free the exploration of the technical aspects, bound him, as to the real structure of the phenomena, to a literal sense of scripture, which he assumed to be outside discussion because divinely inspired. On the other hand Pereira's position, since he avoided a rigid literal interpretation of many biblical passages, assured in principle a greater freedom of research. But this was at the price of projecting into the Bible Aristotelian and Ptolemaic concepts, which took on thereby a theological value. Although Bellarmine intuited that much of what traditional astronomy presented as facts were really just logical constructs, he was not able to extend his intuition to seeing a construct in the immobility of the earth, because this construct, unlike others, was part of the Hebrew cosmology and thus also part of the Bible. This circumstance led him to share in the opposition to Copernicanism and in the decision of 1616. This should not, however, hide the fact that he thought differently than the scholastics and that he tried in some original way to reformulate the classical picture of the cosmos.

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