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 philosphers and the Christian theologians hold that they are made of fire. In his *Timaeus* Plato maintains that the stars are made of the purest fire[72] 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
231v St. Ambrose in his writing on the six days (II, 3)[75]; St. Chrysostom in homilies 9 and 10 to the people of Antioch[76]; Augustine, *De Genesi*, l. II, chapter 3;[77] Theodoret in his question 11 on Genesis[78]; Procopius in his comment on Genesis, I[79]. 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 anwers 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] .....

.....

.....

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 doubt[84]; 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
232r 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

Im 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 igne[72]. 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 pm. 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 fricet 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 ragionem: in loco autem proprio moventur stellae circulariter pro bono totius universi et movebuntur usque ad diem iudicii et tunc cessabunt.[82] 231v

.....

3m 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 232r

like the birds of the air and the fish of the water[88]. 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 phenomena[90] 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 intepreting 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 constrast 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
232v 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 alicuis momenti. Nam quod Aristoteles l. 2° 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 epyciclorum, 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°: 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 9a 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, 232v
non proprio suo motu circulos, sed spiras describunt.[94] dico 3° 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 spatio 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 epiciclorum, et eccentricorum circulorum, ut etiam astrologos pudeat eas commemorare.[98]

Dubium 4m. 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. 6[101] 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]

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 was 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 empiraeal 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 *empiraeum* 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 *empiraeum* 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 anwer 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 antiochenum 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 strenghtened 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 reproborum 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" (Bellarmino 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 threatented 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 simplifing 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 denys 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 plausability 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 scïo communiter omnibus placere. Imprimisque illustrissimo card. Bellarminis, qui etiam a motu planetarum extra orbes 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, altough he was not explicity 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; Rvan 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 artifical 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 heavently 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 demonstrabunt, neque nos, si negare id voluerimus, propterea Haeretici erimus, praesertim cum Moyses tam aperte dicat, fecisse Deum duo luminaria magna: luminare maius, videlicet Solem, ut praeesset diei, et luminare minus hoc est Lunam, ut praeesset 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 contendant. 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 letteram* 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. Altough 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.