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The spot on the moon (The views of John Buridan, Nicholas of Oresme, Albert of Saxony and Marsilius of Inghen, with an edition of Marsilius of Inghen's 'Quaestiones in Librum Aristotelis De caelo et mundo II, 14)

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THE SPOT ON THE MOON

(The views of John Buridan, Nicholas of Oresme, Albert of Saxony and Marsilius of Inghen, with an edition of Marsilius of Inghen's *Quaestiones in librum Aristotelis De caelo et mundo II*, 14)

1. Introduction

Why should one study the moon? In ancient and medieval philosophy there were several reasons for doing so. For instance, natural philosophers had special interest in the heavenly body that illuminates the earth during the night, contributes to growth and decay¹, and helps to determine the months. However, to describe the shape and, especially, to determine the origin of the spot on the moon, or – to use Thomas Harriot's words² – 'of the spottednesse of the moon', raised problems for medieval scientists. A logical problem was that a spot of the sort seen on the moon cannot be found on other heavenly bodies, as a medieval astronomer noted³. Further, the problem of the spot was seen against the background of the generally accepted idea that a simple body like the moon cannot possess such a spot, let alone possess it from its own substance⁴, for this would detract from its simplicity, and simplicity implies perfection; if there were a spot, its cause would have to be something outside the moon.

In the fourteenth century the shape and the origin of the *macula mundi*, the spot on the moon, was studied by the renowned masters John Buridan, Nicholas of Oresme, Albert of Saxony and Marsilius of Inghen. They devoted to this subject a separate question in their commentaries on Aristotle's *De caelo et mundo*.

The occasion to discuss the problem is my work on a critical edition of Marsilius of Inghen's *Quaestiones in Aristotelis De caelo et mundo*. In the

¹ Cf. Aristotle, *De generatione animalium* II, iv, 738 a 21; IV, ii, 767 a 6.

² Galileo's contemporary Thomas Harriot lived 1560-1621.

³ Marsilius of Inghen, see the appendix below, § 3.1.2.

⁴ Marsilius of Inghen, see the appendix below, § 3.1.2.

⁵ This background is clear from the four objections *in oppositum* (see the appendix, esp. § 1.1).

eighth question of the second book of the *Quaestiones in Aristotelis De caelo et mundo* preserved in Ms Cuyk (St. Agatha), *Kruisherenklooster C 12*, ff. 125ra-171vb, the question is raised *Utrum macula quae apparet in luna, sit de natura ipsius lunae* ('whether the spot which appears on the moon, belongs to the nature of the moon itself'). This commentary was written, I believe, by Marsilius of Inghen. I have argued for this ascription elsewhere⁵. The manuscript mentioned above seems to be the only one in which Marsilius' commentary on the *De caelo* (at least in this version) has been preserved. Many years ago I promised to edit the commentary, and I still intend to fulfill this promise.

In the first article of this question Marsilius discusses the shape and origin of the spot. Like his predecessors and contemporaries he considers the spot to be a fixed figure⁶.

To elucidate Marsilius' *quaestio* I shall first (§ II. 1) give a brief historical survey of views on the problem, especially that of the origin; from this survey the presuppositions which determine the various medieval solutions, will, I hope, also become apparent. Then (§ II. 2) I shall discuss some thirteenth-century solutions. In a next paragraph (§ III) I shall present the solutions by the fourteenth-century Parisian masters mentioned above, whose philosophical works are closely related and whose solutions to the problem is essentially the same. Marsilius' own view can be easily understood from this background, I think. It is not an original view, but dependent on that of the other fourteenth-century astronomers of the University of Paris. Their solution to the problem follows Averroes' lead. In an appendix I shall add a critical edition of the question⁷.

⁵ For a discussion of the authenticity of Marsilius' commentary on the *De caelo*, see E. P. Bos, 'A Note on an Unknown Manuscript Bearing upon Marsilius of Inghen's Philosophy of Nature. Ms. Cuyk en St. Agatha (The Netherlands), *Kruisherenklooster, C 12*', in: *Vivarium*, 17 (1979), pp. 61-68; J. M. M. H. Thijssen, 'The Short Redaction of John Buridan's Questions on the Physics and their Relation to the Questions on the Physics attributed to Marsilius of Inghen', in: *Archives d'histoire doctrinale et littéraire du moyen âge*, LII (1985), pp. 237-266; M. Markowski, *Katalog dzieł Marsyliusza z Inghen z ewidencją rękopisów*, in: *Studia Mediewistyczne XXV/2* (1988), pp. 39-132.

⁶ So J. Burnet, *Greek Philosophy*. Part I, Thales to Plato, London 1928, p. 226. Other literature: E. Grant, *A Sourcebook on Medieval Science*, Harvard, 1974 (§ 681 on Buridan). Further discussions of medieval theories are in B. Nardi, 'La dottrina delle macchie lunari nel secondo canto del "Paradiso"', in: B. Nardi, *Saggi di Filosofia Dantesca*, Firenze, 1967, pp. 3-39; and in R. Ariew, 'Galileo's lunar observations in the context of medieval lunar theory', in: *Studies in History and Philosophy of Science*, 15 (1984), pp. 213-227. See also the epilogue to this article (my § V).

⁷ I have edited another question (viz. book I, qu. XIV, *Utrum sint vel possint esse plures mundi*) of the same commentary in an appendix to a contribution in the proceedings (edited by H. A. G. Braakhuis and M. J. F. M. Hoenen) of the Symposium on Marsilius of Inghen held in Nijmegen, 1992, pp. 27-117 (title: E. P. Bos, 'Marsilius of Inghen on the Principles of Natural Philosophy with an edition of *Quaestiones in De caelo I, XIV*').

2. Before the fourteenth century

2.1. Ancient philosophy

In the Presocratic⁸ period several theories were put forward about the nature or substance of the moon. Thales of Miletus, for instance, thought that the moon was basically earthy, Anaximander thought it to be basically fiery. Later philosophers can be clarified according to these two views, though with qualifications⁹.

For the fourteenth-century philosophers mentioned above, Aristotle's view is especially important. As is well known, Aristotle thinks the heavenly bodies to consist of ether, the fifth element¹⁰. If one wishes to retrace in Aristotle one of the two views just mentioned, he seems more in line with Anaximander than with Thales¹¹. Aristotle's view, influential though it has been, is rather exceptional in comparison with other ancient philosophers¹².

It is well known that according to Aristotle the universe is spherical; the center of the earth is near the center of the universe, the heavenly bodies rotate around the earth and the sphere of the fixed stars form the outer shell. Aristotle distinguishes between the sublunary region, where the four elements are the basis of the concrete individual things, and the region of the heavenly bodies. The latter consist of ether. The heavenly bodies are carried round by a number of spheres, 5 or 7 each¹³, which account for the apparent irregularities in their movement.

According to Aristotle, the universe is hierarchically ordered. The centre of the universe, where the earth is at rest, is lowest in rank; the sphere of the fixed stars is highest in dignity and influence. The heavenly bodies influence the sublunary region, which makes study of the moon especially important, and this influence suggests astrology.

In the second book, chapter VII, of his *Peri ouranou (De caelo)* Aristotle discusses the problem of whether or not the stars possess light of their

⁸ In ancient mythology the moon was often identified with the goddess Artemis, the goddess of fertility; during medieval Christianity, the moon was sometimes identified with the Virgin Mary.

⁹ In a recent reconstruction of a Xenophanean lemma which forms part of a *doxographicum* in Aëtius, Prot. D. T. Runia has assigned to Xenophanes the view that the moon is an ignited cloud that has undergone condensation ('Xenophanes on the moon: a doxographicum in Aëtius', in: *Phronesis*, XXXIV (1989) 3, pp. 245-269.

¹⁰ It may be interesting to note that according to Philo of Alexandria (25 B. C. - 40 A. D.), the Old Testament claims that the moon consists of ether and fire (see L. Thorndike, *A History of Magic and Experimental Science*, 6 vols., New York 1923-1941, vol. III, p. 354.

¹¹ Though Aristotle criticized Anaximander in this respect: *De caelo* II, xiii, 295 b 10-12.

¹² Cf. D. T. Runia, 'Xenophanes on the moon ...', p. 264.

¹³ I shall not enter into details about the exact number of spheres here; the problem about the exact number is well known.

own. The stars are made of the fifth element, he says, and emit light by the ignition of the air beneath them, due to the friction caused by their movement.

In chapter VIII he concludes that the motion of the stars is not self-caused, but the result of their being set at fixed points in the revolving heavens. In this chapter we come upon the passage which is the starting point for medieval discussions about the spot on the moon¹⁴. Aristotle says: 'Further, is clear that the moon always shows us its "face" (as people call it)'. This seems to be the only passage in which Aristotle mentions the face of the moon. Aristotle's remarks elsewhere¹⁵ are concerned with the moon's phases, with its role in making up the calendar and with its contribution to growth and decay in the sublunary region, and not with the spot and its origin.

As I already pointed out, according to Aristotle the heavenly bodies, including the moon, move in circular motion on spheres. Centuries later, Ptolemy (who performed observations between 121 and 151) designed a new explanation for the movement of the heavens, using epicycles. In the Middle Ages the two options are sometimes and in some ways combined, e.g. by Marsilius of Inghen, as we shall see later. Marsilius says e.g. in his *Commentary on the Sentences*¹⁶ that Ptolemy's view on the movement of the heavenly bodies is compatible with that of Aristotle¹⁷.

I shall not discuss the views of the Arab astronomers here: they will come up for discussion as far as relevant in section III.

2.2. Albert the Great and Thomas Aquinas

I now take a leap forward into the Middle Ages. Medieval astronomical theories depart in several respects from the ancient views, despite the fact that the medieval masters often denied this. Let us not be tricked by rhetorical form, however. Because their views will help us to elucidate the fourteenth-century masters' texts, two philosophers from the thirteenth century should be discussed first: Albert the Great and Thomas Aquinas.

¹⁴ Aristotle, *De caelo*, II, viii, 290 a 25-30.

¹⁵ See the *Index Aristotelicus* by H. Bonitz, Berlin 2¹⁸⁷⁰. There are especially references to the *De generatione et corruptione* and the *De generatione animalium*.

¹⁶ Marsilius of Inghen, *Quaestiones super quattuor libros Sententiarum*, ed. Straßbourg 1501 (reprint Frankfurt am Main 1966), liber I, qu. ii, f. xvi ra. See also Marsilius van Inghen, *Kennis, wetenschap en theologie*, uitgegeven, ingeleid en van aantekeningen voorzien door E. P. Bos, Baarn 1987, esp. pp. 44 and 45; en E. P. Bos, 'Menselijk verstand en geloofswaarheden volgens Marsilius van Inghen', in: *Tussen ratio en religie* (provisional title), ed. by D. E. H. de Boer and L. Jongen, forthcoming.

¹⁷ As a corollary I note here that Plutarchus' *De facie orbis luna* is a wellknown tract on the shape of the moon (edition with introduction and notes e.g. in Plutarch's *Moralia* XII, edited and translated by H. Cherniss and W. C. Helmbold, London (Loeb Classical Library) 1957 (1984). It seems to have had no influence on the medieval philosophers which come up for discussion here.

2.2.1. Albert the Great (ca. 1200-1280)

Albert the Great gives a description of the spot on the moon (the queen of the heavens according to Albert, though the lowest in rank among the planets¹⁸), which was in some degree accepted by the fourteenth-century Parisian philosophers. He also formulated a theory of the origin of the spot.

In his *De caelo et mundo*¹⁹ Albert the Great discusses the origin and the shape of the *idolum* ('image') of the moon. Its origin was not described correctly by the *Antiqui*. They said²⁰ that the moon was like a mirror, and that the *idolum* was a shadow and figure projected on the moon by the mountains and seas that rise above the curve of the earth. If this were so, the light of the moon would be due to reflection on it, and not to *imbibitio*²¹ by the moon. This occurs because the moon absorbs the light, though not fully²².

Albert then voices his own opinion that the spot belongs to the nature of the moon because this nature is *terrestrial*²³, i.e. it possesses a substance among heavenly bodies like the earth in the sublunary world.

This opinion of Albert's, which can be found in several places of his treatise, may surprise us as at first sight it is different from Aristotle's. It therefore needs some comment. In the first book of his *De caelo*²⁴ Albert says that "what is elevated above fire, is more noble and has more the nature of form than fire; this relation also obtains among heavenly bodies, for the lower sphere is less noble than the higher ones, and the more elevated the higher spheres are, the more noble they are. Therefore Aristotle has excellently said in his *On animals*, that among the heavenly bodies the moon has the place of earth among the elements".

It may be observed that the passage in Aristotle's works to which Albert refers cannot be easily determined, as far as I can see. It is not immediately clear to which book of Aristotle the title *De animalibus* refers to: to the *De generatione animalium*? To the *De partibus animalium*? P. Hoßfeld, the modern editor of Albert's commentary, refers to the *De generatione animalium* III, xi, 761 b 20-21. This seems plausible. In this text Aristotle remarks that, as fire is the outermost of the sublunary elements and is there-

¹⁸ Alberti Magni *De caelo et mundo* (...), liber II, tractatus iii, ch. 6, ed. P. Hoßfeld, Münster in Westfalen 1971, p. 154, line 85.

¹⁹ *Ibidem*, p. 160, lines 3 ff.

²⁰ Cf. Averroes in: *Aristotelis Opera omnia, Averrois Cordubensis in ea commentarii*, Venetiis 1560, liber II, comm. 49 (f. 137 C).

²¹ Alberti Magni *De caelo* ..., p. 154, lines 47 ff.

²² *Ibidem*, p. 168, line. 69.

²³ See the discussion by Cl. Kren in her edition *The Questiones super De celo of Nicole Oresme*, The University of Wisconsin, 1965 (Ph. D. thesis), Ann Arbor (University Microfilms International), part I, book II, qu. x, p. 627.

²⁴ Alberti Magni *De caelo* ..., p. 16, lines 29-36.

fore in contact with the 'heaven' which is nearest to the earth and since this heaven carries the moon, the moon can be said to have a share in fire²⁵. Albert's reference reminds us of the words of Averroes²⁶. As Claudia Kren in her edition of Nicholas of Oresme's *Quaestiones* on Aristotle's *De caelo et mundo* notes, Averroes repeatedly says²⁷ that *Aristoteles dicit in libro De animalibus quod lune natura est sicut natura terre* ('Aristotle says in his book *On animals* that the nature of the moon is like the nature of the earth'). Albert's views on the substance of the moon is in some way close to that of the Parisian philosophers, as I hope to show below²⁸.

Now for Albert's description of the spot. There existed in the Middle Ages other descriptions of the spot on the moon, e.g. that of John de Fundis, who in 1451 composed a defense of astrology against Nicholas of Oresme, according to which "the people of Italy believed that Adam and Eve were stelled on the moon, while English rustics think that a peasant who had stolen thorns was lodged there with the bundle of thorns still on his back"²⁹.

The spot, Albert says³⁰, runs from the east towards the lower bow of the moon. It has the figure of a dragon, that turns its head towards the west, and its tail towards the east. The tail is not sharp but broad, like a loaf having three segments of a circle ending in one point. On the back of the dragon rises the figure of a tree; its twigs from the midst of the stem are oblique in the higher part of the moon towards the east, and on this oblique part of the stem a man is fixed with arms and head, and its bones descend from the higher part of the moon to the western part. Albert promises to give a fuller description elsewhere. I could not find where.

2.2.2. Thomas Aquinas (1225-1274)

In his commentary (*expositio*) on Aristotle's *De caelo et mundo* Thomas Aquinas discusses three explanations of the spot on the moon. He rejects the first two. Some, Thomas says³¹, think a body is interposed between the earth and the moon; this body prevents us from seeing the clarity of the moon completely. This solution is false, according to Thomas, because in that case we would have different images of the moon from different parts of the earth. This is not the case.

²⁵ Cf. note a on p. 352 of A. L. Peck's translation of Aristotle, *Generation of animals*, Cambridge (Mass.) - London 1979 (1942) (Loeb Classical Library).

²⁶ Cf. Averroes in: *Aristotelis Opera omnia* ..., liber II, comm. 42, 49 (f. 132 E; 137B).

²⁷ *Ibidem*, liber I, comm. 16; book II, comm. 32, 42 and 49, and in chapter 2 of his *De substantia orbis*.

²⁸ See also below, § III. 4. 2.

²⁹ See Ch. Haskins, *Studies in the History of Medieval Science*, Cambridge (Mass.), 21927, p. 239f.

³⁰ Alberti Magni *De caelo* ..., liber II, tractatus iii, cap. viii, p. 160, lines 16-29.

³¹ Thomas Aquinas, *In libros Aristotelis De caelo et mundo expositio*, liber II, lectio xii, ed. R. Spiazzi, Turin 1952, n. 410 [9], p. 203.

Others, he says, suggest that the moon is like a mirror, in which the earth, sea and mountains are reflected. The same reply holds as that given to the former view, Thomas says. Moreover, in this case Aristotle's argument would not be correct: the irregularity of the moon would be caused not because the same surface is always directed towards us, but because all parts of the total surface of the moon receives such an appearance, and this would imply according to Thomas that the moon rotates, which is not the case³².

The third solution is a better one, Thomas says. It offers two alternatives. The first alternative is ascribed by him to Iamblichus³³. Forms of effects exist in a way in their causes; now, higher heavenly bodies are causes of lower ones; therefore, the moon, which is a body higher than the earth and in some respect a cause of the earth, shows us the forms of its effects, viz. of the earth. So, as Thomas puts it, there is a kind of *exemplaris diversitas* on the moon. This is not a physical reflection as in a mirror, I think, but a metaphysical theory about the relation between cause and effect, such as can already be found in Augustine³⁴.

The second alternative of this solution resembles the first. It holds that the heavenly bodies possess a nature different from the four elements. Nevertheless, in the heavenly bodies the properties of the four terrestrial elements preexist as in their causes, though in a more eminent way than in the sublunary region itself. Therefore, the moon is proportionate to the earth, and there is a certain assimilation. The moon and the earth affect each other, though not on an equal level, for the moon is the cause. So, on account of this nature the moon cannot be fully illuminated by the sun. This explains the spot. It has always the same disposition, i.e. the moon always shows the same face to us, and the moon does not rotate.

Elsewhere in his commentary Thomas denies that the moon possesses a tail, like other planets³⁵ and that the moon is illuminated by the sun³⁶; it receives its light in a way different from the sublunary world³⁷. I have not found a description of the spot in Thomas' commentary.

3. The fourteenth century: John Buridan, Nicholas of Oresme, Albert of Saxony, Marsilius of Inghen

In the fourteenth century, the problems concerning the spot on the moon were discussed by the Parisian philosophers John Buridan (1300 –

³² See also, II. 1.

³³ Born in the mid-third century A. D., died 327-337.

³⁴ Augustine, *Retractiones*, XII, xix.

³⁵ Thomas Aquinas, *In libros Aristotelis De caelo et mundo expositio*, liber I, lectio xiii, 89 [4].

³⁶ *Ibidem*, liber I, lectio v, 75 [7].

³⁷ *Ibidem*, liber II, lectio x, 392 [11].

shortly after 1358)³⁸, Nicholas of Oresme (taught at Paris between 1345 and 1360-1382), Albert of Saxony († 1390) and Marsilius of Inghen (ca. 1340-1396). They wrote commentaries on Aristotle's *De caelo et mundo* in about the same period: John Buridan wrote his possibly between 1350 and 1358³⁹, Nicholas of Oresme his *Questiones super De celo*⁴⁰ in the same period⁴¹, Albert of Saxony in about 1360⁴², Marsilius of Inghen at some date between 1360 and 1370; his commentary being probably the latest of the four⁴³. Their works were composed probably in this order.

Their solutions of astronomical and cosmological problems resemble each other on the principle points⁴⁴. Buridan seems to have influenced them all, though not to the same extent⁴⁵. Albert of Saxony's discussion of the problem in his *Quaestiones in libros de caelo et mundo*⁴⁶, book II, *quaes-*

³⁸ Liber II, qu. xix of his *Quaestiones super libris quatuor De caelo et mundo*, ed. E. A. Moody, Cambridge (Mass.) 1942 (reprint New York 1970), pp. 212-217.

³⁹ Cf. John Buridan's *Tractatus de infinito*, ed. J. M. M. H. Thijssen, Nijmegen 1991, p. xxi.

⁴⁰ Nicholas of Oresme, *Quaestiones ...*, liber II, qu. xii, pp. 653-667.

⁴¹ *Ibidem*, p. xi.

⁴² G. Heidingsfelder 'Albert von Sachsen, sein Lebensgang und sein Kommentar zur Nikomachischen Ethik bei Aristoteles' in: *Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters*, XXII (1921), Heft 3/4; M. Markowski, 'Die Rezeption des *De caelo*-Kommentar des Albert von Sachsen an den Mitteleuropäischen Universitäten', Symposium Paris 1990, ed. J. Biard, forthcoming; E. Grant, 'Albert of Saxony's Conception of the Cosmos', same volume; J. Sarnowski, 'Albert von Sachsen und die Astronomie des XIV. Jahrhunderts', same volume.

⁴³ G. Ritter, *Studien zur Spätscholastik. I. Marsilius von Inghen und die okkamistische Schule in Deutschland* (Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Philosophisch-historische Klasse, Jahrgang 1921, 4 Abh.), Heidelberg 1921; E. P. Bos, *Marsilius von Inghen: Treatises on the Properties of Terms. A First Critical Edition of the Suppositiones, Ampliationes, Appellationes, Restrictiones and Alienationes with Introduction, Translation, Notes and Appendices*, Dordrecht / Boston / Lancaster 1983; M. J. F. M. Hoënen, *Marsilius van Inghen (d. 1396) over het goddelijke weten. Zijn plaats in de ontwikkeling van de opvattingen over het goddelijke weten ca. 1255-1396*. Deel I: Studie; deel II: Tekstuigave van Marsilius van Inghen, *Quaestiones super Quatuor Libros Sententiarum*, liber I, qu. 38 en 40, Nijmegen, 1989; M. J. F. M. Hoënen, 'Marsilius von Inghen, Bibliographie. Appendix zu der geplanten Edition der wichtigsten Werke des Marsilius von Inghen (gest. 1396)', in: *Bulletin de philosophie médiévale*, 31 (1989), pp. 152-153.

⁴⁴ It should not be forgotten, however, that there are also important differences between their cosmologies. Nicholas of Oresme, for instance, assigns a more prominent place to the center of the universe than do the others and than does tradition. Therefore, Oresme prepares in some respect the way to Copernicus, notwithstanding the fact that Oresme's astronomy was geocentric in contradistinction to Copernicus'. The point is, according to F. Hoffmann, *Scholastik und Kosmologische Reform* (Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters, Neue Folge, Band 6, Münster 1988, p. 8), that, just as for Copernicus, the center is a prominent place according to Oresme.

⁴⁵ Cf. Thijssen, John Buridan's *Tractatus de infinito ...*, 1991, p. xii. On Buridan's influence on Oresme, see Cl. Kren in *The Questiones super De celo of Nicole Oresme*, p. vi, note 8.

⁴⁶ Venetiis 1492, *Questiones (...) emendatae per (...) Hieronymum Syrianum*, no foliation (I have numbered the lines of this edition). Angel Muñoz Garcia ('Albert of Saxony, Biblio-

tio 24, is shorter than that of the others, omits arguments that can be found in the works of the other philosophers, and seems to be derived largely from John Buridan and/or Nicholas of Oresme. The Parisian masters did not form a school in the strict sense of the word, however.

As I said, I shall discuss the theories of Buridan, Nicholas of Oresme, Albert of Saxony and Marsilius of Inghen as a single body of thought⁴⁷. A discussion of the texts by the four philosophers mentioned is by itself an interpretation, I feel, of Marsilius' text. Therefore, I shall not discuss this text separately.

In the commentaries of the Parisian philosophers different problems can be distinguished. These problems concern:

1. The substance of the moon.
2. The source of the moon's light.
3. The shape of the spot.
4. The origin of the spot.

4.1. Suggestions by other philosophers and refutations of these suggestions by the Parisian philosophers.

- 4.2. The Parisians' own solution.

It should be noted that the problems of the substance of the moon and the source of its light are intrinsically connected with the problem of the origin of the spot. For the explanation of the origin of the spot varies according to astronomers' views on the nature of the moon and the source of its light. In the texts of some of the philosophers studied here, the problems on the nature of the moon, the source of its light and the origin of the spot are discussed in connection with one another, while in the text of others they are treated separately.

3.1. *The substance of the moon*

According to Aristotle, the moon was of a substance consisting of ether. As we have seen above, Albert the Great qualifies this, following Averroes, by saying that the moon had a nature among heavenly bodies like the earth among the sublunary elements, without, however, denying that as to its substance the moon is an ethereal body. According to our Parisian philosophers the substance of the moon is simple, homogeneous, eternal and consists of ether⁴⁸; accidentally, there is diversity as will be shown below (§ III. 4. 2).

graphy', in: *Bulletin de philosophie médiévale* 33 (1990), pp. 161-190 mentions (p. 179) an edition by Hieronymus Syriacus of 1497. Is there a printing error? Some parts of this question are translated by R. Arieu, 'Galileo's lunar observations...', pp. 220-221.

⁴⁷ Cl. Kren, *The Quaestiones super De celo of Nicole Oresme*, pp. 1073 ff., argues that, in his Commentary on the *De caelo*, Albert depends on Nicholas of Oresme.

⁴⁸ John Buridan, *Quaestiones ...*, II, xix, p. 217, 1. 27-29; Nicholas of Oresme, *Quaestiones ...*, II, x, p. 627, 1. 233-234; id., p. 665, lines 128-130; Albert of Saxony, *Quaestiones ...*, II, xxiv, 1. 69-72. Marsilius of Inghen, *Quaestiones ...*, II, viii, see the appendix below, § 1.1.

3.2. *The source of the moon's light*

The astronomers agree that the moon does not give out light by itself. Buridan⁴⁹ says that the moon receives light from the sun. To prove this he points to times of eclipse when there is no illumination of the moon because of the interposition of the earth between the sun and the moon, and to times of the waxing or waning moon, when the illumination appears only as far as the sun's rays reach it. The stars give light in virtue of the sun, not by themselves⁵⁰, as does the moon. Marsilius⁵¹ and the other Parisian philosophers agree with Buridan.

To a suggestion⁵² that not always after a new moon the light of the sun is reflected to us, Nicholas of Oresme replies⁵³ that because of its spherical form the light of the sun is always reflected; however, the light is not always reflected according to the shape of the sun or the means by which the moon appears illuminated.

3.3. *The shape of the spot*

As we have seen above, Albert the Great gives a fairly detailed description of the shape of the spot. The fourteenth-century Parisian philosophers do the same: they refer to Albert⁵⁴ for their description of the shape and say that they follow his, but in fact their description is different. In another question of his work⁵⁵ Buridan says that the spot has the shape of a man, but he hardly seems to intend to describe the spot seriously there.

Nicholas' description⁵⁶ is the same as the one given by Albert of Saxony⁵⁷ and Marsilius⁵⁸. The one given by Nicholas is different in some respects from that of Albert the Great (as Mrs. Kren already observed in a note to her edition⁵⁹, without however working this out). Nicholas says: 'As to the final point, that is: the shape <of these spots>, Albert says that they form, so to speak, the figure of a lion, having its head towards the east, and there is, as it were, a tree placed transversally over its back; and similarly, <one finds> the image of a man fixed laterally, and with his feet towards the rear of the lion. And Albert says that this figure can be seen better a

⁴⁹ *Quaestiones* ..., II, xix, p. 213, line 16 – p. 214, line 14. In an answer to objections Buridan denies that the moon possesses even *some* light of its own.

⁵⁰ *Quaestiones* ..., II, xix, p. 215, line 21 – p. 216, line 21.

⁵¹ See the appendix, § 3.2.1.

⁵² *Quaestiones* ..., II, x, p. 657, lines 39-41.

⁵³ *Quaestiones* ..., II, x, p. 657, lines 41-44.

⁵⁴ They explicitly name Albertus Magnus, so they are not referring here to any other Albertus.

⁵⁵ See E. Grant, *A Sourcebook* ..., p. 529 (§ xii, 10).

⁵⁶ *Quaestiones* ..., II, x, p. 665, lines 117-134.

⁵⁷ *Quaestiones* ..., II, xiv, lines 62-68.

⁵⁸ In § 3.1.1. of the appendix Marsilius gives a description of the spot.

⁵⁹ Pp. 1017-1018 of Kren's edition.

little after full moon and near the rising of the sun, because then the air is pure and dense and calm'.

In contradistinction to Albert the Great, Nicholas, Albert of Saxony and Marsilius of Inghen 1. speak of a lion instead of a dragon; 2. say that this lion has its head towards the east, instead towards the west; 3. omit mention of a tail, found in Albert the Great; 4. say that the tree is upside down on the back of the beast, not as in Albert the Great's description; 5. give a different description on the human figure and of its position; 6. except for Albert the Great, note that the spot can be better seen a little after full moon and near the rising of the sun. So they all *say* they have given Albert's description, but in fact give a different one.

3.4. *The origin of the spot: suggestions and refutations*

The Parisian philosophers discuss different views proposed by other astronomers on the way in which the moon reflects its light and therefore, on the way in which the spot originates. According to these views, which are rejected, either 1. the moon is like a mirror⁶⁰, or 2. the moon is like a wall, or 3. the moon in some sense possesses colour, or 4a+b. vapours are the cause of the spot, or (4c) there is some property above the moon which attracts vapours, or 5. the moon is burnt by some fire and therefore shows a spot, or 6. the cause of the spot is the movement of the sun, or 7. the origin of the spot cannot originate from inside the moon because of the epicycle on which it moves. The last two suggestions deny that the cause is something inside or on the moon.

First, I shall discuss these views and the arguments which led the Parisian philosophers to reject them; then I shall present their own solution.

3.4.1. *Suggestions by others and their refutations by the Parisian philosophers*

3.4.1.1. *The moon is like a mirror*

Buridan⁶¹ and the other Parisian philosophers⁶² reject the view that in reflecting light the moon is like a *mirror*. For, if so⁶³, the reflection produced by the moon could be compared to the reflection in a mirror of a candle burning at night in a room. Then, as Buridan says, only a small part of the light of the candle is reflected, namely the portion that falls on the mirror at a right angle. If the moon were like a mirror we should see some part of the reflected earth clearly, and the rest less clearly. We should there-

⁶⁰ Cf. above, the discussion of Thomas Aquinas' view, § III. 2.2.

⁶¹ *Quaestiones* ..., II, xix, p. 214, line 15-p. 216, line 20.

⁶² Nicholas of Oresme, *Quaestiones* ..., II, x, lines 26-39 and 107-116; Albert of Saxony, *Quaestiones* ..., II, xiv, lines 40-51; for Marsilius of Inghen, see the appendix below, § 3.1.4.

⁶³ Buridan refers to the *ars perspectiva*.

fore, Buridan says, see some other form of the moon's spot, viz. the spot would be round corresponding the roundness of the earth. If the moon possessed such a capacity of reflection, then the round image of the earth would be reflected at the same time, which is not the case⁶⁴.

Marsilius⁶⁵ adds that it seems improbable that over such a distance the multiplication of species from the earth to the moon would be possible. This consideration of the multiplication of species seems to be Marsilius' own argument.

3.4.1.2. *The moon is like a wall*

Some suggest⁶⁶ – given the refutation of the view that the moon is like a mirror – that the moon is to be compared to a wall. The wall is illuminated as a whole, not only where the light falls on it at a right angle. Buridan⁶⁷ rejects this suggestion: for, if there is reflection from all parts, this is because of the rough surface of the wall; if the wall were smooth, the reflection would be only partial; one might compare this with reflection in disturbed and quiet water respectively. However, the surface of the moon is according to Aristotle smooth. If so, the model of the moon as a wall reduces to the model of it as a mirror.

3.4.1.3. *The moon possesses colour*

There is a solution, Buridan says⁶⁸, which he considers to be more plausible than the theories that liken the moon with a mirror or a wall. It says that the moon is not giving out light actually, in order to move the transparent medium between object and knowing subject, but potentially, like the coloured surface of an object⁶⁹. Marsilius agrees⁷⁰ with Buridan: no part of the moon is coloured in any proper sense of the word. There are no colours in heaven in the proper sense: they exist only because of different reflections of the sun's rays.

3.4.1.4. *The spot is caused by vapours*

a. Some attempt to solve the problem, Buridan says⁷¹ (referring to Averroes as his source), by suggesting that the spot is caused by a vapour,

⁶⁴ *Quaestiones ...*, II, xix, p. 217, lines 7-18.

⁶⁵ See the appendix, § 3.2.4.

⁶⁶ John Buridan, *Quaestiones ...*, II, xix, pp. 214, line 39-p. 215, line 1. This discussion is not found in Albert of Saxony.

⁶⁷ *Ibidem*, p. 215, lines 2-13.

⁶⁸ *Ibidem*, p. 215, lines 14-30. This discussion is not found in Albert of Saxony.

⁶⁹ In Buridan we find no reply.

⁷⁰ See the appendix, 3.2.2. and 3.2.3.

⁷¹ *Quaestiones ...*, II, xix, p. 216, lines 22-26; Nicholas of Oresme, *Quaestiones ...*, II, x, pp. 661 line 90-663, line 94; Albert of Saxony, *Quaestiones ...*, II, xxiv, lines 24-25; Marsilius of Inghen, *Quaestiones ...*, II, viii, see the appendix below, § 3.1.2.

which is a kind of body, arising from the moon and located between the earth and the moon. Buridan⁷² rejects this solution: in that case the spot could not be in a fixed location, as it is, for vapours are unstable.

b. Others say⁷³ that the moon attracts vapours for its own nutrition. However, this is an unnecessary hypothesis, Buridan says⁷⁴, for the heavenly bodies do not need food, because they are eternal⁷⁵.

c. Still others give what Buridan labels⁷⁶ a more reasonable solution. According to them the moon has a big property above its water and humid material; therefore it attracts vapours. So the vapours exist under the moon. Nicholas⁷⁷ tells us that in this respect the moon has been likened to some fixed stars that like comets possess haloes for the same reason.

This last solution is also rejected. For, as Buridan⁷⁸ and Albert of Saxony argue in almost the same wording, in that case a. the evaporation would not be uniform, whereas the spot is uniform, and b. when the vapour is under the moon, the shape of the spot would not be the same from different view-points. The tails belonging to some fixed stars are not so stable as to account for the perpetual and identical appearance of the spot, Nicholas says⁷⁹.

Why does Buridan call this last solution more reasonable than the theory of vapours just mentioned? It comes closer to his own. Albert mentions this view as an adaptation of the two earlier suggestions⁸⁰.

3.4.1.5. *The spot originates because the moon is burned by fire*

Another solution proposed by opponents⁸¹ is that the moon is burned by a nearby fire. This solution is rejected⁸²: it is impossible, because the

⁷² Implicitly in Buridan, *Quaestiones ...*, II, xix, 216, 33-217, 6; Nicholas of Oresme, *Quaestiones ...*, II, x, p. 663, lines 94-97; Albert of Saxony, *Quaestiones ...*, lines 31-35; Marsilius of Inghen, *Quaestiones ...*, II, viii, see the the appendix below, § 3.1.2.

⁷³ So Buridan, *Quaestiones ...*, II, xix, p. 216, lines 26-28; Albert of Saxony, *Quaestiones ...*, II, xxiv, lines 26-27; The argument is not in Marsilius of Inghen.

⁷⁴ So Buridan, *Quaestiones ...*, II, x, p. 216, lines 28-30; Albert of Saxony, *Quaestiones ...*, II, xxiv, lines 38-40.

⁷⁵ Nicholas, too, rejects the suggestions, in a general way – quoted, according to him, by Avicenna – that the cause of the spot would be vapours (he thinks this solution unreasonable). See Nicholas of Oresme, *Quaestiones ...*, II, x, p. 661, line 90 – p. 663, line 97.

⁷⁶ *Quaestiones ...*, II, xix, p. 216, lines 31-33; Albert of Saxony, *Quaestiones ...*, II, xxiv, lines 27-30 and 35-38.

⁷⁷ *Quaestiones ...*, II, x, p. 662, line 92 – p. 664, line 94.

⁷⁸ *Quaestiones ...*, II, xix, p. 216, line 33 – p. 217, line 6.

⁷⁹ *Quaestiones ...*, II, x, p. 663, lines 94-97.

⁸⁰ Mentioned under a and b above.

⁸¹ Not in Buridan and Albert of Saxony; Nicholas of Oresme, *Quaestiones ...*, II, x, p. 663, lines 97-99.

⁸² Nicholas of Oresme, *Quaestiones ...*, II, x, p. 663, lines 99-101.

heaven is impassible, i.e. it cannot be affected by fire⁸³. In a note⁸⁴, Marsilius cites Avicenna's view that the moon was burned in the middle. This view is rejected by him, because in that case there is no reason to suppose that the only parts of the moon which would have been burned are those parts which form the spot, rather than the entire moon.

3.4.1.6. *The cause of the spot is the movement of the sun*

Nicholas of Oresme⁸⁵ speaks of a suggestion – one of a list of suggestions reported by Avicenna, he says – that the light of the sun passes through the circumference of the moon visible to us and not through the depths of the center, and therefore the moon appears darker in the center. This is false, Nicholas says⁸⁶, because then, at least at the center, the darkness ought to appear uniformly more intense.

Marsilius says⁸⁷ that *some* philosophers suppose that half the moon is not in opposition to the sun, and is therefore not illuminated, i.e. not intensively, as experience teaches us. So the light of the sun is less strong in the peripheral parts than in the middle. Marsilius replies that the moon is spherical; logically speaking, therefore, the reflection should be everywhere. I could not find this remark in the other fourteenth-century masters.

3.4.1.7. *The origin of the spot cannot be from inside the moon because of the epicycle on which the moon moves*

At the beginning of Buridan's question⁸⁸ an opponent argued that the spot would move on account of the epicycle along which the moon moves. Therefore, the opponent concludes, the spot cannot have been caused by the diversity of parts of the moon, as some suggest⁸⁹; so, according to the opponent, the origin of the spot should lie outside the moon, for we see the spot on a fixed place. This inference is compelling, the opponent says, on the supposition that the moon does not move in virtue of its own, but in virtue of a movement of an epicycle.

Nicholas of Oresme⁹⁰ tells us 'that the Commentator denies that the moon is moved with the motion of an epicycle; nonetheless, those who

⁸³ This argument is not in Buridan. For Marsilius, see the appendix, § 3.1.3. The suggestion is made by Avicenna.

⁸⁴ An edition of Avicenna's *De celo et mundo*: M. Renaud, 'Le "De celo et mundo" d'Avicenne', in: *Bulletin de philosophie médiévale* 15 (1973), pp. 92-130.

⁸⁵ *Quaestiones* ..., II, x, p. 663, lines 101-105.

⁸⁶ *Quaestiones* ..., II, x, p. 663, lines 105-107.

⁸⁷ For Marsilius of Inghen, see the appendix, § 3.1.5.

⁸⁸ *Quaestiones* ..., II, xix, p. 212, lines 30-36. Nicholas of Oresme, *Quaestiones* ..., II, x, p. 657, line 44 – p. 679, line 52; the theory is not in Albert of Saxony.

⁸⁹ In fact, Buridan and the other Parsian masters.

⁹⁰ *Quaestiones* ..., II, x, p. 665, lines 131-134.

would concede this might also say that it is also moved around its own center by turning on itself.

Buridan replies⁹¹ that the moon does not move on an epicycle⁹², as he has argued before⁹³, and that, if the moon would move on an epicycle, it moved in virtue of its own. The fixed place of the spot is an argument against the epicycle, he says.

Marsilius notes that the epicycle⁹⁴ of the moon was not known to Aristotle and Averroes: it was Ptolemy's invention. The unchanging place of the spot can be explained by noting that when the epicycle, the existence of which he here assumes⁹⁵, descends, the moon rises. The epicycle is seen as a sphere, with a movement different from that of the moon.

3.4.2. *The Parisians' own solution*

Buridan⁹⁶ and the other Parisian philosophers⁹⁷ say that a solution more plausible than all other suggestions is advanced by Averroes. The spot is the effect – in some way – of the essence of the moon. This thesis should be compared with that of the many others who wish to attribute to the moon a substance as simple as possible.

The moon has parts, and the difference between them constitutes a difference in density and rarity. The denser parts can better retain the light, and are therefore whiter, Buridan's thesis runs. The rarer parts cannot hold the light so easily and are therefore darker. The moon is substantially homogeneous, but accidentally inhomogeneous. Its transparency is not uniform. Nicholas and Albert compare the moon in this respect to alabaster⁹⁸.

Nicholas of Oresme's remarks are also interesting on this score. To an objection, Nicholas replies that the moon is transparent, but because of its

⁹¹ *Questiones* ..., II, xix, p. 217, lines 31-33. Nicholas of Oresme, *Questiones* ..., II, x, p. 657, line 52 – p. 659, line 56.

⁹² Cf. P. Duham, *Le système du monde*, Paris, 1913-1916, tome IV, 140.

⁹³ Elsewhere (liber II, qu. xviii) he says: it cannot be demonstrated. *Questiones* ..., II, xix, p. 211, lines 3-10, where he argues that it can not be *proved* that the moon has an epicycle or not.

⁹⁴ On the epicycle of the moon, see e.g. Plutarch, *De facie orbis lunae*, translated by H. Cherniss and W. Helmbold ..., p. 169, note b.

⁹⁵ Cf. Marsilius of Inghen, *Questiones super quattuor libros Sententiarum*, ed. Straßbourg 1501 (reprint Frankfurt am Main 1966), liber I, qu. ii, f. xvi ra. Cf. note 15 above.

⁹⁶ *Questiones* ..., II, xix, p. 216, line 22-p. 217, line 26.

⁹⁷ Albert of Saxony, *Questiones* ..., II, xxiv, lines 53-61; Nicholas of Oresme, *Questiones* ..., II, x, p. 661, lines 76-88; Marsilius of Inghen, *Questiones* ..., II, viii, see below, the appendix, § 4.

⁹⁸ Nicholas of Oresme, *Questiones* ..., II, x, p. 661, line 83; Albert of Saxony, *Questiones* ..., II, xxiv, line 58. S. Y. Edgerton ('Galileo, Florentine "Disegno", and the "Strange Spottedness" of the Moon', in: *Art Journal*, published by the College Art Association of America, Fall 1984, Art and Science: part II, Physical Sciences, pp. 225-232; p. 226) notes that Renaissance artists, especially in Catholic countries, frequently depicted the Virgin Mary standing on a moon represented as a translucent, alabasterlike ball.

depth, the light of the sun can still not penetrate it fully, and therefore the light is incorporated in it.

It is not allowed to infer that, if parts of the moon are denser and rarer, the moon is intrinsically composed and is no longer a simple body. This conclusion would apply only to sublunary things which are intrinsically composed.

Marsilius enters into more detail. In a nominalist fashion he distinguishes between various ways of expressing the natural phenomenon. One should carefully interpret the expression, he says. The spot does not belong to the moon's substance in a first sense of 'belonging to', for the sun is needed for the moon to give light. The spot belongs to the moon in a secondary sense of 'belonging to', because the moon has parts which are denser and rarer, and therefore the moon can be said to be accidentally, not essentially diverse. The difference between the diversity and rarity of these parts of the moon is less than in sublunary things. The four sublunary elements have parts as well, though this is unknown to us.

If one therefore uses the expression 'the spot originates in the essence of the moon', Marsilius says, this expression can be taken in two sense: a. it follows from the moon's essence; b. it follows from the density and rarity of the moon, which follow, in turn, from the substance of the moon. His concluding theses are: 1. The spot on the moon does not belong to the moon's essence in the first mode of 'belonging to', for the light of the sun is necessary for the existence of the spot. 2. The spot on the moon belongs to the essence of the moon in the second mode of 'belonging to'. The reason is that it follows the density and rarity of the moon.

Along their own line of thought the Parisian philosophers ascribe a terrestrial nature to the moon. Both they and Albert the Great refer for Averroes as their source. However, Buridan and his followers do not refer to Aristotle's *De animalibus*, as Albert the Great did.

4. Conclusions

1. There are different descriptions of the spot on the moon in the Middle Ages. According to Albert the Great, the spot represents in the main a dragon with a tree on its back; according to three of the four Parisian philosophers, the spot has the form of a lion with a tree on its back.

2. Theories about the origin of the spot had to reckon with the generally accepted theory of the simple nature of the heavenly bodies.

3. In Ancient philosophy the substance of the moon was seen either as terrestrial or as fiery, though with qualifications. Aristotle's view that the substance of the heavenly bodies was ether dominated medieval astronomy. With reference to Averroes, Albert the Great thought according to Aristotle the moon had a character among the heavenly bodies like that of the earth among the sublunary elements, which explained the spot. According to

Thomas Aquinas, who followed Aristotle in his view that the substance of the heavenly bodies, including the moon, was ether, the origin of the spot on the moon was a kind of reflection from its effects (viz. the sublunary region).

4. According to the fourteenth-century Parisian philosophers John Buridan, Nicholas of Oresme, Albert of Saxony and Marsilius of Inghen the moon is one of the ethereal planets. However, they denied that the spot of the moon came from outside, in whatever way, with the help of the distinction between essential and accidental properties. In a simple body like the moon, density and rarity follow from the essence in the first sense of 'belonging to', Marsilius of Inghen says, while the spot follows from it in the second sense, unlike the case of sublunary things, because it is dependent on the causality of the sun. They said they followed Averroes in this.

5. In their way, the fourteenth-century Parisian philosophers blurred the strict demarcation line between heavenly bodies and the sublunary region.

5. Epilogue

The problem of the spot on the moon is discussed also by Dante, *Paradiso* II⁹⁹. According to him¹⁰⁰, the different light of the stars derives from their power, differently distributed among the stars, not from their greater or lesser density or rarity. In his *Sidereus nuntius* ('The starry messenger') Galileo concludes on the basis of his telescope observations that there are mountains on the moon which explain the spots¹⁰¹.

⁹⁹ B. Nardi 'La dottrina delle macchie lunari ...', has studied this problem in its historical context.

¹⁰⁰ Esp. *Paradiso* II, 145-148.

¹⁰¹ A good recent study is Ariew, 'Galileo's lunar observations ...'; see also Edgerton, 'Galileo, Folrentine "disegno" ...', an article of the same year as that by that by Ariew, so they have no reference to each other.

APPENDIX

Edition of Marsilius' *Quaestiones in Aristotelis De caelo et mundo*, II, viii; MS Cuyk (St. Agatha) (The Netherlands), *Kruisherenklooster C 12*, ff. 154 rb-155 ra.

[SECUNDI LIBRI OCTAVA QUAESTIO]

Utrum macula que apparet in luna sit de natura¹ ipsius lunae

[1. RATIONES ANTE OPPOSITUM]

Arguitur quod non:

(1.1.) In corpore simplici non debet esse diversitas secundum quam una pars apparet unius figurae et alia pars apparet alterius figurae; sed luna est corpus simplex sicut alia astra; igitur et cetera. Maior apparet: in hiis quae minus sunt simplicia, scilicet in aere et terra etcetera non apparet talis diversitas. Minor apparet: quia cetera astra sunt simplicia, et magis simplicia quam elementa; igitur et luna.

(1.2.) Secundo: si sic, sequeretur quod luna essentialiter intrinsece composita esset ex partibus diversarum rationum, et sic non esset simplex. Consequens non conceditur in caelestibus. Et probatur consequentia: quia ista pars plus distinguitur contra alias partes lucidas quam aliae partes lucidae inter se; sed duae partes lucidae distinguuntur numero; igitur et cetera. Maior nota. Minor apparet: quia una non est alia; igitur differunt numero.

(1.3.) Tertio: color non potest esse de natura caeli; sed haec macula videtur colorata; igitur etc. Maior patet: quia qualitates secundae non reperiuntur in celo. Minor apparet: quia per comparisonem ad alias partes videtur esse nigra.

(1.4.) Quarto: si sic, sequeretur quod quandoque deberet appetere diversa. Consequens falsum. Et patet consequentia: quia astronomi dicunt quod luna movetur in epicyclo; ergo, quando luna esset in epicyclo² in parte superiori, tunc³ una pars secundum situm apparet⁴, quando esset in inferiori parte, deberet apparere (*F. 154va*) secundum alium situm.

¹ natura] naturae MS.

² in] cum MS.

³ tunc] sicut *add.* MS.

⁴ apparet] tunc *add.* MS.

[2. OPPOSITUM]

Oppositum supponit *Philosophus*, secundo *huius*. Et etiam hoc probat *Commentator*, secundo *huius*. Dicit enim quod, quia luna non movetur motu circumgirationis, nec alia astra. Quia, si sic, tunc quandoque appareret eversa.

[3. OPINIO AUCTORIS]

Hic erunt *duo articuli*: in primo erunt diversi modi dicendi et notabilia; in secundo respondetur ad quaesitum.

[3. Articuli]

[3.1. Primus articulus]

[Notabilia]

[3.1.1. Primum notabile]

Quantum ad primum nota quod *Albertus Magnus* dicit quod ista macula lunae apparet ad modum leonis habentis caput versus oriens et arborem eversam cum radicibus sursum habentis in dorso; iuxta arborem apparet facies hominis appendens ibi super. Et qui vellet, posset istud notabiliter experiri post plenilunium luna tendente ad occasum ante ortum solis; tunc clarissime apparet figura istius maculae, quia tunc sol non impedit.

[3.1.2. Secundum notabile]

Secundo nota de causa istius maculae; ex quo non apparet in aliis, sunt diversi modi dicendi.

Primus <est> quod ista macula apparet in luna, quia luna de natura sua semper attraheret vapores sub se. Qui vapores facerent apparere maculam in luna quemadmodum astra aliquando per attractionem vaporum facerent⁵ apparere cometam.

Sed contra istam opinionem arguitur: si sic, tunc non semper ista macula deberet apparere eiusdem figurae. Consequens falsum. Et patet consequentia: quia non apparet quod semper tales vapores consimiliter figurarentur. Secundo: si sic, tunc non semper ista macula deberet apparere, sicut non semper apparet cometa. Item, si apparet propter vapores, tunc non deberet similiter apparere in oriente et in occidente.

[3.1.3. Tertium notabile]

Tertio nota quod *Avicenna* recitat *secundum*⁶ modum dicendi, quod ab igne vel ab elemento ignis luna sic circa medium est combusta, et sic est tam⁷ nigra.

⁵ facerent] facere MS.

⁶ secundum] istum MS.

⁷ tam] quam MS.

Sed contra: si ignis posset cumburere unam partem cum semper sit circa eam, tandem posset comburere totam.

[3.1.4. Quartum notabile]

Quarto nota quod *tertius* modus supponit quod luna est quasi speculum. Secundo supponit quod in terra sunt alti montes et arbores supra montes, et tunc dicit quod istae arbores, et similiter isti montes, multiplicat suas species usque ad lunam, et reflectuntur tales ad oculum. Et propter hoc apparet talis nigra macula.

Sed ista opinio est exilis, quia docet experientia: quando luna eclipsatur, per modum ortus eclipsatur. Et sic non videtur quare potius in una parte deberet apparere quam in alia. Item, non apparet verisimile quod ad talem distantiam multiplicentur species et a tanta distantia reflectantur.

[3.1.5. Quintum notabile]

Quinto nota quod *quarta* opinio⁸ supponit quod medietas lunae que non obicitur soli, non illuminatur⁹ a sole, saltem intensive. Hoc docet experientia. Ex hoc dicit quod lumen solis minus profunditur in profun- (*F. 154vb*) – ditatibus lunae quam in extremitatibus mediis; igitur partes extremae apparent magis lucide quam medii. Et istam demonstrative improbare non est facile.

Non tamen videtur penitus rationalis, ex eo quia, si luna videtur per incorporationem solis vel reflectionem luminis solaris, non est ratio, cum sit sphaerica, quare magis in una parte reflectitur vel invenitur lumen quam in alia.

Et hec de primo.

[3.2. Secundus articulus]

[Notabilia]

[3.2.1. Primum notabile]

Quantum ad secundum articulum nota primo quod alii imaginantur sic quod, cum luna habeat lumen suum a sole, ipsa non est alba vel lucida nisi propter reflectionem vel incorporationem luminis solaris. Apparet ex eo: quia, quamvis luna est sub umbra, nullum habet lumen, et ergo dicit *Commentator* quod omnia astra habent lumen suum a sole. Cuius contrarium dicit *Avicenna*.

[3.2.2. Secundum notabile]

Secundo: nota quod nulla pars in caelo est proprie colorata, quia color est qualitas secunda que consequitur a mixtione primarum qualitatum in subiecto. Modo in caelo non sunt qualitates primae.

⁸ opinio] dicit et *add.* MS.

⁹ illuminatur] eliminatur MS.

[3.2.3. Tertium notabile]

Tertio dicit hec opinio quod colores que apparent in caelo, non proprie sunt in eo, sed apparent in eo propter aliam et aliam reflexionem radiorum solarium. Tunc dicit quod ideo caelum apparet quia radios debiles et remissos remittit, et illi radii remissi non possunt lumen repraesentare directe.

[3.2.4. Quartum notabile]

Quarto nota quod luna est difformis in partibus suis. Quia in quibusdam partibus est magis rara, et in illis lumen solare minus et imperfectius incorporat et reflectit, et in aliquibus est magis densa, et in illis perfectius incorporat lumen solis et reflectit ipsum.

[3.2.5. Quintum notabile]

Quinto: nota quod *istam maculam esse de essentia lunae* potest dupliciter intelligi. Uno modo: quia essentiam lune in se consequitur et non per respectum. Alio modo: quia raritatem et densitatem consequitur, que consequuntur ipsam lunam.

[4. CONCLUSIONES]

[4.1. Prima conclusio]

Tunc sit hec prima conclusio: macula que apparet in luna, non est primo modo de essentia lunae. Si enim radii solares non venirent ad lunam, non apparet ista macula.

[4.2. Secunda conclusio]

Secunda conclusio: ista macula secundo modo est de essentia lunae. Apparet: quia sequitur raritatem et densitatem, que sunt de substantia lunae secundum quas luna in partibus magis densis maius lumen reflectit et in aliis magis alba.

Hec de secundo.

[5. AD RATIONES ANTE OPPOSITUM]

Ad rationes ante oppositum:

(5.1) Ad primam dicitur quod non est inconueniens ad certos fines, licet hoc sit nobis ignotum. Et ultra: conceditur quod in elementis non apparet. Nec est tanta perfectio elementorum sicut astrorum. Unde elementum non habet nisi duas qualitates primas. Sphaera autem octava habet dominium super omnes qualitates¹⁰ (F. 155ra) primas.

¹⁰ qualitates] *iter*. MS.

(5.2) Ad secundam: conceditur consequentia. Ad probationem: negatur quod essentialiter plus differunt¹¹. Sed conceditur quod accidentaliter penes raritatem et densitatem differunt plus.

(5.3) Ad tertiam: conceditur de veris coloribus. Et ultra dicitur quod ista nigretudo non est vera nigretudo, sed est minor lux.

(5.4) Ad quartam: negatur consequens. Ad probationem dicitur quod *Aristoteles* et *Commentator* non posuerunt epicyclos admissio tamen isto quod luna moveatur in epicyclo. Ad improbationem dicitur quod, sicut epicyclus descendit, ita proportionaliter luna ascendit. Et ideo semper apparet in eodem situ ista macula.

Et hec de quaestione.

¹¹ differunt] differt MS.