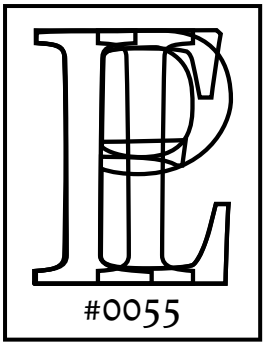

On Light

By Robert Grosseteste
(Published: 1225)

T light. HE first For corporeal light a'f its form very which nature some diffuses caU corporeityl itself in every is in direction my opinion in such a way that a point of light will produce instantaneously a sphere of light of any size whatsoever, unless some opaque object stands in the way. Now the extension of matter in three dimensions is a necessary con· comitant of corporeity, and this despite the fact that both corporeity and matter are in themselves simple substances lacking all dimension. But a form that is in itself simple and without dimension could not introduce dimension itt every direction into matter, which is likewise simple and without dimension, except by multiplying itself and diffusing itself instantaneously in every direction and thus extending matter in its own diffusion. For the fonn cannot desert matter, because it is inseparable from it and matter itself cannot be deprived of form.-But I have pro- posed that it is light which possesses of its very nature the function of multiplying itself and diffusing itself instantaneously m all d,rectIOns. Whatever perfonns this operation is either light or some other agent that acts in virtue of its· participation in light to which this operation belongs essentially. Corporeity, therefore, is either light itself or the agent which performs the aforementioned operation and introduces dlmenslOns mto matter in_ virtue of its participation in light, and acts through the power of this same light. But the first form cannot introduce dimensions into matter through the power of a subsequent form. Therefore light is not a form subsequent to corporeity, but it is corporeity itself. ,

ROBERT GROSSETESTE

ON LIGHT

{DE LUCE}

Translation from the Latin,
with an introduction,

By

CLARE C. RIEDL, M.A.

MARQUETTE UNIVERSITY PRESS
MILWAUKEE, WISCONSIN
1942

MEDIAEVAL PHILOSOPHICAL TEXTS IN TRANSLATION
NO. 1

ROBERT GROSSETESTE *ON LIGHT*

INTRODUCTION

ROBERT GROSSETESTE—Grosseteste is the French version of the Latin 'Grossum Caput' or the English 'Great Head'—lived from about 1175 to 1253. He was born in England at Stradbroke in Suffolk. He studied law and medicine as well as theology at Oxford. It is quite probable that he studied at Paris also. Upon the completion of his studies he taught at Oxford where he organized the curriculum of philosophy. He was made Chancellor of the University about the year 1221, the first to hold this newly created office. He spent the last eighteen years of his life (1235-1253) as Bishop of Lincoln which was at that time the largest diocese in England. He is often referred to by his contemporaries as 'Lincolniensis' or 'the Lincolnian.' In his conduct of his episcopate he distinguished himself by his zeal and energy in laboring for reform both in church and in state affairs. He had been present at Runnymede in 1215 when King John signed the *Magna Charta*, and as Bishop of Lincoln he came to grips on more than one occasion with King John's successor, Henry the Third.

Although a secular himself, he served from 1229 to 1235 as the first reader in theology at the newly founded Franciscan house of studies at Oxford. In this capacity he exerted a tremendous influence on the subsequent development of Franciscan thought. For this reason Miss Sharp devotes the first chapter of her *Franciscan Philosophy at Oxford in the Thirteenth Century* to him, and the noted Franciscan scholar É. Longpré credits him with having inspired 'almost all the principal doctrinal initiatives of Franciscan thought from Bonaventure to Duns Scotus inclusively.'[1]

Roger Bacon, who studied under Grosseteste at Oxford, considered him the most learned man of his day, comparable, in fact, to what Solomon, Aristotle, and Avicenna had been in theirs.[2] While more impartial estimates have not come up to the eulogy of Bacon, Grosseteste's title to fame rests on no slight record of achievement.

He made an important contribution to the learning of his age through his many translations of Greek writers. Both St. Albert the Great and St.

[1] D. E. Sharp, *Franciscan Philosophy at Oxford in the Thirteenth Century* (Oxford: University Press, 1930), pp. 9-46. É. Longpré, 'Thomas d'York et Matthieu d'Aquasparta,' *Archives d'histoire doctrinale et littéraire du moyen âge*, I (1926), 270.

[2] Roger Bacon, *Opus Tertium*, 22, in J. S. Brewer (editor), *Opera Quaedam Hactenus Inedita* (London: Longmans, 1859), I, 70.

Thomas used his version of the *Ethics* of Aristotle.[3] He translated also a considerable portion of Aristotle's *De Caelo et Mundo*, the works of Pseudo-Dionysius, and the *De Fide Orthodoxa* of St. John Damascene, as well as many other shorter works. His interest in studies continued even after he had become Bishop of Lincoln, and a letter written in the early days of his episcopate pictures him spending his leisure time reading and translating Greek.[4]

He was without question one of the most remarkable men of science of his time. Thorndike remarks his tendency to appeal to observation and experiment and his frequent use of the words *experimenta* and *experimentatores*. He notes too the mention in Grosseteste of 'a recent or approaching experimental discovery, that of magnifying lenses,' which 'point the way to the microscope or telescope.'[5] Grosseteste's works on scientific subjects are numerous and cover a wide range of topics, such as optics, mathematics, cosmology and astronomy. Included among them are treatises *On Color* (*De Colore*), *On Lines, Angles and Figures* (*De Lineis, Angulis et Figuris*), *On the Sphere* (*De Sphaera*), *On the Movements of the Heavenly Bodies* (*De Motu Supercaelestium*), *On the Rainbow* (*De Iride*), and *On Comets* (*De Cometis*).

In philosophy Grosseteste represents, and indeed might well be called the founder of, a new tradition, characterized by the blending of philosophy with experimental science. This tradition continued to be characteristic of philosophy at Oxford in opposition to the more metaphysical type of speculation which prevailed at Paris. Thus St. Thomas, teaching at Paris, could ignore almost completely the questions of experimental science, mathematics, and optics, which claimed so much of the interest of his Franciscan contemporary at Oxford, Roger Bacon.

Grosseteste's more strictly philosophical works are few in number. He has written no single comprehensive work on philosophy. A *Summa* which was formerly attributed to him has been shown to be spurious. Among his longer philosophical works must be included the *Hexaemeron*,[6] the commentary on the *Posterior Analytics*, and the commentary on the works of Dionysius. His shorter philosophical writings include works *On the One Form of all Things* (*De Unica Forma Omnium*), *On Intelligences* (*De Intelligentiis*), *On Potency and Act* (*De Potentia et Actu*), *On Truth* (*De Veritate*), *On the Order of Emanation of Effects from God* (*De Ordine Emanandi Causatorum a Deo*), and a treatise *On Free Will* (*De Libero Arbitrio*).

[3] A. Pelzer, 'Les versions latines des ouvrages de morale conservés sous le nom d'Aristote en usage au XIIIe siècle,' *Revue néo-scolastique*, XXIII (1921).
[4] H. Luard (editor), *Roberti Grosseteste Epistolae* (London: Longmans, 1861), letter LVII, p. 173.
[5] *A History of Magic and Experimental Science*, 6 vols. (I and II, New York: Macmillan, 1929; III to VI, New York: Columbia University Press, 1934-1941), II, 440-441.
[6] An edition of this work is being prepared at the Institute of Medieval Studies, St. Michael's College, Toronto, by the Rev. J. T. Muckle, C.S.B. I take this opportunity to thank Father Muckle for allowing me to use his text. Folio references to it will be on the basis of *MS. British Museum Royal, 6E, V.*

The treatise *On Light* is significant: 1) as affording an introduction to one of the comparatively unknown great of the Middle Ages, an influential thinker and man of science, Robert Grosseteste; 2) as an example of the philosophic-scientific synthesis which characterized the Oxford school; 3) as an important source of the 'light metaphysics' of the Middle Ages; 4) for the medieval conceptions relative to cosmology and astronomy contained in it.

For an understanding of the treatise *On Light* it will be necessary to consider some of the characteristics of Grosseteste's doctrine of matter and form. While his terminology is Aristotelian, the ideas which he expresses in that terminology are often decidedly un-Aristotelian in content. The chief point of divergence is that for Grosseteste matter is not pure potency, as it was for Aristotle, but possesses in its own right a certain minimal reality. Thus Grosseteste speaks of matter as a substance, 'Both corporeity and matter are in themselves simple substances.'[7]

When we come to consider the function of the form in Grosseteste's metaphysics, we find that the form completes, perfects, actualizes matter.[8] It is referred to as the *species* and *perfectio* of the object.[9] The term *species* seems to hold special connotation over and above mere form in its static aspect. In the section in the treatise *On Light* where Grosseteste employs this term he is concerned with the influence of forms on other bodies. 'It is clear that every higher body, in virtue of the light which proceeds from it, is the form (*species*) and perfection of the body that comes after it.'[10] In connection with this theory of interaction in virtue of which 'in a sense each thing contains all other things,'[11] it is interesting to note the dynamic aspect which Grosseteste assigns to form. Form, that is to say, the first corporeal form, or light, is in his view more than the 'form of corporeity,' the principle of extension, it is also a principle of activity. Every body, he believes, has a motion or activity which is natural to it, because it proceeds from an intrinsic principle. The intrinsic

[7] *On Light*, p. 10. For this treatise the page references are to the accompanying translation. For Grosseteste's other *opuscula* the references are to L. Baur (editor), *Die philosophischen Werke des Robert Grosseteste*, in Baeumker's *Beiträge zur Geschichte der Philosophie des Mittelalters*, IX (Münster i. W.: Aschendorff, 1912).
[8] *On Light*, p. 13; *De Potentia et Actu*, (Baur, p. 126).
[9] *On Light*, p. 15.
[10] *On Light*, p. 15.
[11] *On Light*, p. 15.

principle from which this motion or activity proceeds must be the form, since matter is passive.[12]

When Grosseteste speaks of 'the *first* corporeal form,'[13] he introduces a conception that is strange to Aristotelian doctrine. For there is implied in this statement a doctrine of plurality of forms. As a matter of fact in other treatises this doctrine is developed more fully.[14] It came eventually to be one of the fixed tenets of the Franciscan school.[15]

Corresponding to the notions of matter and form are the closely related concepts of potency and act. And just as for Grosseteste matter as such has some slight reality, so potency is not purely passive. 'By potency I mean not that which has no actuality whatsoever, but that which is not altogether actual.'[16] The terms act and actualization as used in the treatise *On Light* have some rather interesting implications. *Compleo* and *complementum* are the words Grosseteste uses. In his *De Potentia et Actu*[17] he explains these terms. Actual being is the same, he says, as being 'in complemento.' When we come to consider the meaning of act and actualization in the treatise *On Light* we find that the actualization of matter is practically synonymous with extension. To actualize matter is to extend matter. To actualize matter completely, perfectly, leaving in it no potency to further actualization, is to extend it to the utmost of its capacity, to rarefy it in the highest degree.[18] It would appear from this that the only potency which matter in corporeal substances contains is the potency for extension. This is further borne out by the fact that the first body, the firmament, is perfect 'because it has nothing in its composition but first matter and first form.'[19]

With these preliminary notions in regard to matter and form as a background we can proceed to the consideration of the treatise *On Light*. The subject matter of the treatise is indicated in brief in its opening sentence, where Grosseteste sets forth his thesis that light is 'the first corporeal form.' The remainder of the treatise is occupied with explanation and attempted proof of this proposition together with a detailed analysis of the process by which this first corporeal form united with primordial matter to produce the material universe. The work falls naturally into two divisions. The first part (pages 10-13) is concerned with 'light metaphysics' proper, that is to say, with the composition of material sub-

[12] *De Motu Corporali et Luce,* (Baur, p. 90).
[13] *On Light,* p. 10.
[14] E.g., *De Statu Causarum,* (Baur, p. 125).
[15] Cf. A. C. Pegis, *St. Thomas and the Problem of the Soul in the 13th Century* (Toronto: St. Michael's College, 1934), pp. 26-76.
[16] *De Statu Causarum,* (Baur, p. 123).
[17] (Baur, p. 126).
[18] *On Light,* p. 13.
[19] *On Light,* p. 13.

stance out of first matter and the first corporeal form of light. The second part contains a cosmogony based on this 'light metaphysics,' an account of the way in which light brought about the formation of the thirteen spheres of the material universe. The astronomical question of the movements of the spheres is also treated. The concluding paragraphs of the treatise contain one of those disquisitions on the perfect number which are common in both ancient and medieval philosophers from Pythagoras' time onward.

Grosseteste bases his 'light metaphysics' on the consideration of the properties of light and of the nature of material substance. He finds as a characteristic note of corporeity the requirement of extension, 'the extension of matter in three dimensions is a necessary concomitant of corporeity.' He considers corporeity and matter in themselves 'simple substances lacking all dimension.'[20] His knowledge of the properties of light, its tendency to multiply itself and diffuse itself in all directions, the fact that a point of light will produce instantaneously a sphere of light, lead him to conclude that light is ideally suited to fulfill the requirement of extension, since when it is joined to matter as its form, and as such is inseparable from matter, it will necessarily carry matter along with it in its diffusion and self-multiplication.

The light of which Grosseteste speaks is not the ordinary physical light of our every day experience. It is a simple substance, almost spiritual in its properties. From the sections in the *Hexaemeron* in which he treats of light,[21] it can be seen that the starting point for this theory of light is the account in *Genesis* of the light which God created three days before the creation of the sun and the stars. Grosseteste is greatly influenced by the *Hexaemeron* of St. Basil with its analysis of this doctrine of light in *Genesis*. The distinction between *lux* and *lumen,* which Grosseteste makes, is found in the *Hexaemeron* of St. Basil,[22] and L. Baur suggests that St. Basil is Grosseteste's source on this point.[23] But the distinction can be found also in St. Augustine as well as in many early medieval writers. There seem to be no suitable English words to convey the distinction between *lux* and *lumen.* For this reason I have translated both by 'light,' indicating parenthetically the Latin word used in each case. The distinction appears to be this: *lux* is light in its source, whereas *lumen* is reflected or radiated light. Both however are conceived by

[20] *On Light,* p. 10.
[21] E.g., *Hexaemeron,* fol. 146r, col. 2.
[22] St. Basil, *Homiliae in Hexaemeron,* VI, 3, Migne: *Patrologia Graeca,* XXIX, 121.
[23] 'Das Licht in der Naturphilosophie des Robert Grosseteste,' *Abhandlungen aus dem Gebiete der Philosophie und ihrer Geschichte, eine Festgabe zum 70. Geburtstag Georg Freiherrn von Hertling* (Freiburg i. B.: Herder, 1913), p. 44.

Grosseteste to be substances. Thus he speaks of *lux* as 'a simple being' and of *lumen* as 'a spiritual body.'[24]

The mathematical justification of the attempt to derive extension or quantity from a simple substance through its infinite multiplication[25] recalls the importance which Grosseteste assigned to the science of mathematics as an aid in the study of the natural sciences. 'The study of lines, angles, and figures,' he says, 'is extremely useful, for without them it is impossible to understand natural philosophy.'[26]

The second part of the treatise might well be called a 'philosophy of *Genesis*.' It gives the story of creation in terms of light. This light, in its capacity as first corporeal form united inseparably with matter, proceeded 'in the beginning' to extend matter along with itself into the form of a sphere.[27] The outermost parts of the sphere were naturally more extended and rarefied than the inner parts. In fact their potency for extension was completely actualized. Thus in the outermost part of this sphere the firmament came into being. The firmament in turn diffused its light (*lumen*) from every part of itself to the center of the universe. This light gathered together the dense mass of matter inside of the firmament. In this process again the outermost parts of the mass came to be rarefied and extended to their full capacity and resulted in the formation of the second sphere. In this same way the light reflected from the second sphere produced the third sphere, and so on, until the nine heavenly spheres were brought into being, and also the four spheres of the elements: fire, air, water, and earth.

Light furnishes therefore the principle of continuity in nature, for as the first corporeal form it is common to all things in the universe from the lowest of the elements, earth, up to and including even the firmament. Thus 'all things are one by the perfection of one light.' It is also the principle of distinction and multiplicity since the 'things which are many are many through the multiplication of light itself in different degrees.'[28]

The universe with its thirteen spheres whose formation Grosseteste describes for us is typical of medieval cosmological views. It is the geocentric universe of Aristotle and Ptolemy. The ninth heavenly sphere which Ptolemy had added to Aristotle's eight was retained. According to Duhem the cosmology of the treatise *On Light* shows considerable traces of the influence of Alpetragius (Al-Bitrogi).[29] This Alpetragius

[24] *On Light,* pp. 11, 13.
[25] *On Light,* pp. 11-12.
[26] *De Lineis, Angulis, et Figuris* (Baur, p. 60).
[27] *On Light,* p. 11.
[28] *On Light,* p. 16.
[29] Duhem, *Le système du monde,* 5 vols. (Paris: R. Hermann et fils, 1913-1917). III, 284.

was an Arabian scientist whose work *On the Sphere,* translated at Toledo in 1217, attempted to defend the old cosmological views of Aristotle in opposition to the innovations of Ptolemy. Ptolemy in his *Almagest* had suggested the theory of epicycles and eccentrics to account for the apparent variations in the distance of the heavenly bodies from the earth, which the Aristotelian theory of concentric spheres left unexplained. Grosseteste was familiar with the views of both these men. Thus in his *De Motu Supercaelestium* he speaks of 'the views of Ptolemy in the *Almagest* and the destruction of those views in Alpetragius.'[30] Although this statement would seem to imply that in Grosseteste's opinion Alpetragius had the better of the argument with Ptolemy this was not the case. Duhem remarks that along with many other medieval writers Grosseteste hesitated between these two views, preferring in his more strictly scientific writings the theory of Ptolemy which fit in better with observation and scientific experiment, whereas in his philosophical treatises he preferred the order and precision of Alpetragius' homocentric universe.[31] The notion that the spheres become increasingly less simple and more condensed as they are farther removed from the outermost sphere, as well as the suggestion that fire, air, and water share in the diurnal motion are to be found in Alpetragius.[32]

On the question of the movements of the heavenly spheres Grosseteste refers in this treatise to two different kinds of motion. The diurnal or daily motion was a motion from East to West common to all the heavenly bodies.[33] This motion, in accord with the best medieval tradition, which in turn is under the influence of the Aristotelian doctrine of the intelligences that move the spheres, Grosseteste ascribes to 'the incorporeal power of intelligence or soul.'[34] It is communicated directly to the outermost sphere, the firmament, which imparts it to the other spheres. The movement of the eighth sphere, which this sphere likewise imparts to all the heavenly spheres below it, was somewhat of a new theory in Grosseteste's day. This was a movement of access and recess. The suggestion for it was made by an Arabian writer Thebit ben Coran (Ibn-Thâbit) whose work *On the Movement of the Eighth Sphere* (*De Motu Octavae Sphaerae*) Grosseteste cites frequently.[35]

In Grosseteste's philosophy light is a very fruitful principle. The concept is not restricted to metaphysics as in the treatise *On Light.* In other works the principle is extended to different fields, such as psychology

[30] (Baur, p. 100).
[31] Duhem, *Le système du monde,* III, 286-287.
[32] Duhem, *Le système du monde,* II, 151, 154.
[33] *De Motu Supercaelestium,* (Baur, p. 99).
[34] *On Light,* p. 16. Cf. also Grosseteste's *De Motu Supercaelestium,* (Bauer, pp. 92-100). Aristotle is cited in almost every paragraph of this treatise.
[35] *De Sphaera,* (Baur, p. 25ff.).

where light is brought in to account for the union of soul and body,[36] or knowledge, where light serves as the means whereby the soul gets knowledge from sense data.[37] In these applications and in others of a mystical nature the influence of St. Augustine is very prominent.

The anonymous *Liber de Intelligentiis,* one of the fundamental sources of medieval 'light metaphysics,' has, according to Miss Sharp, an 'almost verbal resemblance' to Grosseteste's theory of light which 'makes it not improbable that the *Liber de Intelligentiis* was written by someone trained in the Oxford school.'[38] This theory also had a considerable influence on Franciscan thinkers both at Oxford and at Paris, especially on St. Bonaventure.[39]

[36] *Hexaemeron,* fol. 147v, col. 2.
[37] *Hexaemeron,* fol. 147v, col. 2.
[38] D. E. Sharp, *Franciscan Philosophy at Oxford in the Thirteenth Century,* p. 22, n. 2.
[39] É Gilson, *La philosophie de saint Bonaventure,* (Paris: Librairie J. Vrin, 1924), p. 264ff.

The *Epistolae* of Grosseteste were edited by H. Luard in the Rolls Series (London, 1861). The philosophical *opuscula* were edited by L. Baur in Baeumker's *Beiträge zur Geschichte der Philosophie des Mittelalters,* IX (Münster, i. W.: Aschendorff, 1912). An edition of the works not yet edited is being prepared by Prof. S. H. Thomson and others. The analysis of manuscript materials has already been made by S. H. Thomson, *The Writings of Robert Grosseteste, Bishop of Lincoln, 1235-1253* (Cambridge: Cambridge University Press, 1940). Three of the *opuscula,* namely, *De Veritate, De Veritate Propositionis* and *De Scientia Dei,* have been translated by R. McKeon, *Selections from Medieval Philosophers,* 2 vols. (New York: Scribners, 1928-1931) I, 263-287. A mimeographed translation of the *De Luce* (Annapolis: St. John's College) has appeared since this translation was set up in type.

The only systematic exposition of Grosseteste's philosophy available in English is that of D. E. Sharp, *Franciscan Philosophy at Oxford in the Thirteenth Century* (Oxford: University Press, 1930). Grosseteste's scientific views as well as his place in the history of science are set forth by L. Thorndike, *A History of Magic and Experimental Science,* 6 vols. (I and II, New York: Macmillan, 1929; III to VI, New York: Columbia University Press, 1934-1941). Biographical data can be gathered from F. S. Stevenson, *Robert Grosseteste* (London: Macmillan, 1899), and from B. C. Boulter, *Robert Grossetête, the Defender of Our Church and Our Liberties* (London: Society for Promoting Christian Knowledge, 1936).

The most comprehensive account of the philosophical and scientific doctrines of Grosseteste is contained in two studies by L. Baur, 'Das Licht in der Naturphilosophie des Robert Grosseteste' in *Abhandlungen aus dem Gebiete der Philosophie und ihrer Geschichte, eine Festgabe zum 70. Geburtstag Georg Freiherrn von Hertling* (Freiburg i. B.: Herder, 1913), pp. 41-55, and *Die Philosophie des Robert Grosseteste* in Baeumker's *Beiträge,* XVIII (1917).

The account of M. DeWulf, *Histoire de la philosophie médiévale,* 2 vols. (6th edition, Louvain: Institut Superieur de Philosophie, 1936), II, is especially useful for the analysis of recent literature on Grosseteste's commentaries and his work as a translator. P. Duhem, *Le système du monde,* 5 vols. (Paris: A. Hermann et Fils, 1913-1917), III, V, contains much useful material on the influence of Greek and Arabian scientific doctrines on Grosseteste.

The text used for this translation is that of L. Baur, *Die philosophischen Werke des Robert Grosseteste* in Baeumker's *Beiträge,* IX (1912), 51-59. This translation was already completed when I visited Professor Baur in Germany in 1938. He very graciously gave his consent to its publication, and was most generous in answering questions concerning the text and the philosophical doctrines of the *De Luce.* In the few cases in which I have taken exception to Professor Baur's reading I have indicated it in the notes, referring to the variants according to the abbreviations in his critical apparatus.

ROBERT GROSSETESTE *ON LIGHT*

OR THE BEGINNING OF FORMS

THE first corporeal form which some call corporeity[1] is in my opinion light. For light of its very nature diffuses itself in every direction in such a way that a point of light will produce instantaneously a sphere of light of any size whatsoever, unless some opaque object stands in the way. Now the extension of matter in three dimensions is a necessary concomitant of corporeity, and this despite the fact that both corporeity and matter are in themselves simple substances lacking all dimension. But a form that is in itself simple and without dimension could not introduce dimension in every direction into matter, which is likewise simple and without dimension, except by multiplying itself and diffusing itself instantaneously in every direction and thus extending matter in its own diffusion. For the form cannot desert matter, because it is inseparable from it, and matter itself cannot be deprived of form.—But I have proposed that it is light which possesses of its very nature the function of multiplying itself and diffusing itself instantaneously in all directions. Whatever performs this operation is either light or some other agent that acts in virtue of its participation in light to which this operation belongs essentially. Corporeity, therefore, is either light itself or the agent which performs the aforementioned operation and introduces dimensions into matter in virtue of its participation in light, and acts through the power of this same light. But the first form cannot introduce dimensions into matter through the power of a subsequent form. Therefore light is not a form subsequent to corporeity, but it is corporeity itself.

Furthermore, the first corporeal form is, in the opinion of the philosophers, more exalted and of a nobler and more excellent essence than all the forms that come after it. It bears, also, a closer resemblance to the forms that exist apart from matter. But light is more exalted and of a nobler and more excellent essence than all corporeal things. It has, moreover, greater similarity than all bodies to the forms that exist apart from matter, namely, the intelligences. Light therefore is the first corporeal form.

[1] According to Father Leo W. Keeler the reference here would seem to be to Philip the Chancellor, who was the first to use the 'form of corporeity' in the technical sense in which it appears here and throughout the *De Luce*. This Philip, according to Father Keeler's thesis, was one of Grosseteste's teachers at Paris. Cf. 'The Dependence of R. Grosseteste's *De Anima* on the *Summa* of Philip the Chancellor,' *The New Scholasticism*, XI, (1937), 218.

Thus light, which is the first form created in first matter, multiplied itself by its very nature an infinite number of times on all sides and spread itself out uniformly in every direction. In this way it proceeded in the beginning of time to extend matter which it could not leave behind, by drawing it out along with itself into a mass the size of the material universe. This extension of matter could not be brought about through a finite multiplication of light, because the multiplication of a simple being a finite number of times does not produce a quantity, as Aristotle shows in the *De Caelo et Mundo*.[2] However, the multiplication of a simple being an infinite number of times must produce a finite quantity, because a product which is the result of an infinite multiplication exceeds infinitely that through the multiplication of which it is produced. Now one simple being cannot exceed another simple being infinitely, but only a finite quantity infinitely exceeds a simple being. For an infinite quantity exceeds a simple being by infinity times infinity. Therefore, when light, which is in itself simple, is multiplied an infinite number of times, it must extend matter, which is likewise simple, into finite dimensions.

It is possible, however, that an infinite sum of number is related to an infinite sum in every proportion, numerical and non-numerical. And some infinites are larger than other infinites, and some are smaller. Thus the sum of all numbers both even and odd is infinite. It is at the same time greater than the sum of all the even numbers although this is likewise infinite, for it exceeds it by the sum of all the odd numbers. The sum, too, of all numbers starting with one and continuing by doubling each successive number is infinite, and similarly the sum of all the halves corresponding to the doubles is infinite. The sum of these halves must be half of the sum of their doubles. In the same way the sum of all numbers starting with one and multiplying by three successively is three times the sum of all the thirds corresponding to these triples. It is likewise clear in regard to all kinds of numerical proportion that there can be a proportion of finite to infinite according to each of them.

But if we posit an infinite sum of all doubles starting with one, and an infinite sum of all the halves corresponding to these doubles, and if one, or some other finite number, be subtracted from the sum of the halves, then, as soon as this subtraction is made, there will no longer be a two to one proportion between the first sum and what is left of the second sum. In-

[2] Throughout the *De Caelo et Mundo* Aristotle is at pains to show that a quantity cannot be produced by combining things which are without quantity. Thus it would be impossible, if two parts of a thing have no weight, that the two together should have weight (III, 1, 299 a 25-30). Grosseteste, however, interprets Aristotle to mean only that a *finite* multiplication of the simple will *not* produce a quantity, thereby leaving the way open for Grosseteste's own notion that an *infinite* multiplication of the simple *will* produce a quantity. Cf. also *De Caelo et Mundo*, I, 5-7, 271 b 1 -276 a 17.

deed there will not be any numerical proportion, because if a second numerical proportion is to be left from the first as the result of subtraction from the lesser member of the proportion, then what is subtracted must be an aliquot part or aliquot parts of an aliquot part of that from which it is subtracted. But a finite number cannot be an aliquot part or aliquot parts of an aliquot part of an infinite number. Therefore when we subtract a number from an infinite sum of halves there will not remain a numerical proportion between the infinite sum of doubles and what is left from the infinite sum of halves.

Since this is so, it is clear that light through the infinite multiplication of itself extends matter into finite dimensions that are smaller and larger according to certain proportions that they have to one another, namely, numerical and non-numerical. For if light through the infinite multiplication of itself extends matter into a dimension of two cubits, by the doubling of this same infinite multiplication it extends it into a dimension of four cubits, and by the dividing in half of this infinite multiplication, it extends it into a dimension of one cubit. Thus it proceeds according to numerical and non-numerical proportions.

It is my opinion that this was the meaning of the theory of those philosophers who held that everything is composed of atoms, and said that bodies are composed of surfaces, and surfaces of lines, and lines of points.[3] This opinion does not contradict the theory that a magnitude is composed only of magnitudes, because for every meaning of the word whole, there is a corresponding meaning of the word part. Thus we say that a half is part of a whole, because two halves make a whole. We say, too, that a side is part of a diameter,[4] but in a different sense, because no matter how many times a side is taken it does not make a diameter, but is always less than the diameter. Again we say that an angle of contingence[5] is part of a right angle because there is an infinite number of angles of contingence in a right angle, and yet when an angle of contingence is subtracted from a right angle a finite number of times the latter becomes smaller. It is in a different sense, however, that a point is said to be part

[3] Aristotle in the *De Caelo et Mundo*, III, 1, 299 a 2 - 300 a 19, attributes this theory to Plato in the *Timaeus* (54d-55b), although he may also have had in mind the Pythagoreans whom he mentions immediately after. In fact, Diogenes Laertius, *Lives of Eminent Philosophers*, VIII, 25, attributes the theory directly to Pythagoras. Grosseteste seems to be aware of Aristotle's criticism of the theory, for he tries in the next sentence to reconcile it with Aristotle's dictum that a magnitude is composed only of magnitudes. Cf. note 2 above.

[4] The reference would seem to be to one of the two shorter sides of a right triangle inscribed in a semi-circle, the diameter of which is the hypotenuse of the triangle. No matter how much either of these sides is extended it will never equal the diameter until it becomes identical with it, in which case there is no longer a triangle.

[5] Grosseteste explains what an 'angle of contingence' is in his *De Lineis, Angulis, et Figuris* (Baur, p. 61). It is the infinitesmal angle between the circumference of a sphere and its tangent.

of a line in which it is contained an infinite number of times, for when a point is taken away from a line a finite number of times this does not shorten the line.

To return therefore to my theme, I say that light through the infinite multiplication of itself equally in all directions extends matter on all sides equally into the form of a sphere and, as a necessary consequence of this extension, the outermost parts of matter are more extended and more rarefied than those within, which are close to the center. And since the outermost parts will be rarefied to the highest degree, the inner parts will have the possibility of further rarefaction.

In this way light, by extending first matter into the form of a sphere, and by rarefying its outermost parts to the highest degree, actualized completely in the outermost sphere the potentiality of matter, and left this matter without any potency to further impression. And thus the first body in the outermost part of the sphere, the body which is called the firmament, is perfect, because it has nothing in its composition but first matter and first form. It is therefore the simplest of all bodies with respect to the parts that constitute its essence and with respect to its quantity which is the greatest possible in extent. It differs from the genus body only in this respect, that in it the matter is completely actualized through the first form alone. But the genus body, which is in this and in other bodies and has in its essence first matter and first form, abstracts from the complete actualization of matter through the first form and from the diminution[6] of matter through the first form.

When the first body, which is the firmament, has in this way been completely actualized, it diffuses its light (*lumen*) from every part of itself to the center of the universe. For since light (*lux*) is the perfection of the first body and naturally multiplies itself from the first body, it is necessarily diffused to the center of the universe. And since this light (*lux*) is a form entirely inseparable from matter in its diffusion from the first body, it extends along with itself the spirituality of the matter of the first body. Thus there proceeds from the first body light (*lumen*), which is a spiritual body, or if you prefer, a bodily spirit. This light (*lumen*) in its passing does not divide the body through which it passes, and thus it passes instantaneously from the body of the first heaven to the center of the universe. Furthermore, its passing is not to be understood in the sense of something numerically one passing instantaneously from that heaven to the center of the universe, for this is perhaps impossible, but its passing takes place through the multiplication of itself and the infinite

[6] The first form is said to 'diminish' matter when instead of rarefying it and extending it to the full it leaves it more dense, as with the inner parts of the sphere. Cf. *De Motu Corporali et Luce* (Baur, p. 92) : 'Quando vero congregatur lux in se cum corpulentia materiae, fit *condensatio vel diminutio*.'

generation of light (*lumen*). This light (*lumen*), expanded and brought together from the first body toward the center of the universe, gathered together the mass existing below the first body; and since the first body could no longer be lessened on account of its being completely actualized and unchangeable, and since, too, there could not be a space that was empty, it was necessary that in the very gathering together of this mass the outermost parts should be drawn out and expanded. Thus the inner parts of the aforesaid mass came to be more dense and the outer parts more rarefied; and so great was the power of this light (*lumen*) gathering together—and in the very act of gathering, separating—that the outermost parts of the mass contained below the first body were drawn out and rarefied to the highest degree. Thus in the outermost parts of the mass in question, the second sphere came into being, completely actualized and susceptible of no further impression. The completeness of actualization and the perfection of the second sphere consist in this that light (*lumen*) is begotten from the first sphere and that light (*lux*) which is simple in the first sphere is doubled in the second.

Just as the light (*lumen*) begotten from the first body completed the actualization of the second sphere and left a denser mass below[7] the second sphere, so the light (*lumen*) begotten from the second sphere completed the actualization of the third sphere, and through its gathering left below this third sphere a mass of even greater density. This process of simultaneously gathering together and separating continued in this way until the nine heavenly spheres were completely actualized and there was gathered together below[8] the ninth and lowest sphere the dense mass which constitutes the matter of the four elements. But the lowest sphere, the sphere of the moon, which also gives forth light (*lumen*) from itself, by its light (*lumen*) gathered together the mass contained below itself and, by gathering it together, thinned out and expanded its outermost parts. The power of this light (*lumen*), however, was not so great that by drawing together it could expand the outermost parts of this mass to the highest degree. On this account every part of the mass was left imperfect and capable of being gathered together and expanded. The highest part of this mass was expanded, although not to the greatest possible extent. Nevertheless by its expansion it became fire, although remaining still the matter of the elements.[9] This element giving forth light from itself and drawing together the mass contained below it expanded its outermost parts, but not to as great an extent as the fire was expanded, and in this way it produced air. Air, also, in bringing forth from itself, a spiritual

[7] Reading 'infra' with *R F D*.
[8] Reading 'infra' with *F*.
[9] Omitting with *V* 'et sic produxit . . . disgregatione.'

body or a bodily spirit, and drawing together what is contained within itself, and by drawing together, expanding its outer parts, produced water and earth. But because water retained more of the power of drawing together than of the power of expanding, water as well as earth was left with the attribute of weight.

In this way, therefore, the thirteen spheres of this sensible world were brought into being. Nine of them, the heavenly spheres, are not subject to change, increase, generation or corruption because they are completely actualized. The other four spheres have the opposite mode of being, that is, they are subject to change, increase, generation and corruption, because they are not completely actualized. It is clear that every higher body, in virtue of the light (*lumen*) which proceeds from it, is the form (*species*) and perfection of the body that comes after it. And just as unity is potentially every number that comes after it, so the first body, through the multiplication of its light, is every body that comes after it.

Earth is all the higher bodies because all the higher lights come together in it. For this reason earth is called Pan by the poets, that is 'the whole,' and it is also given the name Cybele, which is almost like *cubile*, from cube (*cubus*) that is, a solid.[10] The reason for this is that earth, that is to say, Cybele, the mother of all the gods, is the most compact of all bodies, because, although the higher lights are gathered together in it, nevertheless they do not have their source in the earth through its own operations, but the light (*lumen*) of any sphere whatever can be educed from it into act and operation. Thus every one of the gods will be begotten from it as from a kind of mother. The intermediate bodies have a twofold relationship. Towards lower bodies they have the same relation as the first heaven has to all other things, and they are related to the higher bodies as earth is related to all other things. And thus in a certain sense each thing contains all other things.[11]

The form (*species*) and perfection of all bodies is light, but in the higher bodies it is more spiritual and simple, whereas in the lower bodies it is more corporeal and multiplied. Furthermore, all bodies are not of the same form (*species*) even though they all proceed from light, whether simple or multiplied, just as all numbers are not the same in form (*species*) despite the fact that they are all derived from unity by a greater or lesser multiplication.

[10] Cf. Aristotle, *De Caelo et Mundo*, III, 8, 307 a 8-9, where this doctrine of the earth as cube is attributed to Plato in the *Timaeus* (55d-e).
[11] This principle Grosseteste could have found in Pseudo-Dionysius, *De Divinis Nominibus*, IV, 7. Dionysius took it over from Proclus, *Elements of Theology*, prop. 103. Cf. the illuminating history of this formula in Greek philosophy, in Dodds, *Proclus, the Elements of Theology*. (Oxford: Clarendon Press, 1933), p. 254.

This discussion may perhaps clarify the meaning of those who say that 'all things are one by the perfection of one light' and also the meaning of those who say that 'things which are many are many through the multiplication of light itself in different degrees.'[12]

But since lower bodies participate in the form of the higher bodies, the lower body because it participates in the same form as the higher body, receives its motion from the same incorporeal moving power by which the higher body is moved. For this reason the incorporeal power of intelligence or soul, which moves the first and highest sphere with a diurnal motion, moves all the lower heavenly spheres with this same diurnal motion. But in proportion as these spheres are lower they receive this motion in a more weakened state, because in proportion as a sphere is lower the purity and strength of the first corporeal light is lessened in it.

But although the elements participate in the form of the first heaven, nevertheless they are not moved by the mover of the first heaven with a diurnal motion. Although they participate in that first light, they are not subject to the first moving power since that light in them is impure, weak, and far removed from the purity which it has in the first body, and also because they possess the denseness of matter which is the principle of resistance and stubbornness. Nevertheless, there are some who think that the sphere of fire rotates with a diurnal motion, and they take the rotating motion of comets to be an indication of this. They say also that this motion extends even to the waters of the sea, in such a way that the tide of the seas proceeds from it. But all sound philosophers say that the earth is free from this motion.

In this same way, too, the spheres that come after the second sphere, which is usually called the eighth when we compute from the earth upward, all share in the motion of this second sphere because they participate in its form. Indeed this motion is proper to each of them in addition to the diurnal motion.

But because the heavenly spheres are completely actualized and are not receptive of rarefaction or condensation, light (*lux*) in them does not incline the parts of matter either away from the center so as to rarefy them, or toward the center to condense them. On this account the heavenly spheres are not receptive of up or down motion but only of circular motion by an intellectual moving power, which by directing its glance upon them in a corporeal way revolves the spheres themselves in a circular corporeal motion. But because the elements are incompletely actualized and subject to rarefaction and condensation, the light (*lumen*) which

[12] I have not been able to find the source of these quotations. They have, however, a decidedly neo-Platonic savor. Cf. in particular Pseudo-Dionysius, *De Divinis Nominibus*, IV, 4-6.

is in them inclines them away from the center so as to rarefy them, or toward the center so as to condense them. And on this account they are naturally capable of being moved in an upward or downward motion.

The highest body, which is the simplest of all bodies, contains four constituents, namely form, matter, composition and the composite. Now the form being the simplest holds the position of unity. But matter on account of its twofold potency, namely its susceptibility to impressions and its receptiveness of them, and also on account of its denseness which belongs fundamentally to matter but which is primarily and principally characteristic of a thing which is a duality, is rightly allotted the nature of a duality. But composition has a trinity in itself because there appears in it informed matter and materialized form and that which is distinctive of the composition, which is found in every composite as a third constituent distinct from matter and form. And that which is the composite proper, over and above these three constituents, is classed as a quaternary. There is, therefore, in the first body, in which all other bodies exist virtually, a quaternary and therefore the number of the remaining bodies is basically not more than ten. For the unity of the form, the duality of the matter, the trinity of the composition and the quaternity of the composite when they are added make a total of ten. On this account ten is the number of the bodies of the spheres of the world, because the sphere of the elements, although it is divided into four, is nevertheless one by its participation in earthly corruptible nature.

From these considerations it is clear that ten is the perfect number in the universe, because every perfect whole has something in it corresponding to form and unity, and something corresponding to matter and duality, something corresponding to composition and trinity, and something corresponding to the composite and quaternity. Nor is it possible to add a fifth to these four. For this reason every perfect whole is ten.

On this account it is manifest that only five proportions found in these four numbers, one, two, three, four, are suited to composition and to the harmony that gives stability to every composite. For this reason these five proportions are the only ones that produce harmony in musical melodies, in bodily movements, and in rhythmic measures.

This is the end of the treatise on light of the Bishop of Lincoln.