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HENRY MORE AND THE VISION OF A FOURTH DIMENSION

ABSTRACT. The history of the idea of a fourth dimension in physics is very complex and interesting. It was first introduced by Henry More. I found out how the reading of St. Paul suggested it to More. I then show how this idea was neglected by Newton and how it was taken up until its introduction into relativistic dynamics by Henri Poincaré, Hermann Minkowski and Albert Einstein and its influence on literature and art.
KEYWORDS: Henry More. Fourth dimension. Space-time. Relativity. Wave field.

1. Introduction

Henry More (1614-1687)[1] is considered, together with Ralph Cudworth (1617-1688), as one of the greatest exponents of the neo-Platonic school of

[1] Richard Ward, *The life of the learned and pious Dr. Henry More, Late Fellow of Christ's College in Cambridge: To Which Are Annex'd Divers of His Useful and Excellent Letters* (Ann Arbor: University of Michigan Library, 1911, 1923, 2011); Richard Ward, Robert Crocker, *The Life of Henry More - Parts 1 and 2*, in Sarah Hutton, Cecil Courtney, Michelle Courtney, Alfred Rupert Hall (eds.), *International Archives of the History of Ideas / Archives internationales d'histoire des idées* n. 167 (Dordrecht: Kluwer, 2000); Marjorie Hope Nicolson, *Conway Letters, the correspondence of Anna, Viscountess Conway, Henry More and the friends, 1642-1684* (London: Clarendon Press, 1930); Francis Edwards (ed.), *The Elizabethan Jesuits; Historia Missionis Anglicanæ Societatis Jesu (1660) of Henry More* (London: Phillimore 1981); Robert Crocker, *Henry More, 1614-1687: A Biography of the Cambridge Platonist*, *International Archives of the History of Ideas / Archives Internationales d'Histoire des Idées* n. 185 (Dordrecht: Kluwer, 2003).

Cambridge,[2] and mostly studied within the history of philosophy.[3] Its relevance to the history of science has also been emerging for many years, but only to understand the possible metaphysical influences on the work of Isaac Newton (1642-1727).[4]

[2] Aharon Lichtenstein, *Henry More: The Rational Theology of a Cambridge Platonist* (Cambridge, Mass.: Harvard University Press, 1962); Ernst Cassirer, *Die Platonische Renaissance in England und die Schule von Cambridge* (Leipzig: Teubner, 1932); Frederick J. Powicke, *The Cambridge Platonists* (London: Dent, 1926); *Revisioning Cambridge Platonism: Sources and Legacy*, Douglas Hedley and David Leech (eds.), *International Archives of the History of Ideas / Archives internationales d'histoire des idées* n. 222 (New York: Springer, 2019); John Henry Muirhead, *The Platonic Tradition in Anglo-Saxon Philosophy* (London: Allen & Unwin, 1931); Charles Taliaferro, Alison J. Teply & Jaroslav Pelikan (eds.), *Cambridge Platonist Spirituality* (New York: Paulist Press, 2004); John Tulloch, *Rational Theology and Christian Philosophy in England in the Seventeenth Century*, vol. II (Edinburgh e London: Blackwood, 1874); Peter Harrison, *Laws of Nature in Seventeenth Century England: From Cambridge Platonists to Newtonianism*, in Eric Watkins (ed.), *The Divine Order, the Human Order, and the Order of Nature: Historical Perspectives* (Oxford: Oxford University Press, 2013), pp. 127-148; Serge Hutin, *Henry More: Essai sur les doctrines théosophiques chez les Platoniciens de Cambridge* (Zürich: Georg Olms, 1966).

[3] Jasper Reid, "The Metaphysics of Henry More", *International Archives of the History of Ideas / Archives internationales d'histoire des idées* n. 207 (New York: Springer, 2012); Peter R. Anstey (ed.), *The Oxford Handbook of British Philosophy in the Seventeenth Century* (Oxford: Oxford University Press, 2013); Roberto Bondì, *L'onnipresenza di Dio. Saggio su Henry More* (Soveria Mannelli: Rubbettino, 2001); Sarah Hutton (ed.), *Henry More (1614-1687). Tercentenary Studies: with a biography and bibliography by R. Crocker*, *International Archives of the History of Ideas / Archives internationales d'histoire des idées* n. 127 (Dordrecht: Kluwer, 1990); Daniel Clifford Fouke, *The Enthusiastical Concerns of Dr. Henry More: Religious Meaning and the Psychology of Delusion* (Leiden: Brill, 1997); Alexander Jacob, *De Naturae Natura, a study of idealistic conceptions of Nature and the unconscious* (London: Arktos Media Ltd, 2011).

[4] Alfred Rupert Hall, *Henry More and the Scientific Revolution* (Cambridge: Cambridge University Press, 1990, 1996).

Already Edwin Arthur Burtt since 1924, in showing the metaphysical foundations of modern physical science, had studied the cases of Copernicus, Kepler, Galileo, Descartes, and had stressed the importance of Henry More for the understanding of Newton's physics and metaphysics and therefore of all modern physics.[5] The importance of Henry More's theories was also discussed by Markus Fierz[6] and Max Jammer,[7] especially of his ideas on space related to the Jewish *kabbalàh*,[8] still highlighting the influence on Newton, fundamental to understand also the epistolary "fight" between Samuel Clarke, Newton's spokesman, and Wilhelm Gottfried Leibnitz. The question was widely taken up by Alexandre Koyré, who dedicated two long chapters within his *From the Closed World to the Infinite Universe*[9] to Henry More's ideas, but who, also in the pages dedicated to Newton, brought out Newton's debt for the ideas of space and also

[5] Edwin Arthur Burtt, *The Metaphysical foundations of Modern Science* (New York: Doubleday, 1924, 1932; Dover, 2003), pp. 135-150.

[6] Markus Fierz, "Über den Ursprung und Bedeutung der Lehre Newtons vom absolutem Raum", *Gesnerus*, 1954, vol. 11, n. 3-4: 62-120.

[7] Max Jammer, *Concepts of Space. The History of Theories of Space in Physics* (Cambridge, Mass.: Harvard University Press, 1954), pp. 44-51 and 98-100.

[8] Arthur Edward Waite, *Henry More And The Kabalah* (Whitefish: Kessinger Publishing 2006).

[9] Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: The John Hopkins Press, 1957), pp. 110-124, pp. 125-154.

gravitation towards More;[10] he then discussed it to understand above all the relationship between Newton and Descartes.[11] In the same year in which Maurizio Mamiani[12] published his interpretation of More's theories on space, above all in correspondence with René Descartes,[13] Richard Westfall tried to summarize in his biography of Newton[14] the debts towards More. The point on the studies was made by an accurate bibliographic research.[15]

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[10] Koyré, *From the Closed World to the Infinite Universe*, pp. 155-272. The question of gravitation, also in relation to Leibniz, is studied in: Max Jammer, *Concepts of Force. A study in the foundations of dynamics* (Cambridge, Mass.: Harvard University Press, 1954; New York: Dover, 2011), pp. 162-171.

[11] Alexandre Koyré, *Newtonian Studies* (Cambridge, Mass.: Harvard University Press, 1965), pp. 53-114.

[12] Maurizio Mamiani, *Henry More: la discussione sullo spazio nella corrispondenza con Descartes*, in *Teorie dello spazio da Descartes a Newton* (Milano: Franco Angeli, 1981), pp. 59-89.

[13] René Descartes, *Correspondance. Mai 1647 – Février 1650,* in *Œuvres de Descartes* I-XII, ed. by Charles Adam & Paul Tannery (Paris: Adam, 1897-1913; reprinted by Paris: Vrin, 1964-1974), vol. V; *Correspondance de Descartes avec Arnauld et Morus: texte latin et traduction*, G. Rodis-Lewis (ed.) (Paris: Vrin,1953); René Descartes - Henry More, *La Correspondencia Descartes - Henry More*, J. L. González Recio (ed.) (Madrid: Ediciones Antígona, 2011).

[14] Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1981).

[15] Sarah Hutton (ed.), *Henry More (1614-1687). Tercentenary Studies: with a biography and bibliography by R. Crocker*, in *International Archives of the History of Ideas / Archives internationales d'histoire des idées*.

An overall monograph, dedicated to More and modern science, was published by Rupert Hall in 1990:[16] paradoxically, however, this work fails to focus on the relevance of More's work in the history of science. A series of research was then done on various particular aspects.

Indeed, Henry More's importance is much greater than one can think: his conception has structural reflections that have been preserved in Newton's work.

Henry More, indeed, is the author of a series of poems (indeed he began to write as a poet), which are also very complex: they are "philosophical poems" or indeed "scientific poems"[17] in the sense of modern science.[18] A new union of poetry, philosophy, science and religion (theology)[19] is found in his work and it

[16] Alfred Rupert Hall, *Henry More: Magic, Religion and Experiment* (Cambridge: Cambridge University Press, 1990); reprinted new edition as *Henry More and the Scientific Revolution* (Cambridge: Cambridge University Press, 1996, 2002).

[17] Henry More, "Psychathanasia or the second part of the Song of the Soul, Treating of the Immortality of Souls, especially Mans Soul", *A Platonic Song of the Soul* consisting of foure severall poems (Cambridge: Daniel, 1642, second edition 1647); reprinted in *The Complete Poems of Dr. Henry More*, ed. by Alexander Balloch Grosart (Edinburgh: Chertsey Worthies' Library, Edinburgh University Press, 1878, and then Zürich: Olms, 1969; Whitefish (MT): Kessinger, 2010). See also: Henry More, *Philosophical Poems* (Saarbrücken: Scholar Press, 1970); Alexander Jacob, *Henry More. A Platonick Song of the Soul* (Lewisburg (PA): Bucknell University Press, 1998); Lee Haring, *Henry More's Psychathanasia and Democritus Platonissans: A Critical Edition* (New York: Columbia University, Ph.d. dissertation, 1961).

[18] Audrey Taschini & Enrico Giannetto, *Psychathanasia: il poema cosmico di Henry More,* in *Non più la Luna è cielo a noi, che noi alla Luna,* ed. by Enrico Giannetto (Catania: Cuecm, 2019), pp. 57-70.

[19] Henry More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2* (Londini: J. Maycock for W. Kettilby, 1675; J. Maycock for J. Martyn & W. Kettilby, 1679; Norton for J.

is this aspect that will be discussed, because the platonization of physics in More indeed passed paradoxically also from his poems. In this way, More overcame Plato's negative judgment on poetry and opened the horizon of science to a new form of vision.

More embraces Descartes' thesis, that the Copernican revolution shows that the senses cannot be a reliable source of knowledge.[20] The soul can then get to the

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Martyn & W. Kettilby, 1679; reprinted Zürich: Olms, 1966); Flora Isabel Mackinnon (ed.), *Philosophical Writings Of Henry More* (New York: Oxford University Press, 1925; Whitefish: Kessinger Publishing, 2007); Alexander Jacob, *Henry More's Manual of Metaphysics. A Translation of the Enchiridion metaphysicum (1679) with an Introduction and Notes*, I-II (Zürich: Olms, 1995); Henry More (1668, 1679), *Dialogi Divini*, in Henry More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*, vol. II.1, pp. 637-772; Henry More, *Enchiridion metaphysicum sive de rebus incorporeis succincta et luculenta dissertatio* (Londini: Flesher, 1671; Cambridge: Morden, 1671); Henry More (1674), *Magni Mysterii Pietatis Explanatio sive Vera ac fidelis Representatio Æterni Evangelii Domini ac Servatoris nostri Jesu Christi, Dei Filii, Unigeniti, Hominumque Principis ac Angelorum*, in Henry More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*, Vol. I; Enrico R. A. Giannetto, *Un fisico delle origini. Heidegger, la Natura e la scienza* (Roma: Donzelli, 2010), pp. 217-237; Paul Russell Anderson, *Science in Defense of Liberal Religion: A Study of Henry More's Attempt to Link 17th Century Religion with Science* (New York and London: G. P. Putnam's Sons 1933); Peter Harrison (ed.), *The Cambridge Companion to Science and Religion (Cambridge Companions to Religion)* (Cambridge: Cambridge University Press, 2010); Amos Funkenstein, *Theology and the Scientific Imagination - from the middle ages to the seventeenth century* (Princeton: Princeton University Press, 1986); John Hoyles, *The Waning of the Renaissance 1640-1740: Studies in the Thought and Poetry of Henry of Henry More, John Norris and Isaac Watts*, *International Archives of the History of Ideas / Archives internationales d'histoire des idées* n. 39 (The Hague: Nijhoff, 1971); David H. Levy, *The Sky in Early Modern English Literature: A Study of Allusions to Celestial Events in Elizabethan and Jacobean Writing* (New York: Springer, 2011); William B. Hunter, *The English Spenserians: The Poetry of Giles Fletcher, George Wither, Michael Drayton, Phineas Fletcher, and Henry More* (Salt Lake City: University of Utah Press, 1976).

[20] René Descartes (1633; 1664, 1677), *Le Monde,* in *Œuvres de Descartes* I-XII, ed. by Charles Adam & Paul Tannery (Paris: Adam, 1897-1913; reprinted by Paris: Vrin, 1964-1974), vol. XI.

Copernican system, relying only on its own forms that reside in her. Sensible vision was no long considered as a source of knowledge in More's Platonism: it was replaced with an intellectual, spiritual vision. This spiritual vision lead More to conceive a fourth dimension. This idea will lead, many years later, to a revolution of geometry and physics, to relativistic chrono-geometry of space-time.

2. More's vision of a fourth dimension

Isaac Newton refused to accept the philosophical basis for modern science provided by Descartes:[21] mechanism was based on empty hypotheses of speculative philosophy and had to be abandoned. In 1687, he published the first edition of *Philosophiæ Naturalis Principia Mathematica,* which contrasted with Descartes' own *Principia Philosophiæ*:[22] the principles of natural philosophy had to be strictly mathematical (as Spinoza had already understood – and may have served him as reference in his viewpoint – it was necessary to have an axiomatic

[21] Enrico Giannetto, *Galileo, Descartes and Newton's Laws*, in *Galilæana,* 2020, v. 17: 167-192.

[22] René Descartes (1644), *Principia Philosophiæ*, in *Œuvres de Descartes* I-XII, vol. VIII, second part, § 39, pp. 63-65; René Descartes (1647), *Principes de la Philosophie*, in *Œuvres de Descartes* I-XII, vol. IX, second part, § 39, pp. 85-86.

organisation and demonstrations)[23] and they should not be linked to a theory of a conscious human subject but, in some way, to God.[24] Although Newton had elaborated his own theology, his theology and physics can only be understood via the theology and physics of Henry More, on which his remained dependent.[25]

More was opposed to Cartesian dualism,[26] deconstructing the Cartesian

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[23] Baruch Spinoza, *Renati Des Cartes Principiorum Philosophiæ* Pars I & II, *More Geometrico demonstratæ per Benedictum de Spinoza Amstelodamensem. Accesserunt Ejusdem Cogitata metaphysica, In quibus difficiliores, quæ tam in parte Metaphysices generali, quam speciali occurrunt, quæstiones breviter explicantur* (Amstelodami: Apud Johannem Riesuwertsz, 1663); Enrico R. A. Giannetto, *La fisica di Spinoza fra Descartes e Newton, e la sua influenza su Einstein*, in *Da Archimede a Majorana: la fisica nel suo divenire*, ed. by Enrico R. A. Giannetto & Giulia Giannini & M. Toscano (Bologna: Guaraldi, 2009), pp. 75-85.

[24] See for example: E. A. Burtt, *The Metaphysical foundations of Modern Science*, pp. 207-302; James E. McGuire & Piyo M. Rattansi, "Newton and the 'Pipes of Pan'", *Notes and Records of the Royal Society of London*, vol. 21 n. 2 (Dic., 1966): 108-143; Daniel P. Walker, *The Ancient Theology* (New York: Cornell University Press, 1972).

[25] Hall, *Henry More. Magic, Religion and Experiment*, pp. 202-241; McGuire & Rattansi, "Newton and the 'Pipes of Pan'"; Daniel P. Walker, *The Concept of Spirit or Soul in Henry More and Ralph Cudworth*; It. tr. ed. by S. Ricci, *Il concetto di spirito o anima in Henry More e Ralph Cudworth* (Napoli: Bibliopolis, 1986).

[26] Lynda Gaudemard *Rethinking Descartes's Substance Dualism,* Studies in History and Philosophy of Science 29 (New York: Springer Nature, 2021); Jasper Reid, *Henry More, Supporter and Opponent of Cartesianism*, in Steven Nadler, Tad M. Schmaltz, and Delphine Antoine-Mahut (eds.), *The Oxford Handbook of Descartes and Cartesianism* (Oxford: Oxford University Press, 2019), pp. 629-642; Jasper Reid, *Henry More on Material and Spiritual Extension*, *Dialogue* 2003, v. 42 n. 3: 531-558; Calvin Normore, *Descartes and the Metaphysics of Extension*, in Janet Broughton and John Carriero (eds.), *The Blackwell's Companion to Descartes* (London: Blackwell, 2007), pp. 271-287; Mariafranca Spallanzani, *La "virtus divina", il vuoto e gli atomi. Su alcune obiezioni di Henry More a Descartes*, in Antonio Santucci (ed.), *Filosofia e cultura nel Settecento britannico, I-II, I. Fonti e connessioni continentali*, *John Toland e il deismo. II. Hume e Hutcheson, Reid e la scuola del senso comune* (Bologna: Il Mulino, 2000), I, pp. 3-42; *Descartes and More, Les études philosophiques* v. 108 n. 1 (2014); Jean-Pascal Anfray, *Partes extra partes. Étendue et impénétrabilité dans la correspondance entre Descartes et More*, in *Les Études Philosophiques*, 2014/1 n. 108: 37-59;

identity between matter and extension: if these are not identical, then the extension may also refer to the spirit, thereby breaking the Cartesian distinction/separation between *res extensa* and *res cogitans*.[27] As well known, Descartes' project of a

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Jean-Pascal Anfray, *L'étendue spatiale et temporelle des Esprits: Descartes et le holenmérisme, Revue Philosophique de la France et de l'Étranger,* 2014**,** v. 139 n. 1:23-46; David Leech, *The Hammer of the Cartesians: Henry More's Philosophy of Spirit and the Origins of Modern Atheism* (Leuwen: Peeters, 2013); *Locus-Spatium XIV Colloquio Internazionale (Roma, 3-5 gennaio 2013)*, Delfina Giovannozzi e Marco Veneziani (eds.), *Lessico intellettuale europeo*, vol. 122 (Firenze: Olschki, 2014); *Space, Imagination and the Cosmos from Antiquity to the Early Modern Period*, Frederik A. Bakker, Delphine Bellis, Carla Rita Palmerino (eds.), *Studies in History and Philosophy of Science* 48 (New York: Springer Nature, 2019); Luisa Simonutti *Platonismo e ateismi. "Spiritus naturae" e antispinozismo: More e Limborch*, in Luisa Simonutti (ed.), *Forme del neoplatonismo. Dall'eredità ficiniana ai platonici di Cambridge* (Firenze: Olschki, 2007), pp. 297-331; Luisa Simonutti *Reason and toleration: Henry More and Philip van Limborch***,** in Sarah Hutton (ed), *Henry More (1614-1687). Tercentenary Studies: with a biography and bibliography by R. Crocker*, *International Archives of the History of Ideas / Archives Internationales d'Histoire des Idées* n. 127 (Dordrecht: Kluwer, 1990), pp. 201-218; Luisa Simonutti, *Liberté et vérité. Politique et morale dans la correspondance hollandaise de More et de Cudworth,* in *The Cambridge Platonists in Philosophical Context,* Graham A. J. Rogers, Jean-Michel Vienne, Yves Charles Zarka (eds.), *International Archives of the History of Ideas / Archives Internationales d'Histoire des Idées* n. 150 (Dordrecht: Kluwer Academic Publishers, 1997), pp. 17-37; Robert Pasnau, *Mind and Extension (Descartes, Hobbes, More)*, in Henrik Lagerlund (ed.), *Forming the Mind. Studies in the History of Philosophy of Mind*, vol. 5 (Dordrecht: Springer, 2007), pp. 283-310; Geneviève Rodis-Lewis, *L'Œuvre de Descartes* (Paris: Vrin, 1971 deux volumes; 2013 un volume); G. Rodis-Lewis, *Idées et vérités éternelles chez Descartes et ses successeurs* (Paris: Vrin, 1985); J. Laporte, *Le rationalisme de Descartes* (Paris: Puf, 1945, 1950); *Studi sul Seicento e sull'immaginazione*, a cura di Paolo Cristofolini, Collezione "Studi di Lettere, Storia e Filosofia della Scuola Normale Superiore di Pisa", n° 36 (Pisa: Edizioni Scuola Normale Superiore, 1985); Arrigo Pacchi, *Cartesio in Inghilterra. Da More a Boyle* (Bari: Laterza, 1973); *Eredità cartesiane nella cultura britannica,* Quaderni del Giornale Critico della Filosofia Italiana, 24, a cura di Paola Dessì e Brunello Lotti (Firenze: Le Lettere, 2011); *Disguised and Overt Spinozism around 1700.* Papers presented at the International Colloquium held at Rotterdam, 5-8 October 1994, Wiep von Bunge (ed.) **(**Leiden: Brill, 1996).

[27] Mamiani, *Teorie dello spazio da Descartes a Newton*, pp. 60-89; Jammer, *Concepts of Space. The History of Theories of Space in Physics*, pp. 43-51; Koyré, *From the Closed World to the Infinite Universe*, pp. 125-154; Henry More, *The Immortality of the soul, so farre forth as it is demonstrable from the knowledge of Nature and the light of reason* (London: Flesher, 1659, and then in *Collection of severall philosophical writings of Henry More*, London: Flesher,

mathesis universalis had led him to the presumed subjectivist absolute certainty of *res cogitans* (*cogito ergo sum*) and to the only indirect inference (by means of the idea of God) of existence of the so-called external world and to the trial to reduce physics to geometry by postulating the identity of Nature with matter and of matter with *res extensa*. This reductionist view of Nature was justified by Descartes only by the fact that it does work to explain phenomena and by the consideration that God cannot deceive us: despite Copernican revolution, mankind could thus regain its superiority over Nature. Conceiving Nature as pure matter like a machine (also animals were considered automata), Descartes developed a mechanist conception of Nature allowing for the use of mechanical experiments to actually simulate natural phenomena.

More believed that mechanical philosophy with its principles could not explain even a simple phenomenon as the fall of a thrown upwards stone on the ground: Nature, following Plato, must indeed be conceived as a living and

1662), b. I, c. II, § 11, pp. 19-20; More, *Enchiridion metaphysicum sive de rebus incorporeis succincta et luculenta dissertatio*, I, 28 § 7; Jacob, *Henry More's Manual of Metaphysics. A Translation of the Enchiridion metaphysicum (1679) with an Introduction and Notes*; More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2,* vol. II, tomus I, p. 133; Tonino Griffero, "Sensorium Dei. Variazioni sul tema della spazialità divina (Schelling, Oetinger, Newton, Leibniz/Clarke, More/Descartes)", *Rivista di estetica*, nuova serie, n. 10, anno IXL (Torino: Rosenberg & Sellier, 1999), pp. 69-107, in particular pp. 95-107; Antoine Faivre, *Philosophie de la Nature - Physique sacrée et théosophie XVIII^e^-XIX^e^ siècle* (Paris: Albin Michel, 1996).

animated being, whereas this identification of matter and extension did not leave any place to any spirit and to God.

The non-identity of matter and extension implies the existence of a vacuum, empty space, and some kind of atomism.

According to More, matter is associated with divisibility (discerpibility as actual divisibility, that is actual possibility to be torn apart), impenetrability and three-dimensionality. However, there may be an "extended" substance, like the spirit, which is not only undividable into parts (indiscerpibility), but also has the characteristic of penetrability: this extended being, therefore, is something different from the extended being of matter, it has another sense (the terms *amplitudo*, *extensio* and *spissitudo* have a different meaning if linked to the spirit).[28] Spirit must be conceived in terms of indivisibility, indiscerpibility, self-penetrability, self-mobility and as able to penetrate, to move and to act on matter. Furthermore, whereas matter is unable to expand or to contract by itself, spirit is self-expanding or self-contracting.

[28] Mamiani, *Teorie dello spazio da Descartes a Newton*, p. 86, where it is noted that there is a different use of *amplitudo* and *extensio* in Descartes, who speaks also about divine *amplitudo*.

God Himself extends and expands in His powerfulness and His is not an inert space,[29] separate from His power (as we shall see, instead, in Newton). More accused Cartesian mechanism of insufficiency, of not being able to describe phenomena like gravity: this is a fundamental point, which will be pursued by Newton (who, consequently, is not original on this point), but, while More had to admit the existence of a Spirit of Nature as World Soul, to whom the force of gravity was due,[30] for Newton this was due, as we shall see, only to God or his representative, Christ.

More, indeed, derived the need of a gravity force as a non-material active principle (*The Spirit of Nature*) by the law of the conservation of uniform rectilinear motion as considered in Descartes' *Principia Philosophiæ,* because matter in vacuum cannot have any parabolic or curvilinear motion; no mention is made of a conservation of rest as in Descartes.[31]

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[29] Mamiani, *Teorie dello spazio da Descartes a Newton*, p. 62.

[30] Koyré, *From the Closed World to the Infinite Universe*, pp. 132-134.

[31] More, *The Immortality of Soul so farre forth as it is demonstrable from the Knowledge of Nature and the Light of Reason*, book III, chap. XIII, 6, pp. 198-199; Henry More, *Immortalitas Animæ quatenus ex Cognitione Naturæ Rationisque Lumine est demonstrabilis,* in Henry More, *Opera Omnia. II. Opera Philosophica*, tomus II, book III, chap. XIII, 6, p. 434; Alexander Jacob, *Henry More. The Immortality of the Soul*, edited with an Introduction and Notes, in *International Archives of the History of Ideas / Archives Internationales d'Histoire des Idée*s n. 122 (Dordrecht: Nijoff, 1987), book III, chap. XIII, 6.

For More, then, Nature could not be reduced to pure inert and passive matter; it was also Spirit. Nature is animate and alive, and the empty space in matter is filled with the Spirit of Nature, which animates and brings it to life, much more deeply than the air for individual animals.[32] Whilst air could be extracted with a pneumatic pump, the Spirit of Nature was a reality that no instrument or mechanical operation could eliminate.

The capacity of the spirit to penetrate matter, actively and passively, to penetrate via the matter, was geometrically comprehensible for More with the introduction of a fourth dimension.[33] Fourth dimension is related to spirit's properties of self-contractility and self-dilatability: when these events occur, its "essential magnitude", "essential intensity" respectively grows or decreases. Just as when a piece of matter is compressed in one dimension, it expands in another, the "compression" that the spirit experiences as it penetrates the matter within a three-dimensional space corresponds to an "extension" into another, a fourth dimension, which constitutes its *spissitudo essentialis*:

[32] Jammer, *Concepts of Space. The History of Theories of Space in Physics*, pp. 48-49.

[33] More, *The immortality of the soul, so farre forth as it is demonstrable from the knowledge of Nature and the light of reason*, b. I, c. II, § 11, pp. 19-20; More, *Immortalitas Animæ quatenus ex Cognitione Naturæ Rationisque Lumine est demonstrabilis,* in More, *Opera Omnia. II. Opera Philosophica*, vol. II, liber I, chap. II, § 11, p. 294.

> So the *Immediate Properties* of a *Spirit* or *Immaterial Substance* are *Penetrability* and *Indiscerpibility*...For there is no necessary connextion discernible betwixt *Substance* with *three dimensions*, and *Impenetrability*...And as what was lost in *Longitude* was gotten in *Latitude* or *Profundity* before, so what is lost here in all or any two of the dimensions, is keep safe in *Essential Spissitude*: For so I will call this *Mode* or *Property of a Substance*, that is able to receive one part of it self into another. Which *fourth Mode* is as easy and familiar to my Understanding, as that of *Three Dimensions* to my Sense or Phansy. For I mean nothing else by *Spissitude*, but the redoubling or contracting of Substance into less space then it does sometimes occupy. And Analogous to this is the lying of two substances of several kinds in the same place at once.[34]

As long as *spissitudo essentialis* has to be related to spirit's self-contracting and self-expanding "motion", its extension has to do with time.

In this book (1659), More introduced the locution fourth mode, but in 1671 *Enchiridion metaphysicum* he spoke explicitly of a "fourth dimension":

> 7. Quod præter trinas illas Dimensiones quæ omnibus rebus extensis competunt, quarta etiam admittenda est, quæ proprie competit Spiritibus. ...*quarta hæc dimensio* quam appello *Spissitudinem essentialem*.[35]

More spoke about fourth dimension also in a letter to John Norris:

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[34] More, *The Immortality of the Soul,* b. I, chap. II, § 11, pp. 19-20.

[35] More, *Enchiridion metaphysicum sive de rebus incorporeis succincta et luculenta dissertatio*, in More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*, vol. II.1, tomus I, chap. 28 § 7, p. 320 and *Scholia*, p. 326, where he wrote about *spissitudo essentialis* or *quarta dimensio*. See also: More, *The true Nature of a Spirit*, sect. XXII, in Joseph Glanvil, *Saducismus Triumphatus: or, Full and Complete Evidence Concerning Witches and Apparitions* (London: Newton, 1682, 2nd Ed.).

> ..., but what seems to be lost in Longitude, Latitude, and profundity, is gained or compensated in *Essential Spissitude,* which is that *fourth dimension* I stand for, that it is in *Rerum Natura.*[36]

To use contemporary relativistic terms, there is an invariant fourth-dimensional extension. In this way, More criticised Descartes and the nullibists, who had left no place for the spirit, the souls, the angels or God in their system, by their identifying of extension and space with matter.[37]

Where had More picked up the idea of the fourth dimension? It is clear that the idea of extension related to spirit came to More in analogy to immaterial light, who extends itself temporally in space, its intensity decreasing with expansion: light can penetrate matter, light can be absorbed or emitted by matter. Koyré rightly speaks also of gravity, magnetism, ether, and of contemporary fields as examples of spiritual-immaterial entities in physics.[38] In some way, More's physics, constituting the ground for Newton's dynamics, represents a physical turn which solves also the philosophical dualism of matter and spirit in a unitary vision of mankind within Nature.

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[36] More, *Letter to Norris 19 January 1684/5*, in John Norris, *The Theory and Regulation of Love. A Moral Essay. In Two Parts. To which are added Letters Philosophical and Moral between the Author and Dr. Henry More* (Oxford: Clements, 1688), p. 158.

[37] Koyré, *From the Closed World to the Infinite Universe*, pp. 136-138.

[38] Koyré, *From the Closed World to the Infinite Universe*, pp. 130-132.

More, explaining an indivisible spiritual extension, wrote about a "sphere or orbe of light" ("sphæra sive orbis lucis").[39] Isaac Newton accepted the idea of space as an attribute of God as an absolute space different from material bodies' relative space, but did not introduce a fourth dimension because he had a corpuscular conception of light.

From a historical perspective, Amos Funkenstein noted that Oresme may have been More's reference, although he later denied this possibility:[40] in effect, though, Oresme does say that, if we want to represent the distribution of a quality on a three-dimensional body, we do not have a fourth spatial dimension at hand, but we can speak of a dual corporeality: the true one, linked to the subject's extension through each dimension, the other, imaginary, starting from the intension of the qualities according to the multiplicity of the subject's surfaces; that is, the fourth dimension is not linked to an extensive material quantity, but, intensive and which More will call true-"extensive-spiritual".[41] Besides More,

[39] More, *An Antidote against Atheisme. Or an Appeal to the Natural Faculties of the Minde of Man, whether there be not a God* (London: Flesher for Morden, 1653), 2nd edit. corrected and enlarged, with an Appendix, 1655, Appendix, chap. 10, § 9, p. 173, then More, "Antidotum adversus Atheismus"*, Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*, vol. II.2, chap. 10, § 9, p. 169.

[40] Funkenstein, *Theology and the Scientific Imagination - from the middle ages to the seventeenth century*, pp. 27-29 and 92-95, and, for Oresme, pp. 370-371.

[41] Nicole Oresme, *Tractatus de configurationibus qualitatum et motuum*, in *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, ed. by Marshall Clagett (Madison (Wis.):

Tonino Griffero also discusses Oetinger, who took up the idea and linked it to his theology of space as divine light, to the *Kabbalàh*: it is the fourth *sephiràh*, the one that is usually called *Chesed* or Divine Love or Grace, but also *Gedulàh*, or the Divine Extension or Quantity.[42] Max Jammer also reveals the clear influence of the *Kabbalàh* on More and Spinoza and shows how the idea of the various divine attributes, of which thought and extension are an example, is also derived from the kabbalah. Against all the objections that have been made to Jammer, on this point, even by Koyré, it would suffice to see the consistency, the great fraction of More's kabbalistic writings in the complex of his works.[43] It is my opinion, though, that the main reference is St Paul, *Eph.* 3.18, and I have found confirmation of that in a passage where More interprets this verse, identifying one of the four dimensions as *Spiritualis Latitudo*: "...*Spiritualis Latitudo, Longitudo, Profunditas & Sublimitas*, qua de loquitur Apostolus".[44]

University of Wisconsin Press, 1968), Part 1, chap. 4, pp. 172-177, where Paul's idea of a glorified body is explicitly discussed.

[42] *I Chronicles* 29.11; Griffero, *Sensorium Dei. Variazioni sul tema della spazialità divina (Schelling, Oetinger, Newton, Leibniz/Clarke, More/Descartes)*; Tonino Griffero, *Oetinger e Schelling. Teosofia e realismo biblico alle origini dell'idealismo tedesco* (Segrate: Nike, 2000); Tonino Griffero, *Il corpo spirituale. Ontologie "sottili" da Paolo di Tarso a Friedrich Christof Oetinger* (Milano: Mimesis, 2007), pp. 289-292.

[43] More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*.

[44] Henry More (1674), *Magni Mysterii Pietatis Explanatio sive Vera ac fidelis Representatio Æterni Evangelii Domini ac Servatoris nostri Jesu Christi, Dei Filii, Unigeniti, Hominumque*

Even the St Paul reference could be called a "kabbalistic" reference, but in the sense of the original Essene-Nazarene-Christian gnosis into which Paul had been initiated and from which the *Kabbalàh* of the middle ages and later has certainly drawn.[45] Paul considered the new world to be a divine pleroma, a cosmic body of Christ. Inexplicably for modern translations, St Paul connects the Divine Love (and, consequently, the *Chesed-Gedulàh*) of Christ not with three dimensions, but four! Breadth (Aramaic-Syriac *phtà*, Greek *platos*), length (Aramaic-Syriac *aurqà*, Greek *mekos*), height (Aramaic-Syriac *rumà*, Greek *hupsos*), depth (Aramaic-Syriac *uqmà*, Greek *bathos*)! Paul refers to a passage from the Book of Job 11.7-9 (other connected passages are: *Job* 28.12-14 and 21-22; *Sirach-Ecclesiastics* 1.3; *Rom.* 8.35-39; *Rom.* 11.33-34; *Col.* 2.2-3). Francis Watson[46] speaks of four dimensions and, continuously, of the Pauline space-time, but indicates the fourth dimension as time for the term usually translated as length,

Principis ac Angelorum, in More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2*, vol. I, Liber VIII, chap. XI, p. 343: More here speaks about "*Spiritualis Latitudo, Longitudo, Profunditas, Sublimitas*".

[45] Enrico Giannetto, *Il Vangelo di Giuda – traduzione dal copto e commento* (Milano: Medusa, 2006).

[46] Francis Watson, *Writing the Mystery: Christ and Reality in the Letter to the Ephesians*, A paper presented to the Later Pauline Epistles Section, Society of Biblical Literature, Denver 2001, http//www.abdn.ac.uk/divinity/documents, with title "Christ and Reality in Ephesians.doc".

mekos in Greek. *Mekos* certainly has both spatial and temporal connotations, but this simply reflects the fact that, even at the level of our daily vocabulary, it includes the vital knowledge that crossing a space implies time. Yet, the additional divine extension to the usual three dimensions, just like time, is to be connected to either depth, *bathos* in Greek, as can be deduced from the Aramaic-Syriac text of the letter[47] and from clues in More himself (one of his characters is called *Bathynous*, man of deep thinking)[48] or breadth, which corresponds to *Latitudo*, that is, *platos* or *phtà*, as seems most probable from More's interpretation of *Eph.* 3.18, mentioned above: it is the depth or the breadth which most properly indicates the spiritual attribute. St Augustine had already introduced an extension that was not linked to matter, a *distensio animi,* and this indicated time:[49] even St Augustine may have influenced More. More wrote to Descartes also about time

[47] *Der Paulustext des Hl. Ephräm*, ed. by Joseph Molitor (Rom: Päpstliches Bibelinstitut, 1938), p. 88.

[48] More (1668, 1679), *Dialogi Divini*, in More, *Opera Omnia. I. Opera Theologica. II. Opera Philosophica 1-2* vol. II.1, pp. 637-772.

[49]Aurelius Augustinus, *Confessionum Libri Tredecim,* in Jacques Paul Migne, *Patrologia cursus completus, Series Latina*, 222 voll. (Paris: Garnier, 1844-1864, and Turnholt: Brepols, 1972), vol. 32, XI, 26, 33. See also Aurelius Augustinus, *De quantitate animæ*, in Migne, *Patrologia cursus completus, Series Latina*, 222 voll., vol. 32, pp. 1033-1080.

as a form of extension related to spirit.[50] The other thing worth noting is that More, in giving an example of non-material extension, is effectively referring to light. In short, More was already connecting the fourth dimension to light, to its temporal expansion (Koyré also connected it to the idea of a field),[51] and, therefore, to time as well as spirit: light-like spirit, as a dynamical entity, requires the fourth dimension of time.

Our first conclusion, therefore, is that, before the *n*-dimensional geometry came to be considered from a technical point of view, the motivation for the fourth dimension was theologically explicit in More; this was based directly on the *Kabbalàh* and Essene-Christian Gnosticism and could be found textually in the New Testament, in St Paul, *Eph.* 3.18, where we understand the *Gedulàh-Chesed* to be the fourth *sephiràh*: the Divine Love of Christ extends and embraces the whole of the cosmos, so that St Paul can assume the stoic point of view expressed in *Acts* 17.28 ("For in him we live and move and have our being", a passage that was subsequently cited by Newton in the *General Scholium* at the end of the

[50] More, *Letter to Descartes 5 March 1649*, in *Letters to Des-Cartes, Collection of severall philosophical writings of Henry More,* and then in More, *Opera Omnia,* vol. II, tomus 2, pp. 242-250.

[51] Koyré, *From the Closed World to the Infinite Universe*, pp. 132-134; Fierz, *Über den Ursprung und Bedeutung der Lehre Newtons vom absolutem Raum*, pp. 91 and ff.

Principia;[52] being-in-Christ, for both St Paul and More, meant being-in-the four-dimensional-world- which included all the ecstasy of time; cf. *Rom*. 11.36).

3. From More to Newton's absolute space and to relativistic space-time

An early comment on More's thinking and writings, as a non-Euclidean monstrosity, can be found in the *Treatise of Algebra* (1685) by John Wallis: the fourth dimension is called "a Monster in Nature, and less possible than a Chimera or Centaurus".[53] Another commentator of More's fourth dimension was John Keill, who considered More only a poet.[54]

Yet what makes this origin in More so incredible, complicating our history no end, is the fact that Newton clearly derived from More the idea of an absolute space,[55] in which the universe was contained. The historical complexity lies in the fact that the then fundamental idea for relativity, that of the fourth dimension,

[52] Newton, *Scholium Generale*, in *Philosophiæ Naturalis Principia Mathematica*, editio tertia, (London: Innys, 1726), pp. 526-530; Engl. tr. ed. by Alexandre Koyré & Ierome Bernard Cohen (Cambridge, Mass.: Harvard University Press, 1972).

[53] John Wallis, *Treatise on algebra* (London: Playford 1685), p. 125; Benoit B. Mandelbrot, *The Fractal Geometry of Nature* (New York: Freeman, 1977, 1983), p. 9.

[54] John Keill, *Examination of Dr. Burnet's Theory of the Earth* (Oxford: Clements,1698).

[55] Jasper Reid, *The evolution of Henry More's theory of divine absolute space*, *Journal of the History of Philosophy,* 2007, v. 45 n. 1: 79-102.

in fact, was neglected by Newton's conception of space as an attribute of God and its neglect gave rise to Newton's absolutism. Newton reduced this divine and spiritual extension of More's, which could be self-contracted or self-dilated, having been conceived topologically without any definite size, as a dynamic expansion of God (infinite space is related to infinite self-dilating of God and spirit's or God's power is invariant considering the fourth dimension; or His contraction, to make place for the world, as in the kabbalistic *zimzum* without any contradiction with the infinite divine omnipresence)[56], to a motionless and *inert* space, from which the Newtonian divine forces were separated in a dialectic opposition[57]. If God, as a power-force, was considered in a "poetic" relationship to space (in as much as it was identified with God and His Power), as in More for whom space omnipresence is implied by power presence ("Unde necesse est Deum esse ubique, si potentia eius ubique sit"),[58] then maybe gravity would have

[56] Griffero, *Oetinger e Schelling. Teosofia e realismo biblico alle origini dell'idealismo tedesco* (Segrate: Nike, 2000), p. 123.

[57] Jammer, *Concepts of Force. A study in the foundations of dynamics* (Cambridge, Mass.: Harvard University Press, 1954; New York: Dover, 2011), chapp. 8 & 12.

[58] René Descartes, *Morus a Descartes, 23 Juillet 1649. DLXIV*, in *Correspondance. Mai 1647 – Février 1650,* in *Œuvres de Descartes* I-XII, ed. by Charles Adam & Paul Tannery (Paris: Adam, 1897-1913; reprinted, Paris: Vrin, 1964-1974), vol. V, pp. 376-390, in particular p. 379. Serge Hutin, *Henry More. Essai sur les doctrines théosophiques chez les Platoniciens de Cambridge* (Hildesheim: Olms, 1966), p. 120.

been thought of like in general relativity. Anyway, according to More, gravity was not due to God but to the Spirit of Nature which was united with, and inner to (penetrating) the material body of Nature through fourth dimension. More's perspective gave autonomy to Nature in respect to God, and autonomy to science in respect to theology. More's Christian-Platonic view was unacceptable for Newton. Newton had attributed the order of cosmos directly to God. Newton eliminated the Spirit of Nature and attributed gravity to God. Space was *no more* a *sensorium* of the Spirit of Nature, but was only *sensorium Dei*. Not only that, but, following More, space would not have been considered differently from eternal time in which all events take place, which can contract or dilate without problems for matter, and it would not have been possible to consider it, as in Newton, as an inert absolute reference for absolute motion. The contracting or expanding immaterial space of God cannot constitute an absolute reference (frame) at rest. Certainly, More criticised Descartes' physical relativism; he considered the reality of motion as unavoidable, seeing it as a change in the body's own place and not as a change in position compared to neighbouring bodies (this Cartesian definition would exclude rotation as motion, because the positions of internal bodies are maintained with respect to their neighbours and, more generally, would exclude the collective motions of internal bodies of a system,

because of the relative stillness between them). Koyré is too critical of More, judging him to be a bad physicist based on Newton's subsequent physics and not grasping the difference between *real* motion and *absolute* motion with respect to Newtonian absolute space.[59] However, if More considered motion as real, it was not absolute in the Newtonian sense, or measured in relation to an absolute motionless space, but a real intrinsic change (even if often we cannot know). Newton did not see the *spissitudo essentialis* of More as a fourth dimension, but reduced the space of God to the three-dimensional Euclidean space, empty of matter, in which God explicated His own power separately from it, losing the dynamic dimension and the ecstatic temporality of the *Duration of God* [60] as related to the fourth dimension. For Newton, God and matter were in the same three-dimensional space, without any further divine fourth dimension. Not until the divine breadth of More was re-branded as the additional fourth dimension did the theory of relativity come into being. The relativity of motion of 1905 and 1915 theories was different from the Cartesian form of unreality of motion that was equated to stillness and implying a deeper reality to three-dimensional matter. In relativity theories, first of all, space and time belong to immaterial light extension,

[59] Koyré, *From the Closed World to the Infinite Universe*, pp. 142-146.

[60] Koyré, *From the Closed World to the Infinite Universe*, pp. 153-154.

and motion and time are not denied but included within an intrinsic truth of *physis* as a non-separable whole of light,[61] a reality independent of the plurality of subjectivist views of human material measurements. With More's idea, one can also understand why the three-dimensional space of the universe expands, why there are contractions in length and dilations of time for the material processes immersed in a four-dimensional world!

The story of the fourth dimension was best outlined by Florian Cajori,[62] but with more attention to the authors (Aristotle, Ptolemy, Oresme, Stifel, Cardan, Clavius, Descartes, Pascal, Leibniz, Kant and others) who rejected it: the most important reference – Henri Poincaré – however is missing.

Jean Baptiste Le Rond D'Alembert[63] had read about More's idea within the John Wallis' *Treatise* and at the entry *Dimension* of the *Encyclopedie* he made explicit the connection of the fourth dimension with time:

> Un homme d'esprit de ma connoissance croit qu'on pourroit cependant regarder la durée come une quatrieme *dimension*, & que le produit du tems par la solidité seroit une quelque maniere un produit de quatre

[61] Enrico R. A. Giannetto, *Saggi di storie del pensiero scientifico* (Bergamo: Sestante for Bergamo University Press, 2005), pp. 299-321 and 403-437.

[62] Florian Cajori, "Origins of Fourth Dimension Concepts", *The American Mathematical Monthly*, Oct., 1926, vol. 33, No. *8:* 397-406.

[63] Michel Paty, "Le trois dimensions de l'espace et les quatre dimensions de l'espace-temps", *Dimension, dimensions I.,* ed. by Dominique Flament (Paris: Fondation Maison Sciences de l'Homme, 1998), pp. 87-112.

> *dimensions*; cette idée peut etre contestée, mais elle a, ce me semble, quelque mérite, quand ce ne seroit que celui de la nouveauté.[64]

The man to whom D'Alembert did reference was probably D'Alembert himself. I suggest that D'Alembert's wave (a function of space and time) equation was fundamental for that intuition of time as fourth dimension.[65]

Joseph-Louis Lagrange (in the *Mécanique analytique* of 1788 and in the *Théorie des fonctions analytiques* of 1797) introduced time as the fourth dimension within mechanics. Lagrange wrote:

> Je vais maintenant considérer la théorie des fonctions relativement à la mécanique. Ici les fonctions se rapportent essentiellement au temps, que nous désignerons toujours par *t*; et comme la position d'un point dans l'espace dépend de trois cordonnées rectangulaires *x, y, z*, ces cordonnées, dans les problèmes de mécanique, seront censées être des fonctions de *t*. Ainsi on peut regarder la mécanique comme une géométrie à quatre dimensions, et l'analyse mécanique comme une extension de l'analyse géométrique.[66]

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[64] Jean Baptiste Le Rond D'Alembert, "Dimension", *Encyclopédie ou Dictionnaire raisonné des science, des Arts et des métiers, par une societé de gens de Lettres*. Mis en ordre et publié par M. Diderot...; et quant à la partie mathématique par M. D'Alembert ..., tome IV, Paris, 1754, pp. 1009-1010; third edition, Livourne, tome IV, 1772, pp. 922-923.

[65] Jean Baptiste Le Rond D'Alembert, "Recherches sur la courbe que forme une corde tenduë mise en vibration", *Histoire de l'académie royale des sciences et belles lettres de Berlin*, 1747, *3*: 214-219; "Suite des recherches sur la courbe que forme une corde tenduë mise en vibration, *Histoire de l'académie royale des sciences et belles lettres de Berlin*, 1747, *3*: 220-249; "Addition au mémoire sur la courbe que forme une corde tenduë mise en vibration", *Histoire de l'académie royale des sciences et belles lettres de Berlin*, 1750, *6*: 355-360.

[66] Joseph-Louis Lagrange, *Théorie des fonctions analytiques* (Paris: L'Imprimerie de la République, 1797), Application à la Mécanique § 185, p. 223; Raymond Clare Archibald, "Time as a Fourth Dimension", *Bulletin of the American Mathematical Society*, 1914, *20*: 409-412.

After the technical development of non-Euclidean and *n*-dimensional geometries in the early nineteenth century,[67] the subject of a fourth dimension often being connected with time was quickly connected to an attempt to understand spiritual, psychic and para-psychological phenomena at the end of the same century.[68]

Johann Karl Friedrich Zöllner,[69] marginalized for contacts with the spiritualists, attempted to introduce the fourth dimension also to explain some phenomena of the "astrophysics" he had just founded. After Zöllner and Gustav Fechner,[70] Charles Howard Hinton was the first to treat this systematically,

[67] Jagdish Mehra, "Einstein, Hilbert and the Theory of Gravitation", *The Physicist's Conception of Nature*, ed. by Jagdish Mehra (Dordrecht: Reidel, 1973), pp. 92-178, in particular p. 161, note n. 114.

[68] Enrico Giannetto, "Towards a Photical Idea of Nature: Physics as Photics or the Light of Relativity", *Representing Light across Arts and Sciences: Theories and Practices*, ed. by Elena Agazzi, Enrico Giannetto & Franco Giudice (Göttingen: V&R Unipress, 2009), pp. 233-246.

[69] Johann Karl Friedrich Zöllner, "Zur Metaphysik des Raumes", *Wissenschaftliche Abhandlungen*, 4 Bde. (Leipzig: L. Staackmann, 1878-1881), vol. II, pp. 893-941; Johann Karl Friedrich Zöllner, *Die transzendentale Physik und die sogenannte Philosophie. Eine deutsche Antwort auf eine "sogenannte wissenschaftliche Frage"*, in *Wissenschaftliche Abhandlungen*, vol. III (Leipzig: L. Staackmann, 1879); *Transcendental Physics*, partial Engl. tr. ed. by Charles C. Massey (Boston: Colby & Rich, 1881);

[70] Gustav Theodor Fechner, *Der Raum hat vier Dimensionen*, in *Vier Paradoxa* (Leipzig: Voss, 1846); Johann Karl Friedrich Zöllner, *Theorie des 4-dimensionalen Raumes* (Leipzig: Mutze, 1867); Johann Karl Friedrich Zöllner, *Naturwissenschaft und christliche Offenbarung. Populäre Beiträge zur Theorie und Geschichte der vierten Dimension* (Leipzig: Staackmann, 1881); Johann Karl Friedrich Zöllner, *Naturwissenschaft und christliche Offenbarung. Populäre Beiträge zur Theorie und Geschichte der vierten Dimension, nebst einem besonderen*

starting with an essay in 1884[71] and then also in literary works, and it is known that Hinton was deeply influenced by More. Following this essay, there were the considerations of an anonymous scientist in *Nature* (1885)[72] and of the astronomer Simon Newcomb (1893, 1898);[73] then, Herbert George Wells, in his novel *The Time Machine* (1895),[74] and, lastly, the great astronomer poet Camille Flammarion developed the idea. Flammarion had already investigated thoroughly the properties of light as being time-less, deducing the relativity of space and time

abdruck des offenen briefes an herrn consistorialrath prof. Luthardt aus dem 3. bande der Wissenschaftlichen abhandlungen (Gera: Griesbach 1886); Johann Karl Friedrich Zöllner, *Vierte Dimension und Okkultismus*. Aus den "wissenschaftlichen Abhandlungen" ausgew. und hrsg. von Rudolf Tischner (Graz: Geheimes Wissen, 2008). See also: Griffero, *Sensorium Dei. Variazioni sul tema della spazialità divina (Schelling, Oetinger, Newton, Leibniz/Clarke, More/Descartes)*, pp. 69-107.

[71] Charles Howard Hinton, "What is the fourth dimension?", *Scientific Romances* (London: Sonnenschein, 1884); then ed. by James Webb (New York: Arno Press, 1976); Charles Howard Hinton, *Speculations on the Fourth Dimension – Selected Writings*, ed. by Rudolf v. B. Rucker (New York: Dover, 1980); Rudolf Rucker, *The Fourth Dimension*. *A Guided Tour of the Higher Universes* (Boston: Houghton Mifflin Company, 1984); Rudolf v. B. Rucker, *Geometry, Relativity and the Fourth Dimension* (New York: Dover, 1977); Elizabeth L. Troesch, *Before Einstein. The Fourth Dimension in Fin-de-Siècle Literature and Culture* (London & New York: Anthem Press, 2017).

[72] S., "Four-Dimensional Space", Letter to the Editor, dated March 16 1885, *Nature* 31 (26 March 1885): 481.

[73] Simon Newcomb, "Modern Mathematical Thought", Nature, February 1, 1894, *49*: 325-329; Alfred M. Bork, "The Fourth Dimension in Nineteenth-Century Physics", *Isis,* Sep., 1964, vol. 55, No. *3*: 326-338.

[74] Herbert George Wells, *The Time Machine*, ed. by Nicholas Ruddick (Peterborough, Ontario: Broadview Press, 2001), with excerpts from many relevant articles on this topic.

conceptually (*Lumen*, 1866, 1872);[75] then, he developed the idea of the fourth dimension in order to understand spiritual and psychic phenomena (where spirits could be found), the relationship between life and death, eternity and time.[76] Flammarion also wrote a very prominent book on *Dieu dans la Nature* (1867),[77] developing an electromagnetic conception of Nature.[78]

Indeed, one can consider Flammarion as the historical missing link between the cultural heritage of More's spiritual conception of the fourth dimension and scientific conception.

In Poincaré there are many quotations of Flammarion's works, from student notebooks to epistemological works. Poincaré also gave a speech in honor of Flammarion.[79] Poincaré was deeply influenced by Flammarion's poetic and spiritual vision of the universe as a living and animate being: this vision was

[75] Camille Flammarion, *Lumen* (Paris: Flammarion, 1872).

[76] Philippe de la Cotardière & Patrick Fuentes, *Camille Flammarion* (Paris: Flammarion, 1994), pp. 270-279; Camille Flammarion, *Rêves étoilés* (Paris: Flammarion, 1888, 1896, 1914).

[77] Camille Flammarion, *Dieu dans la Nature* (Paris: Didier, 1867).

[78] Enrico Giannetto, "The Electromagnetic Conception of Nature at the Root of the Special and General Relativity Theories and its Revolutionary Meaning", *Science & Education,* 2009, *18*: 765-781.

[79] Henri Poincaré, "Discours au jubilé de M. Camille Flammarion", *Bulletin de la Société Astronomique de France,* 1912, *26*: 101-103; de la Cotardière & Fuentes, *Camille Flammarion*, pp. 310-311.

certainly the inspiration behind his work that produced the great relativistic space-time revolution in science.

This shows how, even at the rise of the theory of relativity, based by Henri Poincaré on a four-dimensional spacetime, with time as the fourth dimension,[80] there was already a strong link between theology and science: the theology of the divine fourth dimension of St Paul and More.

Poincaré certainly knew the work of Lagrange and introduced, on the same basis, a quadridimensional (pseudo-)euclidean chrono-geometry, a space-time for an electromagnetic mechanics, in the paper presented at the *Circolo matematico di Palermo* on 23 July 1905 and then published on 1906: it was a paper in which he developed mathematically the new relativistic dynamics published on 5 June 1905, based on electrodynamics and thus invariant by Lorentz transformations which Poincaré himself corrected[81] and then described as a rotation in four-

[80] Henri Poincaré (5 June 1905), "Sur la dynamique de l'électron", *Comptes Rendus de l'Académie des Sciences*, 1905, v. *140*: 1504-1508; Henri Poincaré (23 July 1905), "Sur la dynamique de l'électron", *Rendiconti del Circolo Matematico di Palermo*, 1906, v. *21*: 129-176; Enrico Giannetto, **"**Henri Poincaré and the rise of special relativity", *Quanta Relativity Gravitation: Proceedings of the XVIII Workshop 'Problems on High Energy Physics and Field Theory*, Protvino (Mosca), 1996, pp. 3-31; Enrico Giannetto, **"**Henri Poincaré and the rise of special relativity", *Hadronic Journal Supplement,* 1995, vol. *10*: 365-433.

[81] "Letter of Poincaré to Lorentz, 1904-1905", Arthur I. Miller, *Albert Einstein's Special Theory of Relativity: Emergence (1905) and Early Interpretation (1905-1911)* (Reading, Mass.: Addison-Wesley, 1981), pp. 80-81.

dimensional space-time and he defined also the space-time interval as an invariant quantity:

> Regardons *x, y, z, t (-1)*$^{1/2}$ ... comme le cordonnées de trois points *P, P', P''*, dans l'espace à quatre dimensions. Nous voyons que la transformation de Lorentz n'est qu'une rotation de cet espace autour de l'origine, regardée comme fixe. Nous n'aurons donc pas d'autres invariants distincts que les six distances.... $x^2+ y^2+z^2-t^2$.[82]

It was not a pure, formal, mathematical change of geometry. Space-time was needed to describe physical reality in terms of the electromagnetic field, of light, which was constituted by waves as functions of space and time *f(x, y, z, t)* that cannot exist at rest in a pure space: fourth dimension was needed by an electromagnetic conception of Nature (electron was considered in terms of the electromagnetic field), where electromagnetic field is the fundamental, immaterial, physical reality. Light velocity as a unity expresses the identity of the space of light and time: time is the space of light, and the space of light is time.

In a lecture delivered on 5 November 1907, Hermann Minkowski declared that he took up Poincaré's ideas on a four-dimensional space-time, but unfortunately the text was published only on 1915 and this source of his work was not recognized, because all scholars considered the paper on *Raum und Zeit* of

[82] Henri Poincaré (23 July 1905), "Sur la dynamique de l'électron", *Rendiconti del Circolo Matematico di Palermo*, 1906, v. *21*: § 9 (Hypothèses sur la Gravitation): 168-169.

1908 as his first published work on space-time. Minkowski further clarified, mathematically and conceptually, Poincaré's vision of a world of light that was eternal and absolute in time and space.[83] Albert Einstein, after 1907, followed Minkowski's elaboration and created general relativity on a four-dimensional pseudo-Riemannian chrono-geometry.[84]

The great physicist Edmund Whittaker wrote a book on the history of the physical concept of space, analysing the correlation of space and spirit which lead to the general relativistic connection of space and field as an immaterial physical reality that involves time as a fourth dimension.[85]

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[83] Hermann Minkowski, "Das Relativitätsprinzip", Lecture delivered on 5 November 1907, *Annalen der Physik*, IV Folge, 1915, v. *47*: 927-938; Hermann Minkowski, "Raum und Zeit", Lecture delivered before the Versammlung Deutscher Naturforscher und Ärzte, Cologne, September 21, 1908, *Physikalische Zeitschrift*, 1909, *10*: 104-111.

[84] Albert Einstein, "Zur Elektrodynamik bewegter Körper", *Annalen der Physik,* 1905, *17*: 891-921; Albert Einstein, "Die Feldgleichungen der Gravitation", *Königlich Preussische Akademie der Wissenschaften (Berlin), Sitzungsberichte,* 25 November 1915: 844-847; Albert Einstein, "Die Grundlagen der allgemeinen Relativitätstheorie", *Annalen der Physik* (Leipzig: Barth, 1916), ser. 4, 49 n. *7*: 769-822; Enrico R. A. Giannetto, "Da Bruno ad Einstein", *Nuova Civiltà delle Macchine* **24** n. 3 (2006), pp. 107-137.

[85] Edmund Whittaker, *Space and Spirit. Theories of the Universe and the Arguments for the Existence of God* (London: Nelson, 1952).

Picasso[86] and Escher,[87] and many other artists, in fact, were influenced by the work of Poincaré on non-Euclidean and four-dimensional geometries.[88] Ouspensky and Florensky looked back and "discovered" a spiritual and theological sense of relativity.[89]

4. Conclusions

Newton's neglecting of More's fourth dimension of space also brought about other developments. Newton modified More's Platonic-Christian attribution of space and time also to the Spirit of Nature as a too Platonic, pagan, perspective, because God could be reduced to the World Soul, whereas God has to be

[86] Arthur I. Miller, *Einstein, Picasso. Space, Time and the Beauty That Causes Havoc* (New York: Basic Books, 2001), pp. 100-106; Meyer Schapiro, *The Unity of Picasso's Art. Einstein and Cubism: Science and Art* (New York: Braziller, 2000).

[87] Eli Maor, *To Infinity and Beyond. A Cultural History of the Infinite* (Princeton: Princeton University Press, 1987), pp. 127, 172-173.

[88] Linda Darlymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton: Princeton University Press, 1983, second edition 2014).

[89] Ioan Petru Couliano, *Out of the World. Otherworldly Journeys from Gilgamesh to Albert Einstein* (Boston: Shambhala, 1991), pp. 12-32; Peter Demianovitch Ouspensky (1912), *Tertium Organum: The Third Canon of Thought; A Key to the Enigmas of the World*, Engl. tr. ed. by Nicholas Bessaraboff & Claude Bragdon (New York: Vintage Books, 1970); Peter Demianovitch Ouspensky (1931), *A New Model of the Universe: Principles of the Psychological Method in Its Applications to Problems of Science, Religion and Art* (New York: Vintage Books, 1971); Pavel Florensky, *Lo spazio e il tempo nell'arte*, It. tr. ed . by Nicoletta Misler (Milano: Adelphi, 1995), pp. 13-202; Rudolph Steiner, *Die vierte Dimension: Mathematik und Wirklicheit* (Dornach: R. Steiner Verlag, 1995).

considered as an external *Dominus*. Space and time, according to Newton, had a dual aspect: those attributes which can be measured directly are connected to matter, whilst those real and mathematical ones are attributes only of God, absolute and independent of Nature-matter: they are only the expression of the omnipotence and eternity of God and not of other spiritual entities.[90] The time measurable by matter is irreversible, but the real, mathematical and divine time is reversible. In order to build physics, the space and time measurable by matter are not sufficient; we need to turn to those that are true, mathematical and divine. Only in these terms, can absolute motion be found (it is the straight-line centrifugal force, present in rotatory motion, which, said Newton, would also identify absolute motion with respect to absolute space), and the truth of the Copernican-Keplerian world system be established. The true, mathematical and absolute space is the *sensorium Dei*, the means by which God perceives, experiences and knows the world (somehow, for Newton, the world exists in space, as for Berkeley, in having been perceived and thought up by God; Kant, instead, secularises the theological perspective of Newton, replacing God with the transcendental human subject). Heidegger notes how Newton's conception of

[90] Newton, *Philosophiæ Naturalis Principia Mathematica*, editio tertia.

space as *sensorium Dei* [91] is, in some way, a consequence of the Nominalist-Franciscan turning-point of Duns Scotus and Ockham, whereby, the authentic being is no longer universal, but is *this* singular being, here and now, where space and time are essential properties, to the extent they are existent in all entities and, therefore, in some way, also in God, so that, before they are even knowable by God, the things are in God, see *Acts* 17.28 and *Rom*. 11.36 (as we have already mentioned, this is referred to by Newton in the *Scholium Generale* of the *Principia*). Newton, though, does not interpret this being-in-God in those Nominalist terms referred to by More as the fundamental *dimension* of existing and, then, by Heidegger, for whom our being, while distinct in the entities, is, univocally, just the being of God, but as the being of an entity in God as a mere external container entity.[92]

[91] Isaac Newton (1704, 1730[4]), *Opticks or Treatise of the Reflections, Refractions, Inflections & Colours of Light*, ed. by Ierome Bernard Cohen with contributions by Albert Einstein, Edmund Whittaker, Duane H. D. Roller (New York: Dover, 1952), Qu. 28, p. CXIV, pp. 362-370, in particular p. 370.

[92] Martin Heidegger (1936-1937), *Übungen für Anfänger. Schillers Briefe über die ästhetische Erziehung des Menschen. Wintersemester 1936-37 (Seminar-Mitschrift von Wilhelm Hallwachs). Mit einem Essay von Odo Marquard*, ed. by Ulrich von Bülow (Marbach a. N.: Deutsche Schillergesellschaft, 2005), pp. 7-133; Martin Heidegger (1928-1929), *Einleitung in die Philosophie,* ed. by Otto von Saame & Ina Saame-Speidel (Frankfurt am Main: Klostermann, 1996), § 26.

The Euclidean and Archimedean geometry, to which physical phenomena could be traced, was, above all, the science of God as the Great Mechanic and Creator of the world, not of a human subjectivity but a divine subject-ity. Physics could only be founded upon this view of geometry as divine, archaic and Pythagorean: the theory (from *theòs* and *orao*) is the vision of God, in the sense of a genitive subject, it is that which God sees, and the theo-rem (from *theòs* and *rema*) is really the word of God. For this reason, the rules of natural philosophy coincided, for Newton, with those in the Scripture interpretations.[93]

In order to overcome the human subjectivism of Descartes, Newton, had turned back not only to More, but also Spinoza (albeit indirectly and probably via More himself), to the theory of space as an attribute of God and of geometry as a divine science, but separating space from matter and, once again, God from Nature. Thus, Newton eliminated More's Spirit of Nature and fourth dimension, and we had to wait *more* than two centuries to have a four dimensional relativistic dynamics.

[93] Isaac Newton (1660-1680), *Trattato sull'Apocalisse*, Latin unpublished manuscript ed. by Maurizio Mamiani (Torino: Bollati Boringhieri, 1994); Maurizio Mamiani, *La scienza esatta delle profezie*, in Newton, *Trattato sull'Apocalisse*, pp. VII-XLI.