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British Physico-Theological Poetry and Newtonian Physics
The Use of *Principia Mathematica* (1687) in Sir Richard Blackmore's *Creation* (1712)

Benedetta Burgio
Università Cattolica del Sacro Cuore, Italia

Abstract The turn of the eighteenth century was a time in which science and literature were mutually enriching disciplines. Those years witnessed extraordinary advancements in natural philosophy. Newton was the most prominent and influential among the natural philosophers whose thought contributed to the scientific revolution and his work altered dramatically the way in which the universe was understood. His *Principia Mathematica* (1687) crowned the new tradition of physico-mathematics and contributed to shaping the new trend in natural theology known as physico-theology. Physico-theology was at the crossroads of natural theology and natural philosophy and employed the new science to demonstrate the existence and attributes of God, and it was often given expression in poetry. One of the earliest and most accomplished instances of physico-theological poetry is Sir Richard Blackmore's *Creation* (1712), which successfully synthesised the latest scientific theories. Blackmore's verses have been neglected for centuries and it is the aim of this article to pay critical attention to his accomplishment, in particular regarding Blackmore's use of the Newtonian physics of the *Principia*.

Keywords Physico-theology. Natural Theology. Eighteenth-century Poetry. Newtonian Physics. Sir Richard Blackmore. Creation.

Summary 1 Introduction: Physico-theology, a European Phenomenon. – 2 Late seventeenth-century Natural Philosophy and Newton's *Principia Mathematica*. – 3 Sir Richard Blackmore's *Creation* (1712). – 4 The Presence of Newton's *Philosophiae Naturalis Principia Mathematica* in *Creation*. – 5 Conclusion.

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1 Introduction: Physico-theology, a European Phenomenon

Recent years have witnessed a renewal of scholarly interest in an extraordinary cultural phenomenon that characterised the turn of the eighteenth century. Physico-theology was the branch of natural philosophy that intersected natural theology, employing the most state-of-the-art scientific ideas to demonstrate the existence of God. Studying this crossroads of interests has resonance on a number of levels in the history of Western thought, but it is especially relevant for its role in the popularisation of the natural philosophy that eventually developed into modern science (cf. Brooke, Manning, Watts 2013).

The label 'physico-theology' became popular in England at the beginning of the eighteenth century, though several specimens of it can be found throughout Europe from the second half of the seventeenth century. Identifying physico-theology is as challenging a task as defining it. Given its interdisciplinary nature, physico-theology eludes any attempt at strict categorisation. Harrison argues that the very hyphenation of the noun points to its hybrid nature:

> 'physico-theology' is best understood as a new term developed within a growing lexicon of practices in natural philosophy that specified a particular kind of natural theological argument drawn from an assumed knowledge of final causes. (Blair, von Greyerz 2020, 71-2)

That is to say, physico-theology had a composite nature at the intersection of theology and natural philosophy. Physico-theology is yet fundamentally distinct from the etymologically analogue 'natural theology'. If natural theology resorted to rational arguments, physico-theology exploited the most recent scientific discoveries to achieve the same end: demonstrating the existence of God. Whilst most critics tend to use the two terms interchangeably, Blair and von Greyerz (2020) make it clear that physico-theology is substantially different from natural theology on account of its chronological specificity as a cultural phenomenon and of its ontological dependence on the latest natural philosophy. Hence, physico-theology can be regarded as a sub-genre of natural theology that thrived throughout Europe on the crest of the scientific revolution of the second half of the seventeenth century and that, in England, survived well into the nineteenth century.

Outlining a history of the development of physico-theology in England is also testing. One of the main reasons lies in the difficulty to determine the mutual conceptual and chronological boundaries of natural theology and physico-theology. Mandelbrote (2007) maintains that, in the seventeenth century, two major styles of natural theol-

ogy came into being in the two main English universities, and the two differed in the way their best-known exponents interpreted divine evidence in nature. On the one hand, a group of scholars based in Oxford saw the universe as providentially ordered according to laws acting as a mediation of the hand of God and understood natural phenomena chiefly in terms of regularity. On the other hand, the group formed around the Cambridge Platonists relied on wondrous revelations observed in nature as signs of the existence of God, thus attempting to combine Christian views with platonic philosophy (Harrison 2001). The major scientific changes that occurred in the latter half of the seventeenth century ultimately collided with these tendencies and caused the emergence of a third strain in natural theology founded on the demonstration of the providence of a wise Creator through the argument from design (von Greyerz 2022, 8-11: 49-89). It was the very compatibility of the natural theology of the Oxford group with the new popular experimental philosophy that gave rise to physico-theology.

In England, the inauguration of the golden age of physico-theology is conventionally considered 1691, the year of the foundation of the famous Boyle Lectures (cf. Dahm 1970; Harrison 2005, 172-3) and of the publication of John Ray's seminal *The Wisdom of God* (Calloway 2014, 20). The more the insight into the natural world granted by the new physical sciences impacted on natural theology, the more scientists and scholars felt the need to show that those disciplines were in harmony with traditional Christian beliefs. Harrison argues that the very existence of the term physico-theology

> signals an attempt to arrive at a solution to the question of how the new forms of natural philosophy related to theology. (Harrison 2005, 181)

Physico-theology gradually left its learned nest and works in that genre started to be translated, or to be redacted in English. Physico-theological writings proliferated in Britain at the turn of the eighteenth century and all of them drew heavily on the main principles of the scientific revolution. There were several forms that physico-theology assumed and poetry was a particularly effective one, as it was accessible to the common reader mainly thanks to its appeal to common sense and imagination.

2 Late Seventeenth-Century Natural Philosophy and Newton's *Principia Mathematica*

In scientific literature, the eighteenth century is commonly labelled as the century of Newton, in light of the tremendous impact his physics had on the development of modern science. The changes in the scientific world of the last decades of the seventeenth century reached their acme with the works of a group of natural philosophers who set a new standard of scientific inquiry. Newton's scientific work can be pigeonholed in the tradition known as 'physico-mathematics' – that is those disciplines that employed the rigour of mathematics to study natural phenomena (Blair, von Greyerz 2020, 41). Between the end of the seventeenth century and the beginning of the eighteenth century, physico-mathematics, supported by the extensive accumulation of empirical observations, definitively supplanted the traditional Aristotelean means of investigating the natural world. It was especially thanks to Newton's pioneering work that mathematics became the privileged language of natural philosophy and assumed a more prominent academic status in Europe (cf. Guicciardini 2019). Mathematics became the ideal form of exposition of science (Porter 2003, 26-7); it followed that natural philosophy increasingly became detached from other branches of philosophical inquiry. Yet, even if we think of Newton's legacy for his invaluable contributions to the fields of mechanics, we should not forget his involvement in religious matters. In fact, his religious pursuits formed perhaps the most significant part of his life (Iliffe, Smith 2016, 519) and, since he saw the world as God's temple, he understood his role as a natural philosopher as that of a priest of nature (Iliffe 2017).

Newton's *Philosophiae Naturalis Principia Mathematica* was published for the first time in 1687 and is the crown jewel of the seventeenth-century tradition of physico-mathematics. The volume went through two other Latin editions in 1713 and 1726, and was translated into English in 1729. The greater part of the work remained substantially unvaried, but the second edition saw the addition of a preface by Roger Cotes[1] and the famous *Scholium Generale*, which were momentous integrations that served to frame the *Principia* in a "much more overtly apologetic and carefully theologically positioned" background (Snobelen 2001, 175).

In the first two books of the treatise Newton developed mathematical laws on the basis of abstract constructs, which he then compared with observed natural phenomena, creating models progres-

1 Roger Cotes (1682-1716) was the first Plumian Professor of Astronomy and Experimental Philosophy at Cambridge University and worked with Newton on the second edition of the *Principia* that was published in Latin in 1713.

sively more similar to reality by combining the use of induction and deduction in the third book. Those models and ways of reasoning were meant to be applied to the delineation of a complete system of the world. Mathematics alone, however, could not be sufficient to explain all phenomena, hence empirical observation was intertwined with the more strictly mathematical method (Sambrook 2013, 2). It was in the third book that, through a process of inductive generalisation, Newton formulated the famous law of universal gravitation, according to which

> [g]ravity exists in all bodies universally and is proportional to the quantity of matter in each. (*The Principia*, 810)

The theory of universal gravitation was an extraordinary breakthrough in Western thought. In mathematical and physical terms, it was understood by Newton not so much as a centripetal force, but as a form of attraction: as a mutually acting force, universal gravitation affects all the bodies of a studied system proportionally to their masses and in inverse proportion to the square of their distance.

The second and third edition of the *Principia* are closed by the *General Scholium*, one of Newton's best known essays and a point of reference for eighteenth-century physico-theology. The *Scholium* is a precious document, as it expounds Newton's view of God in relation to his view of physics. Here Newton asserts that the order and beauty of this system of the world governed by the action of gravity are sufficient proof of God's existence. He also illustrates the characteristics of the one God and states that "to treat of God from phenomena is certainly a part of experimental or natural philosophy" (*The Principia*, 274-5). Indeed, it is in the *Scholium* that the famous methodological stance of the *Principia* is summarised as *hypotheses non fingo*, that is "I do not feign hypotheses" (*The Principia*, 943): hypotheses not sustained by empirical evidence ought not be accepted as a basis for certain knowledge. In the first edition of the *Principia*, however, Newton never provides an explanation for the ultimate cause of gravity. A valuable document preceding the *Scholium* is a later letter sent by Newton to the classical scholar Richard Bentley (1662-1742) on the occasion of his Boyle Lectures, where he employed Newton's theories apologetically. In that famous letter Newton seems to have argued that the logical ultimate cause of gravity is God himself (Park, Daston 2006, 754):

> 'Tis unconceivable that inanimate brute matter should (without the mediation of something else which is not material) operate upon & affect other matter without mutual contact […]. That gravity should be innate inherent & [essential] to matter so that one body may act upon another at a distance through a vacuum without the me-

> diation of any thing else by & through which their action or force {may} be conveyed from one to another is to me so great an absurdity that I beleive [sic] no man who has in philosophical matters any competent faculty of thinking can ever fall into it. Gravity must be caused by an agent {acting} consta{ntl}y according to certain laws, but whether this agent be material or immaterial is a question I have left to the consideration of my readers. (Letter from Isaac Newton to Richard Bentley, 25 February 1692/3)[2]

While it is true that in the *Principia* Newton openly admits his failure to explain how a force like gravity can act at a distance through a void, and to determine its ultimate cause, his empirical observations still enable him to assert with certainty that such a force unquestionably exists and is responsible for a wide range of natural phenomena. Moreover, far from dismissing the presence of God in the world, Newton's physics was compatible with the Christian tenets that saw the world as God's creation and managed to demonstrate this relation with mathematical certainty. Natural philosophy had proven that natural phenomena were consistent with the action of a divine agent, who had created a universe governed by regular laws that could be studied through mathematics. Indeed, it was not so much Newton's sporadic theological statements in his scientific works but rather the implications of his physics that influenced and shaped British physico-theology and made it a distinct genre.

By the dawn of the eighteenth century, Newtonian physics had become one of the most frequently employed weapons brandished by British physico-theologians. The influence of Newton's thought remained strong in the first half of the century and the application of Newton's physics to culture at large, known as Newtonianism, pervaded all strata of knowledge (Schaffer 1996). Newton's theories found their fortune also in non-scientific literature and in particular in poetry, where their contamination with physico-theology found a perfect outlet.

3 Sir Richard Blackmore's *Creation* (1712)

At the beginning of the eighteenth century there were few poems entirely devoted to physico-theology, as physico-theological echoes were rather distributed in a variety of compositions (cf. Jones 1963). One of the first and most accomplished physico-theological poems was *Creation: A Philosophical Poem in Seven Books* (1712) by the poet-

2 https://www.newtonproject.ox.ac.uk/view/texts/normalized/THEM00258.

physician Sir Richard Blackmore[3] (1654-1729).

Although his poem is a unique specimen of the scientific literature of its age, Blackmore's work has been neglected by modern critics mainly as a result of his rift with some of his more powerful contemporaries, including John Dryden (1631-1700), John Dennis[4] (1658-1734), and Alexander Pope (1688-1744) (Rosenberg 1953, 54-7; 144-6). In his days, however, his writings were discretely popular and some of them even won the approval of Dr. Johnson (1709-1784), who accorded Blackmore much more space than he did to other writers in his *Lives of the Poets* (1779-81) (Kelly 1961, 189) and used several of Blackmore's verses when composing the *Dictionary of the English Language* (1755) (Atkinson 1952). While Johnson recognised the value of Blackmore's texts, he also pointed out that the doctor's literary formation was not up to the task of writing masterpieces and that his poems were well-conceived and structured but fundamentally lacked in elegance (Johnson 2010, 775). The aesthetic mediocrity of his literary compositions was the reason why Blackmore's works were not customarily welcomed very warmly in literary circles, where the doctor was often referred to as the "City Bard" or the "Knight Physician" (Kelly 1961, 186). The so-called wits addressed harsh strictures against the doctor's inept versification and lack of true poetic talent (Boys 1949): among others, Swift nicknamed the physician "England's Archpoet" (Rolleston 1926, 9), and most notoriously Pope scorned "Blackmore's endless line" (Pope 2017, 441) in *The Dunciad*. Still, Blackmore was an emblematic figure of his time, and only

> few literary figures so adequately mirror the concerns of their own age. (Solomon 1980, 9)

Compensating for what was often pronounced his literary dullness with enthusiasm and vigour in the defence of his convictions, Blackmore succeeded in being remembered for his most momentous work.

It is indeed the unanimous opinion of readers and critics that *Cre-*

3 Born in Wiltshire in 1654, Richard Blackmore obtained a MA from St Edmund Hall, Oxford, and was awarded the degree of Doctor of Medicine in Padua. After becoming a fellow of the Royal College of Physicians, he was chosen by King William III as one of his personal physicians and was knighted in 1697. At the same time his sense of moral duty compelled him to embark on a prolific literary career. His extensive literary production includes medical tracts, epic poems, religious and theological writings, periodicals, and physico-theological compositions. After the death of Queen Anne and the Hanoverian accession, Blackmore was removed from his position as royal physician, yet in 1716 he was made Censor and Elect of the College of Physicians. 1722 was the year of Blackmore's official retirement from the public scene and he spent the last years of his life in Essex, writing mainly on medical matters before he died in 1729.

4 After the publication of *Creation* Dennis turned from enemy to defender of Blackmore's poetry in light of its moral value (Rosenberg 1953, 119).

ation is Sir Richard Blackmore's best composition and has been recognised as such since its publication in 1712. The poem was the only of Blackmore's works to be reprinted after the author's death (Blackmore 1806, xv). With *Creation*, Blackmore accomplished what earlier scientist-theologians had wished to do since he refuted atheism in poetry by

> put[ting] into verse the wisdom of God in nature as demonstrated by 'natural philosophy' in the discoveries of the new science. (Jones 1966, 86)

While this was not Blackmore's first attempt at versifying the same subject, *Creation* exceeded all previous endeavours and became the first comprehensive poetic encyclopaedia of physico-theology. Addison himself praised the poem only few weeks after its publication in *Spectator* No. 339 (29 March 1712), in which he observed that

> [t]he Work was undertaken with so good an Intention, and is executed with so great a Mastery, that it deserves to be looked upon as one of the most useful and noble Productions in our English Verse. (Addison 1965, 261)

As we have seen, the tradition of physico-theology enjoyed a period of great fortune in the latter half of the seventeenth century but, at that time, it was read only by those who knew Latin. Blackmore overtly declared his intention to commit to paper a work that was to be accessible to people who did not have an academic education (*Creation*, xl-xli).

The chosen subject is that of the divine creation of the universe and the subtitle "Philosophical Poem" hints at the prominent role that the new philosophy was to have in the text. The poem is divided into seven books, a number that recalls the seven days of creation described in the Book of *Genesis*. Its subject is physico-theological: the celebration and demonstration of the existence of a wise creator from the observation of an array of natural phenomena in the universe by way of scientific examples. The best expression of such intention is found in the programmatic opening lines of the first book:

> See thro' this vast extended theatre
> Of skill divine what shining marks appear:
> Creating power is all around exprest,
> The God discover'd, and his care confest.
> Nature's high birth, her heavenly beauties show;
> By ev'ry feature we the parent know.
> Th' expanded spheres amazing to the sight,
> Magnificent with stars and globes of light;

> The glorious orbs, which heaven's bright host compose,
> Th' imprison'd sea, that restless ebbs and flows;
> The fluctuating fields of liquid air,
> With all the curious meteors hov'ring there,
> And the wide regions of the land, proclaim
> The power divine, that rais'd the mighty frame.
> (*Creation*, 1.34-47)

In the preface to the poem Blackmore openly acknowledges his debt to physico-theological sources, although he never mentions them. Following the same kind of reasoning, each part of the poem reaches the conclusion that the perfect contrivance of the world could not have been brought about but by a wise, almighty designer:

> That I may reach th' Almighty's secret throne,
> And make his causeless power, the cause of all things, known.
> (*Creation*, 1.18-19)

Each of the seven books of *Creation* is devoted to a different portion of the created world. Blackmore's logical proceeding is quite straightforward: the reasonableness of each feature is brought to the fore and the atheists addressed by the lyrical I – who voices the viewpoint of the author – are shown that the providential order visible in the world cannot be the result of chance. Blackmore's very insistence on the providential design behind all works of creation positions the poem in the physico-theological tradition of the argument from design. This was the seventeenth and eighteenth centuries' most popular argument whereby the existence of an intelligent designer is demonstrated through the observation of the harmony of creation. The opening book argues the existence of a deity from evidence of design in the position, unity, stability, structure and motion of the earth and the seas. Throughout Book I and the whole poem, Blackmore never fails to celebrate the beauty of all the works of creation as yet another evidence of their benign maker. All these elements enable the poet to conclude that a wise contriver must have been responsible not only for the creation of the world, but also for its preservation.[5]

Blackmore's use of the scientific argument from design is strong again in Book II, which is by far the most consequential when it comes to Blackmore's application of Newtonian physics, as it surveys the harmony of the solar system. In the history of mankind, there have been several theories trying to explain heavenly motions and so the attempts by Ptolemy, Copernicus, and Kepler are duly summarised and lead to the theory of the action of gravity. After three books de-

5 On the proximity of Blackmore to Boyle, see Rosenberg 1953, 103.

voted to the confutation of atheistic positions, the scientific discourse is again central in Book VI. Here, Blackmore's professional expertise emerges when he uses the human body as evidence of the existence of a divine anatomist behind its wondrous contrivance. The book opens with a review of several classical accounts of the origin of mankind, which in turn occasions a detailed anatomical and physiological description of the human body. Both eighteenth-century and modern critics have commended this very portion of the poem, for here Blackmore succeeds in transforming physiology into poetry (Jones 1966, 89) by way of occasional "pictorial" language that embellishes an otherwise plain physiological and anatomical survey (Pizzol Giacomini 2007, 34). It was not the first time that such a topic had been included in physico-theological literature,[6] yet Blackmore's account of anatomy and physiology is detailed and well-informed in its compendium of the most recent discoveries in the field, such as the circulation of the blood described after William Harvey's (1578-1657) *De Motu Cordis* (1628), or the illustration of the functioning of the nervous system indebted to the work of Thomas Willis (1621-1675), or the theories of light and sight (Nicolson 2015, 103-4).

The final book concludes the previous account of the human body as God's extraordinary handiwork that reveals the hand of a sage anatomist in each of its parts. Here Blackmore evokes a familiar topic of philosophical inquiry, the workings of the human mind, which he tackles in a proto-psychological way that draws heavily on John Locke's *Essay Concerning Human Understanding* (1689). Blackmore does so in order to show that the wonders and mysteries of the human mind, because complex and unfathomable, must presuppose a divine origin more than any other aspect of creation (Jones 1966, 89).

4 The Presence of Newton's *Philosophiae Naturalis Principia Mathematica* in *Creation*

Granted that in the early eighteenth century poems thematising science were relatively numerous, not all poets had the same degree of expertise to understand and use scientific ideas in an original way. As a man of science, Blackmore had privileged access to various branches of exact knowledge that formed the solid skeleton of several of his works. He was also likely *au courant* with the latest scientif-

6 See for instance the 1692 Boyle Lectures by Sir Richard Bentley (1662-1742) published as *The Folly and Unreasonableness of Atheism* (1693). Blackmore himself had already introduced the subject in the earlier *The Nature of Man* (1711). The poem dealt with the nature of man in a literal sense and analysed from a physiological point of view "What different Virtues, and as different Crimes | Owe their Production to peculiar Climes" (*The Nature of Man*, 1.21-2).

ic discoveries that circulated in Europe in light of his public life in London – he was known to frequent coffee-houses – and his proximity to the Royal Society. The mathematical account of natural phenomena was popularised by the works of the natural philosophers who operated around this new institution and played a key role in the establishment of empiricism and experimentalism as the only reliable modes of scientific inquiry.

As an early eighteenth-century physician, Blackmore was brought up in an intellectual environment imbued with empirical philosophy. Though in *Creation* the poet never explicitly declares his epistemological stand, his advocation of empiricism and rejection of any form of knowledge based on hypothetical conjecture can be gathered from his several medical treatises (Gregori 2004). More than that, medicine is ontologically one of the most empirical branches of science and Blackmore agreed with the experimental interpretation of the natural world. He supported empiricism, "emphasising practical observation versus mere theory learned from books" (Pizzol Giacomini 2007, 8. Johnson himself noted that Blackmore was suspicious of scientific knowledge derived only from ancient sources and of transmitted knowledge (Johnson 2010, 771-2). This attitude is clearly detectable in *Creation* too, and even more so in view of its subject matter: what sets *Creation* apart from other contemporary poems dealing with the natural world is that in every book the empirical observation of natural phenomena disproves atheistic theories as unfounded – and therefore invalid – hypotheses. One should not forget that medicine was a field deeply affected by the discoveries of the new philosophy, especially of the mechanistic trend that thrived in the latter part of the seventeenth century (cf. Ishizuka 2016, 230) and this too points to Blackmore's scientific attitude.

It is safe to suppose that Blackmore had the chance to know Newton's *œuvre*, either in its original form or through its numerous popularisations.[7] It is likely that Blackmore knew Newtonian physics and its theological implications through Richard Bentley's Boyle Lectures of 1692, one of the first instances in which the *Principia* were used in an apologetic fashion to defend the Christian religion. John Locke himself had commended Blackmore's use of Newtonian physics in the epic poem *King Arthur* (Locke 1708, 219) and, although in *Creation* Blackmore showed himself to be conversant also with Newton's *Opticks* (1704) (Nicolson 2015, 66), he seemed to favour the *Principia*. It should be remembered that in 1712 Newton had still not pub-

7 After the *Principia* were first published in 1687, Newton became very popular in England and "soon assumed in the minds of many a godlike status" (Snobelen 1998, 160). The key ideas from the *Principia* became part of the collective imagination of early eighteenth-century Britain by means of translations, popularisations, public lectures, and works of physico-theology.

lished the second edition of his masterpiece with the *General Scholium* and Roger Cotes's preface, so it can be supposed that Blackmore had found evidence to infer what role Newton attributed to God in his universe either from the early Boyle Lectures or from the *Opticks*. Newton's piety and genius were also a favourite subject of much popular literature of the day and it was no accident that devout Blackmore praised the author of the *Principia*. For Blackmore, religion and natural philosophy had to be intimately connected, for "[t]here's no Philosophy without a God" (*Creation*, 1.280). This is repeatedly argued throughout the poem: while the mysteries of the universe can be studied mathematically, not all aspects of nature can be demystified and therefore such circumstances are accountable only if God comes into play.

Blackmore uses Newton's *Principia* at various times in *Creation*. Book I, for instance, is centered on the internal cohesion of the earth. Here Blackmore begins by surveying a series of hypotheses that should account for the cohesion of the several parts of planet earth. Such cohesion is clearly due to some force or power that contrasts the centripetal tendency of rotating bodies to shake off whatever is on their surface. The atomistic view born in ancient Greece with Leucippus (5th c. BC) and Democritus (5th-4th c. BC) is, in Blackmore's opinion, unacceptable since it presupposes atoms – that is, inanimate matter – to have their own will. The lyrical I takes a stand against an essentialist view of gravity::

> Those who ascribe this one determin'd Course
> Of pondrous Things to Gravitating Force,
> Refer us to a Quality occult,
> To senseless Words, for which, while they insult
> With just Contempt the famous Stagyrite,
> Their Schools should bless the World with clearer Light.
> (*Creation*, 1.136-41)

We may be surprised that Blackmore dubs the force of gravity a "quality occult", and we may be led to think that he was dismissive of Newton's discovery. Yet Blackmore rejects a mysterious quality of gravity to which Newton too objected, preferring to consider gravity for its manifest aspects. Newton himself admitted that the force of gravity that he postulated as responsible for the harmony of the universe through the law of universal gravitation does not have a verifiable cause for it but can be known only through its effects. As we have seen in the above-quoted letter to Richard Bentley, the author of the *Principia* discarded the 'Epicurean' notion that gravitation is essential and inherent to matter.

Blackmore then considers the position of those who account for the action of gravity by attributing it to magnetic power. This theo-

ry could not be accepted on physical grounds: magnetic force is never proportional to mass, while the force of gravity is, and whereas gravity exists in all bodies having a mass and is therefore universal, magnetic force does not. Newton himself points this out in Book III of the *Principia*:

> COROLLARY 5. The force of gravity is of a different kind from the magnetic force. For magnetic attraction is not proportional to the [quantity of] matter attracted. Some bodies are attracted [by a magnet] more [than in proportion to their quantity of matter], and others less, while most bodies are not attracted [by a magnet at all]. And the magnetic force in one and the same body can be intended and remitted [i.e., increased and decreased] and is sometimes far greater in proportion to the quantity of matter than the force of gravity; and this force, in receding from the magnet, decreases not as the square but almost as the cube of the distance, as far as I have been able to tell from certain rough observations.
>
> Proposition 7, Theorem 7
> Gravity exists in all bodies universally and is proportional to the quantity of matter in each. (*The Principia*, 810)

In light of the core argument of Book II, it is safe to suppose that Blackmore understood gravity as a mutually attractive magnetic power following "Nature's constant Law" (*Creation*, 1.171) that prevents matter from fleeing its God-chosen course. Whatever its ultimate cause, the force that Blackmore describes is responsible for the earth's cohesion, and the lines in which he deals with this topic also evoke the catastrophic effects that a stronger or a weaker force of gravity would have on the earth, should gravity not be what it is in the Newtonian account.

Thus, Blackmore uses a typical argument from design: the providential coincidence that allows our earth not to collapse on itself, or to disperse into pieces, could have never been brought about by chance. Although Blackmore is partial to Newton's explanation, he is also aware that the latter was not able to find empirically or mathematically the cause of gravity, and so he must conclude that there is no completely satisfactory theory that can account for the shape of the earth as it is. Similar arguments are employed to describe the diurnal and annual motion of the earth around the sun. Here Blackmore explicitly addresses the readers who are "not verst in Reas'ning so severe" (*Creation*, 1.386) and proceeds to explain that, while such a motion can be formally described thanks to mathematics, its original cause cannot be determined so that God is again deemed to be the ultimate cause behind all natural occurrences. The same conclusion is reached for the last earthly phenomenon Blackmore describes

in the first Book: the tide. While he quickly dismisses the position of those who believe that the flux and reflux of the sea is occasioned simply by the rotation of the earth around its axis, he considers in earnest the Newtonian theory as expressed in Book III of the *Principia*:

> Proposition 24, Theorem 19
> The ebb and flow of the sea arise from the actions of the sun and moon. (*The Principia*, 835)

Thus, the flux and reflux of the tide is to be ascribed to the gravitational attraction that the sun and moon exercise on the watery parts of the earth. Once more, though, the unknown cause of gravity poses a problem and God's action needs to be taken into account.

Book II is devoted to the celebration of the Creator's wisdom in the design of a cosmos ruled by laws that can be studied mathematically. The concept of universal gravitation pervades the pages coherently with the prevailing theme of the book, which is the celebration of the harmony, order, and beauty of the universe. Both Cotes and Newton would stress the very same points in their additions to the second edition of the *Principia*, since

> [t]his most elegant system of the sun, planets, and comets could not have arisen without the design and dominion of an intelligent and powerful being. (*The Principia*, 940)

Creation, however, was composed well before the second edition of the *Principia* was issued and it likely benefitted from various apologetic texts that employed Newton's physics in its providential acceptation.

Besides the usual reflection on the usefulness and providence of the position of the sun in the solar system, Blackmore praises the vastness of the universe and the harmony and internal cohesion of all the planets:

> While these so numerous, and so vast of size,
> In various ways roll thro' the trackless Skies;
> Thro' crossing Roads perplext and intricate,
> Perform their Stages, and their Rounds repeat;
> None by Collision from their Course are driv'n,
> No Shocks, no Conflicts break the Peace of Heav'n.
> No shatter'd Globes, no glowing Fragments fall,
> No Worlds o'erturn'd crush this terrestrial Ball.
> In beauteous Order all the Orbs advance,
> And in their mazy complicated Dance,
> Not in one part of all the Pathless Sky
> Did any ever halt, or step awry.
> (*Creation*, 2.83-94)

The description of the harmony of the universe is the result of a mutually attractive force that allows planets to move regularly and in perfect coordination. This force is gravity, hence all phenomena described through the law of universal gravitation provide orderliness in the universe.

Although Blackmore repeatedly praises the theory of universal gravitation, he observes that there is no satisfactory ultimate explanation for the workings of gravity and urges inquirers not to "pretend, by Reason's strictest Laws, | Of an Effect to manifest the Cause" (*Creation*, 2.341-2). Gravity is known empirically only through its effects and its action can be formalised mathematically, but whatever lies behind it remains a mystery that should not be fathomed. Blackmore cannot but recognise the greatness of Newton's empirical and mathematical theory, and illustrates the role of universal gravitation as follows:

> If some, you say, prest with a pond'rous load
> Of Gravity, move slower in their Road,
> Because, with Weight encumber'd and opprest,
> The sluggish Orbs th' Attractive Sun resist;
> Till you can Weight and Gravity explain,
> Those Words are insignificant and vain.
> (*Creation*, 2.467-72)

Blackmore disproves the hypothesis according to which the sun's gravitational field is responsible for the motion of the planets of the solar system by resorting to empirical evidence, showing the inconsistent motion of the moon. This is another instance of Blackmore's understanding of Newtonian physics: the law of universal gravitation involves at least two bodies and when a more complex system of entities comes into play, the motion of each body depends on the reciprocal interaction of those bodies.

Another debt *Creation* probably owes to Newton, or at least to Newtonian astronomy, is Blackmore's idea of the cosmos at large. The poet describes the universe as a compound of thousands of systems like the solar one, and galaxies like the Milky Way, and mentions the interplanetary space as filled with "liquid sky" (*Creation*, 2.535) or "ether" (*Creation*, 2.546). In the *Opticks*, Newton had theorised the existence of a matter filling the empty cosmic space as being responsible for several optical phenomena (*Opticks*, 324-5). Although briefly and superficially, Blackmore also refers to

> […] Comets, which in *Ether* stray,
> Yet constant to their Time, and to their Way;
> Which Planets seem, tho' rarely they appear,
> Rarely approach the radiant Sun so near,

That his fair Beams their Atmosphere pervade,
Whence their bright Hair and flaming Trains are made,
Would not this View convincing Marks impart
Of perfect Prudence, and stupendous Art?
(*Creation*, 2.546-53)

Newton studied the periodic motion of comets in Book III of the *Principia* as a case in point of the action of universal gravitation; he also theorized that their luminosity was due to their ability to reflect sunlight. Newton's work on comets and on how to calculate their orbit was cutting-edge (cf. Hughes 1988) and Blackmore included it in his account of the Newtonian universe.

As we have seen, Newton's presence in *Creation* is ubiquitous but latent; on one occasion he is explicitly mentioned as the chief among "[t]he Masters form'd in Newton's famous School" (*Creation*, 2.554). Blackmore commends Newton for fathering the leading school of thought in modern science especially because of its power of accounting for natural phenomena through mathematical laws. Blackmore then proceeds to explain how the force of gravity works between bodies, which are at a time attracting and attracted by each other proportionally to their masses:

That Matter is with active Force endu'd,
That all its Parts Magnetic Pow'r exert,
And to each other gravitate, assert.
While by this Pow'r they on each other act,
They are at once attracted, and attract.
Less bulky Matter therefore must obey
More bulky Matter's more engaging Sway;
By this the Fabrick they together hold,
By this the Course of Heav'nly Orbs unfold.
(*Creation*, 2.559-67)

Here Blackmore explains the force responsible for keeping the universe together and the planets in their respective orbs in pure Newtonian terms. Although the initial stress is placed on the mathematical certainty of this fundamental discovery, Blackmore finds the true strength of Newton's physics in the combination of the mathematical solidity of the theory of gravitation with the awareness that the ultimate cause of the regular arrangement of the universe is to be attributed to God. This a typically providential belief that Blackmore embraces in all his works. It was the combination of science and faith that can be found in Newton's *Principia* that probably appealed to the physician in the first place. It should be noted that Newton is the only natural philosopher to be extensively praised by Blackmore in the poem, much beyond all other scientists of the age.

5 Conclusion

Since Newton was very much alive and in the prime of his publishing career when Blackmore wrote *Creation*, and since both of them frequented the same institutions in London, it is legitimate to inquire whether the two were acquainted. As yet, no document has been found attesting any personal or professional contact between the two men. However, while there is no certainty that he had chances to know Blackmore personally or to read any of his works, considering the content of Newton's library is a good starting point to establish any possible link between the two. John Harrison's *The Library of Isaac Newton* (1978) reveals that Newton might have known Blackmore to some degree since he possessed a copy of the eight edition of his *Essays upon Several Subjects* (1716-17). The lack of evidence of any personal connection between the two might have been due to Newton's lack of interest in Blackmore's poetry and in poetry in general. It is common knowledge that Newton held quite an extreme position when it came to the value of poetry, which he considered nothing more than "a kind of ingenious nonsense" (Shapiro 1983, 259). The content of Newton's library however confirms that he was at least aware of Blackmore as a writer of popular literature. Blackmore's letters have not survived the test of time and in Newton's correspondence there is no mention of the physician, hence there is no evidence of actual links between the natural philosopher and the poet-physician. On the other hand, there is enough internal evidence in Blackmore's *Creation* allowing us to say that not only was he acquainted with Newton's scientific discoveries but that he also digested and applied them to his own poetic description of the universe and of its laws. *Creation* successfully summarised several of the contemporary ideas about the universe and human beings and, although some scholars consider *Creation* "a noble failure" (Rogers 2016, 324), Blackmore's poem worked successfully as a poetic adaptation of Newton's discoveries and held enormous prestige throughout the century, becoming the source and model of numerous later poetic works that combined scientific and religious issues.

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