

# The Theology of Isaac Newton's *Principia Mathematica*: A Preliminary Survey

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LORD, thou hast been our dwelling place in all generations.  
Before the mountains were brought forth,  
or ever thou hadst formed the earth and the world,  
even from everlasting to everlasting, thou art God.  
Psalm 90:1–2 (KJV)

## I. *The theology of the Principia: opening questions*

This paper provides a preliminary survey of the theology of Isaac Newton's *Principia mathematica*, first published in 1687 and later printed in revised and expanded second and third editions in 1713 and 1726.<sup>1</sup> With only one direct reference to God and a single mention of the Bible, the first edition of Newton's *Principia* may have struck many contemporaries as an oddly secular work. Even the mechanical philosopher René Descartes' *Principles of philosophy* (1644) contains numerous references to God and his activity in the world. From the vantage point of today, as well, it may seem that God and theology do not impinge in any significant way on the thought-world of the *Principia*. There is after all more explicit theology in Charles Darwin's *Origin of Species* (1859) than in the first edition of Newton's great work. In fact, there is in popular culture a common belief that Newton's physics makes God superfluous. Did not Newton's work inevitably lead to that famous moment over a century later when the French physicist Pierre-Simon de la Place told Napoleon (who had asked him why his work did not mention God when Newton's did): "Sire, I have

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<sup>1</sup> This paper was presented twice at conferences prior to this publication. First, at the Newton in the Pursuit of the Secrets of God and Nature conference held at the Van Leer Institute, Jerusalem, Israel (17 June 2007). Second, at a one-day IHSPT Workshop on Science and Religion entitled How Much Religion Tolerates Science?, held by the Toronto School of Theology, Toronto, Ontario (9 February 2010). I benefited from feedback at both these events and thank all those who offered comments and advice. I am also grateful to Yiftach Fehige for asking me to speak at the IHPST workshop as well as to the editors of this journal for inviting me to contribute this paper. In addition, I would like to offer my gratitude to Mordechai Feingold of Cal-Tech for encouraging me to tackle the theme of this study and then for offering incisive criticism and advice. Thanks are also due to Scott Mandelbrote and Jeff Wigelsworth for additional criticism and advice. The conclusions of this paper are of course mine alone. Finally, as this is a preliminary survey, I welcome comments and criticism. There is much more work to be done.

no need of that hypothesis”?<sup>2</sup> The belief that Newton invented a ‘clockwork universe’ that was initially created by God and then left to tick away on its own, or that this mechanical cosmos implies that God is not really necessary to begin with, appears to be firmly entrenched in the popular imagination. The *Principia* is a work of physics that brilliantly presents the three laws of motion and the inverse-square law; what does all of this have to do with theology? Certainly, works of physics today do not also present theology. All of these considerations may suggest that a paper that proposes to speak about the theology of Newton’s *Principia* will either be very short or involve strained apologetics.

Yet we now know that Newton produced a substantial body of theological writings and that he devoted close to six decades to a passionate study of the Bible, theology, prophecy, church history and natural theology. Newton’s theological papers total a minimum of two and a half million words and constitute the single largest category in his manuscript corpus. Recent scholarship has shown that Newton not only did not invent a clockwork universe, but that his theological cosmology opposed such a conception.<sup>3</sup> The popular culture understanding of ‘Newton’s clockwork universe’ is no mere exaggeration; it is in a certain sense the inverse of the truth. Given the apparent conflicting information about Newton’s science and his religion (very little religion in his public science, but a great deal of it in his private writings), one could propose various models for explaining the relationship between the two. First, one could claim that Newton was some kind of proto-positivist, that is, that he adhered to the methodological, epistemological and motivational separation of science and religion. One could also argue that Newton, while being a pious believer, nevertheless embraced an early

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<sup>2</sup> Laplace had come to this conclusion because he believed that through more precise physics he had eliminated the irregularities in the cosmos that were one reason why Newton concluded that God must continue to intervene to set the planets and other celestial bodies back on course. History has repeated itself. A flurry of publicity in early September 2010 just prior to the publication of the book *The Grand Design* by Stephen HAWKING and Leonard MLODINOW announced that this book claimed that modern physics made God redundant and that Newton’s belief that God must have created the universe had been superseded. The news reports treated this as a new thing, but in fact Hawking and Mlodinow were two centuries late. Theology – including theological understandings of the cosmos – survived the Laplacean moment. This will also undoubtedly be true of the assertion of Hawking and Mlodinow. This is not to say that appeals to God and Newton do not make good sense when marketing a book on cosmology and the universe.

<sup>3</sup> Edward B. DAVIS, “Myth 13. That Isaac Newton’s Mechanistic Cosmology Eliminated the Need for God”, in *Galileo Goes to Jail and Other Myths about Science and Religion*, ed. Ronald L. NUMBERS (Cambridge, MA: Harvard University Press, 2009), 115–122; *idem*, “Newton’s rejection of the ‘Newtonian worldview’: the role of divine will in Newton’s natural philosophy,” in *Facts of Faith and Science. Vol. 3: The Role of Beliefs in the Natural Sciences*, ed. Jitse M. VAN DER MEER (Lanham, MD: University Press of America, 1996), 75–96. See also Stephen D. SNOBELEN, “The myth of the Clockwork Universe: Newton, Newtonianism and the Enlightenment”, in *Decoding the Enlightenment*, ed. Chris L. FIRESTONE and Nathan JACOBS, forthcoming.

form of methodological naturalism and because of this did not raise theological issues when studying optics, physics and cosmology. Second, some, even before Auguste Comte laid the foundations for the positivistic view of the history of science, suggested that Newton turned to theology only after a mental breakdown or in old age. Given the unavoidable evidence that Newton did produce theological writings, including sincere writings on apocalyptic biblical prophecy (for many, the polar opposite of science), one could argue that such writings are the product of Newton's dotage and came later than his great works of science, the 'holiness' of which are thus protected from the 'blasphemy' of theology. Third, one could simply conclude that Newton's theology is a product of his time and is therefore not particularly noteworthy. If Newton were alive today, one could argue, he would surely be a secular thinker – for brilliant thinkers are certainly not also religious thinkers. Fourth, perhaps Newton's theological understanding of his physics is merely post-*Principia* justification. On this view, Newton's theology would sit lightly on the *Principia* as pious reflections or a kind of rhetorical flourish, but not much more. Is it not true that the young clergyman Richard Bentley managed to elicit natural theological reflections on the *Principia* from Newton a half-decade after the book's publication? Perhaps this cleric turned Newton's attention to matters he had neglected before. Fifth, one might want to argue that there is *partial* integration or at least certain points of contact between Newton's theology and his physics. Sixth, one could go to the other extreme from the first possibility and contend that in Newton's thought there is a full, undifferentiated unity between the science and religion at the methodological, epistemological and motivational levels. These are not the only possibilities, but they do help capture the range of options proposed by various observers, commentators and scholars over the past two centuries.

In 1969, the eminent Newton scholar I. Bernard Cohen published a paper in which he argued that "Newton's concern with God and with the Divine Providence was a continuing feature in all editions of his *Principia*".<sup>4</sup> His paper also showed that there was more theology behind the first edition of the *Principia* than previously assumed. This paper, although perhaps not intended to be so, was a major step forward in the understanding of the theological dynamics bound up in Newton's natural philosophy. Cohen backed up his claims with an impressive familiarity with the manuscript drafts of the *Principia*.<sup>5</sup> I first read Cohen's paper while still an un-

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<sup>4</sup> I. Bernhard COHEN, "Isaac Newton's *Principia*, the Scriptures, and the Divine Providence", in *Philosophy, Science, and Method: Essays in Honor of Ernest Nagel*, ed. Sidney MORGENBESER, Patrick SUPPES and Morton WHITE (New York: St. Martin's Press, 1969), 523–548 (quotation from p. 523).

<sup>5</sup> Cohen was at the time completing the magisterial critical edition of the text that has served Newton scholarship well for close to four decades. See Isaac NEWTON, *Isaac Newton's Philosophiae naturalis principia mathematica*, ed. Alexandre KOYRÉ and I. Bernard COHEN, 2 vols. (Cambridge: Cambridge University Press, 1972).

dergraduate. The possibilities of his conclusion, along with the rigour of his research, have helped inspired my own work on Newton ever since. For at least two reasons, we can now go further than Cohen did in 1969. Historiographically, it is now much more acceptable to speak about theology informing Newton's natural philosophy, including his physics. But we also have the benefit of more accessible manuscript sources and much more scholarly analysis of that material. Thus, while the echoes of the positivism of early work on Newton's science can still be felt, and even though one still encounters rational reconstructionist and present-centred accounts of Newton that present him as a proto-scientist and that imply that his scientific writings are both the most worthy of study and the most representative of the 'real' Newton – hints of this stance can be found even in Cohen's works on Newton, including those published near the end of his career – a new consensus is emerging that has a more balanced and historically-rooted attitude towards the importance of Newton's theology to his natural philosophy.

One of the first studies to demonstrate that Newton's physics were informed by providentialist and even prophetic conceptions was David Kubrin's 1967 paper "Newton and the Cyclical Cosmos".<sup>6</sup> Frank E. Manuel's 1973 Freemantle Lectures used Newton's theological writings to illuminate both the seriousness of Newton's theology and ways in which this theology may have related to his science.<sup>7</sup> Manuel's work represents the first significant study of the Yahuda collection of Newton's theological papers, which had arrived at the Jewish National and University Library in Jerusalem in the late 1960s.<sup>8</sup> J. E. McGuire's tireless efforts directed towards an understanding of Newton's metaphysics have also revealed the subtle and yet often very profound ways in which Newton's physics were tied up with his theological world view.<sup>9</sup> Through publications and conferences beginning in the 1980s, James E. Force and Richard H. Popkin helped create the contemporary scholarly study of both Newton's theology proper and the relationship between his science and religion. Amongst other things, Force and Popkin argued for the existence of creative synergies between Newton's science and his religion.<sup>10</sup> Nowadays, the best biographies of Newton include sections and chapters dedicated to his theol-

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<sup>6</sup> David KUBRIN, "Newton and the Cyclical Cosmos: Providence and the Mechanical Philosophy", *Journal of the History of Ideas* 28 (1967), 325–345.

<sup>7</sup> Frank E. MANUEL, *The Religion of Isaac Newton* (Oxford: Clarendon Press, 1974).

<sup>8</sup> This institution has since been renamed The National Library of Israel.

<sup>9</sup> Many of the pertinent studies are reprinted in J. E. MCGUIRE, *Tradition and Innovation: Newton's Metaphysics of Nature* (Dordrecht: Kluwer, 1995). McGuire's more recent paper, "The Fate of the Date: The Theology of Newton's *Principia* Revisited", in *Rethinking the Scientific Revolution*, ed. Margaret J. OSLER (Cambridge: Cambridge University Press, 2000), 271–296, is immediately relevant to the present study.

<sup>10</sup> Their most important contribution is FORCE and POPKIN, *Essays on the Context, Nature, and Influence of Isaac Newton's theology* (Dordrecht: Kluwer Academic Publishers, 1990).

ogy.<sup>11</sup> This is in large part a result of the steadily increasing availability of Newton's theological manuscripts since World War Two. Recent television documentaries on Newton have given his theology and theological understanding of science centre stage, even if their tendency to sensationalism is at odds with the sensibilities of the historians who consulted for and were interviewed for these productions.<sup>12</sup> The work of the Newton Project, which is placing professional and searchable transcriptions of Newton's theological papers on the Internet, is bringing this 'new Newton' (who is really just the authentic 'old Newton') to the world in the early twenty-first century.

Despite the recent flourishing of scholarship on Newton's theology, we still have an imperfect idea of the ways in which Newton's theology played a role in the conceptualisation and composition of the *Principia mathematica*. Certainly, the *General Scholium* that Newton appended to the second edition and revised for the third edition, complete with its discussions about natural theology, divine design and the person and attributes of God, makes regular appearances in the relevant scholarly literature. Much of its theology and natural theology is overt and obvious and for this reason its content is not a focus of this paper.<sup>13</sup> Similarly, the natural theological apologetics in Roger Cotes' preface to the second edition of 1713, while itself worthy of study and contextualisation, is not controversial insofar as it is on open display. Still, it is easy for observers to conclude that these features of the second and third editions of the *Principia* are superadditions that serve to frame the intervening physics in a theological way but are not integral to it and are perhaps even at variance with its true 'essence'. Instead, this paper attempts to determine – in a preliminary fashion – the extent to which theology is present in the first edition of 1687 and in the main body of the work in the second and third editions and thus part of the vision of the work as a whole.<sup>14</sup> It also examines this theology in the context of Newton's thought before and after 1687. The answers to these historical chal-

<sup>11</sup> This includes popular biographies that reach a wider audience. See Rob ILIFFE, *Newton: A Very Short Introduction* (Oxford: Oxford University Press, 2007) and James GLEICK, *Isaac Newton* (New York: Pantheon Books, 2003), the first written by a respected Newton scholar and director of the Newton Project and the second by a popular science writer.

<sup>12</sup> The two most notable are the 2003 BBC 2 production *Newton: The Dark Heretic* and the 2005 Nova special *Newton's Dark Secrets*.

<sup>13</sup> Besides, I have already treated this subject in a previous paper and thus do not need to rehearse the details here. See SNOBELEN, "'God of Gods, and Lord of Lords': the theology of Isaac Newton's General Scholium to the *Principia*", *Osiris* 16 (2001), 169–208.

<sup>14</sup> Compare my earlier work on the theology of the *Opticks*: SNOBELEN, "'La Lumière de la Nature': Dieu et la philosophie naturelle dans l'*Optique* de Newton", *Lumières* 4 (2004), 65–104. See also my more general treatments of Newton's science and religion: SNOBELEN, "'The true frame of Nature': Isaac Newton, Heresy and the Reformation of Natural Philosophy", in *Heterodoxy in Early Modern Science and Religion*, ed. John BROOKE and Ian MACLEAN (Oxford: Oxford University Press, 2005), 223–62 and *idem*, "'To Discourse of God: Isaac Newton's Heterodox Theology and His Natural Philosophy'", in *Science and Dissent in England, 1688–1945*, ed. Paul B. WOOD (Aldershot, Hampshire: Ashgate, 2004), 39–65.

lenges should also help explain how the various disciplines in which Newton worked ultimately constituted for him “the great ocean of truth”.<sup>15</sup>

To direct this preliminary survey, this paper asks five questions. Did Newton have a *considered* theological conception of “the system of the world” prior to and during the composition of the *Principia*? Do theology and natural theology sit lightly on the *Principia*? Was there a ‘theological turn’ in Newton’s natural philosophical thought after 1687? Are natural theological readings of Newton’s great work merely a hopeful post-*Principia* gloss by the author and his followers? Are theology and natural theology integral to the *cognitive content* of the *Principia* or are they best described as *corollaries* or *inferences* of the physics therein? What follows is an outline of some of the available evidence that will inform our tentative answers to these questions.<sup>16</sup>

## II. *The theology of the Principia: an afterthought?*

When Richard Bentley was revising his 1692 Boyle Lectures for publication,<sup>17</sup> he desired to use Newton’s recently-published *Principia* to bolster his natural theological apologetics. For this purpose he sought the advice of the author. In his reply to Bentley’s initial letter, Newton began:

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<sup>15</sup> Here I allude to the famous anecdote that Joseph Spence obtained from Andrew Michael Ramsay, who may well have received it from Newton himself either directly or indirectly (and possibly through Samuel Clarke): “Sir Isaac Newton, a little before he died, said, ‘I don’t know what I may seem to the world, but as to myself, I seem to have been only like a boy playing on the sea-shore and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me’” (SPENCE, *Observations, Anecdotes, and Characters of Books and Men Collected from Conversation*, ed. James M. OSBORN, 2 vols. [Oxford: Clarendon Press, 1966], 1:462). Most, I think, will grant that the ocean of truth did not lay *entirely* undiscovered at the end of Newton’s career.

<sup>16</sup> The answers must for the time being remain tentative as my own research on this subject is not complete and in any case the full body of the relevant manuscripts is still not conveniently accessible. And even where the evidence is available, I have not been side to include all of it in this preliminary survey. I fully expect to refine and, in certain ways at least, both amend and expand my arguments and conclusions. For instance, greater clarification is needed on what precisely theology and natural theology meant to Newton and his contemporaries and, additionally, how much of Newton’s theology and natural theology was original, how much reveals reflexivity with contemporary debates and so on. More attention also needs to be paid to the contextualisation of Newton’s various theological manuscripts. Additionally, although advances have been made in the dating of these manuscripts, in many cases we are still limited to general estimates – and some of these estimates (especially the pre – 1687 examples) are crucial to the conclusions of this study. This study remains both preliminary and descriptive.

<sup>17</sup> Richard BENTLEY, *A Confutation of Atheism from the Origin and Frame of the World. The Third and Last Part. A Sermon Preached at St Mary-le-Bow, December the 5th 1691* (London, 1693). Bentley’s published Boyle Lectures are available on the website of The Newton Project ([www.newtonproject.sussex.ac.uk](http://www.newtonproject.sussex.ac.uk)).

When I wrote my treatise about our System, I had an eye upon such Principles as might work with considering men for the belief of a Deity and nothing can rejoice me more than to find it useful for that purpose. But if I have done the public any service this way 'tis due to nothing but industry and a patient thought.<sup>18</sup>

Thus, if we take Newton at this word, he had all along intended his *Principia* to serve natural theological ends. Newton went on to offer some examples of what he believed to be design in the constitution of the cosmos. On the distinction between shining and opaque bodies in the heavens, Newton wrote: "I do not think [this is] explicable by mere natural causes but am forced to ascribe it to the counsel and contrivance of a voluntary Agent".<sup>19</sup> And there is more:

To make this system therefore with all its motions, required a Cause which understood and compared together the quantities of matter in the several bodies of the Sun and Planets and the gravitating powers resulting from thence [...] [a]nd to compare and adjust all these things together in so great a variety of bodies argues that cause to be not blind and fortuitous, but very well skilled in Mechanics and Geometry.<sup>20</sup>

For Newton, the orderly motions of the sun and planets in the solar system pointed to a Designer: "[...] the diurnal rotations of the Sun and Planets as they could hardly arise from any cause purely mechanical, so by being determined all the same way with the annual and menstrual motions they seem to make up that harmony in the system which [...] was the effect of choice rather than of chance".<sup>21</sup> In 1692, therefore, Newton was happy to point to the natural theological utility of his *Principia*. But had Newton thought this way when he was writing his great work or had the probing questions of an earnest young clergyman awakened in him an awareness of this pious potential? Or ought one to be cynical and point out that this is precisely the sort of thing an embarrassed author would say to a clergyman about a book that barely mentioned God?

Many years later William Whiston – Newton's natural philosophical disciple, successor to the Cambridge Lucasian Chair of Mathematics and eventual convert to Newton's heretical theology – spoke of a conversation he had had with Newton sometime between the publication of the first and second editions of the *Principia*:

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<sup>18</sup> Newton to Bentley, 10 December 1692 (first letter), *The Correspondence of Isaac Newton*, ed. H. W. TURNBULL (Cambridge: Cambridge University Press, 1961), 3:233. I have modernised the spelling of these transcriptions. The extant Bentley-Newton correspondence can be found in TURNBULL, *Correspondence of Newton* (cf. above, n. 18), 3:233–41, 244–45, 246–256. Professional transcriptions of the Bentley-Newton correspondence of 1692–1693 can also be accessed on The Newton Project website.

<sup>19</sup> Newton to Bentley, 10 December 1692, TURNBULL, *Correspondence of Newton* (cf. above, n. 18), 3:234.

<sup>20</sup> Newton to Bentley, 10 December 1692, TURNBULL, *Correspondence of Newton* (cf. above, n. 18), 3:235.

<sup>21</sup> Newton to Bentley, 10 December 1692, TURNBULL, *Correspondence of Newton* (cf. above, n. 18), 3:236.

I well remember [...] that when I early asked him, Why he did not at first draw such Consequences from his Principles, as Dr. *Bentley* soon did in his excellent Sermons at Mr. *Boyle's Lectures*; as I soon did in my *New Theory*; and more largely afterward in my *Astronomical Principles of Religion*; and as that Great Mathematician Mr. *Cotes* did in his excellent *Preface* to the later Editions of Sir *I.N.'s Principia*: I mean for the advantage of Natural Religion, and the Interposition of the Divine Power and Providence in the Constitution of the World; His answer was, that 'He saw those Consequences; but thought it better to let his Readers draw them first of themselves.' Which Consequences however, He did in great measure draw himself long afterwards in the later Editions of his *Principia*, in that admirable *General Scholium* at its Conclusion; and elsewhere, in his *Opticks*.<sup>22</sup>

If we accept both the authenticity of Whiston's testimony (which I am inclined to do) and the honesty of Newton's explanation (which is what is in question here), Newton is saying that he saw the natural theological implications of his great work *at the time of its composition*. If true, this is significant testimony. Even still, it falls short of an acknowledgement by the author that he had intentionally included natural theological argumentation in the work.

Now, Newton's response to another earnest and pious disciple could be still construed either as an attempt to please an acolyte or as an *ex post facto* theological reading of the text – or both. In this regard it is surely relevant that Whiston had published in 1696 a work of theology, natural theology and theological cosmogony that makes full use of Newtonian principles of physics for these ends and opens with a note of praise to Newton himself.<sup>23</sup> This early example of theological use of the *Principia* can be added to Bentley's published Boyle Lectures from a three years before and could be seen as evidence of a discerning reading drawing out the theological implications "of themselves". Nevertheless, as Cohen put it in his 1969 paper:

Because the General Scholium was written only in 1712–1713 for the second edition of the *Principia* and did not appear in the first edition in 1687, and because the Queries of the *Opticks* dealing with God are not part of the first edition of 1704, there appears at first glance to be some possible justification for the view advanced by [Jean-Baptiste] Biot and [Pierre-Simon de] Laplace in which Newton's concern with religious questions is referred to a late period in his life.<sup>24</sup>

<sup>22</sup> William WHISTON, *A Collection of Authentick Records* (London, 1728), II, 1073–1074. After Newton's death, Whiston republished the natural theological material from Newton's *Principia* and *Opticks*, along with a passage from Cotes' preface to the *Principia* of 1713 and a relevant quotation from Newton's *Chronology of Ancient Kingdoms Amended* (1728), in WHISTON, *Sir Isaac Newton's Corollaries from His Philosophy and Chronology, in His Own Words* [London, 1728]. Another edition was published in 1729.

<sup>23</sup> William WHISTON, *A New Theory of the Earth, from the Original, to the Consummation of All Things. Wherein the Creation of the World in Six Days, the Universal Deluge, and the General Conflagration, as Laid out in the Holy Scriptures, Are Shewn to be Perfectly Agreeable to Reason and Philosophy* (London, 1696). Whiston claimed both that Newton helped edit the book and that the approved of its contents. See WHISTON "Memoirs of the life and writings of Mr. William Whiston" 2nd ed., 2 vols. (London, 1753), I: 38 and *idem*, *A vindication of the new theory of the earth from the exceptions of Mr. Keill and others*, (London, 1698), sigs. A5r-v.

<sup>24</sup> COHEN, "Isaac Newton's *Principia*, the Scriptures, and the Divine Providence" (cf. above, n. 4), 523.

The addition of the *General Scholium* – more than half of which is devoted to theological and natural theological themes – to the second edition of the *Principia* is commonly seen to point to a turn to theology and even a transgression of some kind of proto-scientific methodological naturalism in the first edition. Stanley L. Jaki's account is typical:

Nothing showed so much the methodological independence of a fully fledged science from theology as the complete absence of any reference to God in the first edition of Newton's *Principia* (1687). Newton [...] contradicted that independence when he invoked, in the General Scholium that he added to the second edition of the *Principia* (1713), the Pantokrator as the all-powerful, infinitely dynamic Creator described in the Bible. Moreover, that Pantokrator is pictured as intervening periodically in the workings of the solar system so that it may stay in equilibrium.<sup>25</sup>

Jaki is right to speak of the powerful, biblical God of the *General Scholium*. But is he right to intimate that this same powerful, biblical God is completely absent from the first edition? Clearly, if Jaki is wrong, some kind of evidence that corroborates Newton's claims to Bentley and Whiston of authorial intention is needed. Was theology present with the *Principia* all along? Did Newton come to realise the theological utility of this book only afterward and in part due to the earnest promptings of the young reverend Bentley? Or does the truth lay somewhere between these two possibilities?

### III. *Theology and natural theology in the Principia (1687)*

With only one direct reference to God and one clear allusion to the Bible in the first edition of the *Principia*, the heading of this section may appear overly optimistic. Yet although it is true that there is only one direct reference to God and one clear allusion to the Bible in the first edition of the *Principia*, there is more theology in the *Principia* than these bare facts suggest, as I will now begin to argue. So, just how much theology might a careful survey of the first edition of the *Principia* reveal? First, a truly thorough survey should include the front matter. Prominent in the front matter is Edmund Halley's Latin *Ode to Newton*, written in a Classical guise, replete with Classical allusions and characterised by a Lucretian tone. It opens:

Behold the pattern of the heavens, and the balances of the divine structure.  
Behold Jove's calculation and the laws  
That the creator of all things, while he was setting the beginnings of the world,  
would not violate;  
Behold the foundations he gave to his works.<sup>26</sup>

<sup>25</sup> Stanley L. JAKI, "God, Nature, and Science", in *The History of Science and Religion in the Western Tradition: An Encyclopedia*, ed. Gary B. FERNGREN (New York: Garland Publishing, 2000), 48.

<sup>26</sup> Edmund HALLEY, *Ode to Newton*, in Newton, *The Principia: Mathematical Principles of Natural Philosophy*, a new translation by I. Bernard COHEN and Anne WHITMAN assisted by Julia BUDNEZ (Berkeley: University of California Press, 1999), 379.

There is much more in the same vein. This is theology, even if largely that of the pagan and polytheistic Hellenes. But it is not just Classical Greek theology. Might there be hints in these lines to the opening verses of Job 38? Even if not, the allusion to Moses later in the Ode cannot be denied. Halley writes that “He who commanded us by written tablets to abstain from murder,/Thefts, adultery, and the crime of bearing false witness”,<sup>27</sup> along with the ones who first built walled cities, introduced agriculture, pressed wine from grapes and invented writing, “[e]xalted the human lot less, inasmuch as he was concerned with only a few comforts of a wretched life,/And thus did less than our author for the condition of mankind”.<sup>28</sup> Halley’s suggestion that Newton was greater than Moses might have been considered unorthodox, but it is still an allusion to the Bible and the Decalogue. However, let us remember that this is an *ode* to Newton, a panegyric of praise to the author of the *Principia* that not only contains language that is florid and poetic in nature, but does not come from the book’s author. Nor should we forget the Epicureanism of the Ode and that Halley might not have been the most god-fearing of men. And what did Newton, who seems to have had a voluntarist conception of God, think of the apparently intellectualist language of Halley, who has the Creator creating according to what may be co-existent laws? Even with these caveats, Halley’s Ode contains theological language and a fully exhaustive survey of the theology of the *Principia* should not overlook it.

The next example of explicit theological language in the *Principia* comes near the beginning, in the *Scholium on the Definitions*. This how Newton commences this section:

Thus far it has seemed best to explain the senses in which less familiar words are to be taken in this treatise. Although time, space, place, and motion are very familiar to everyone, it must be noted that these quantities are popularly conceived solely with reference to the objects of sense perception. And this is the source of certain preconceptions; to eliminate them it is useful to distinguish these quantities into absolute and relative, true and apparent, mathematical and common.<sup>29</sup>

This distinction between the absolute and the relative is important to both Newton’s physics and to his thought as a whole. He continues:

Absolute, true, and mathematical time, in and of itself and of its own nature, without reference to anything external, flows uniformly and by another name is called duration. Relative, apparent, and common time is any sensible and external measure (precise or imprecise) of duration by means of motion; such a measure – for example, an hour, a day, a month, a year – is commonly used instead of true time.<sup>30</sup>

<sup>27</sup> HALLEY, Ode to Newton, in Newton, *Principia* (cf. above, n. 26), 380.

<sup>28</sup> HALLEY, Ode to Newton, in Newton, *Principia* (cf. above, n. 26), 380.

<sup>29</sup> NEWTON, *Principia* (cf. above, n. 26), 408.

<sup>30</sup> NEWTON, *Principia* (cf. above, n. 26), 408.

Thus for Newton there is such a thing as absolute time that must be distinguished from relative time. When we speak of a month, this relates to the complete orbit of the moon around the earth. When we speak of a year, this relates to the full circuit of the earth around the sun. And so it is with space:

Absolute space, of its own nature without reference to anything external, always remains homogeneous and immovable. Relative space is any movable measure or dimension of this absolute space; such a measure or dimension is determined by our senses from the situation of the space with respect to bodies and is popularly used for immovable space, as in the case of space under the earth or in the air or in the heavens, where the dimension is determined from the situation of the space with respect to the earth.<sup>31</sup>

Newton's conception here is of an immovable frame of reference against which motion ultimately occurs although we normally conceive of motion in relative terms. Newton's fundamental distinction between absolute and relative space and time is one of the pillars of the *Principia* and is widely recognised.

What is less well known is that Newton applied this same distinction to his theology and scriptural studies and, what is more, that he hints at this in the first edition of the *Principia*:

Relative quantities, therefore, are not the actual quantities whose names they bear but are those sensible measures of them (whether true or erroneous) that are commonly used instead of the quantities being measured. But if the meanings of words are to be defined by usage, then it is these sensible measures which should properly be understood by the terms "time," "space," "place," and "motion," and the manner of expression will be out of the ordinary and purely mathematical if the quantities being measured are understood here. Accordingly those who there interpret these words as referring to the quantities being measured do violence to the Scriptures. And they no less corrupt mathematics and philosophy who confuse true quantities with their relations and common measures.<sup>32</sup>

This reference to the Scriptures in the *Scholium on the Definitions* is the one direct allusion to the Bible in the *Principia* mentioned above. Its significance in the context of the *Principia* will be discussed below. But at this juncture it is important to note that it is this open reference to the Scriptures that Cohen in his 1969 paper demonstrated was dropped from Florian Cajori's 1934 revision of Andrew Motte's 1729 edition of the *Principia* and also showed conclusively to be a reference to the Holy Scriptures rather than writings in a more general sense.<sup>33</sup> In this passage *Sacrae litterae* without question refers to the Bible.

But Newton also openly mentioned God along with the presentation of a natural theological argument later in the first edition of the *Principia*.

<sup>31</sup> NEWTON, *Principia* (cf. above, n. 26), 408–409.

<sup>32</sup> NEWTON, *Principia* (cf. above, n. 26), 413–414.

<sup>33</sup> COHEN, "Isaac Newton's *Principia*, the Scriptures, and the Divine Providence" (cf. above, n. 4), 525–527.

Thus in Proposition VIII, Corollary 5 of Book III, he writes: “God therefore set the planets at different distances from the sun so each one might, according to the degrees of its density, enjoy a greater or smaller amount of heat from the Sun”.<sup>34</sup> This is what today would be called a ‘fine-tuning’ argument. Natural theology was widely accepted and widely promoted by natural philosophers of Newton’s age. One thinks of the works of Robert Boyle and John Ray, to name but two of Newton’s British contemporaries. Thus, the presence of natural theology in the *Principia* should not be surprising. What may be surprising is that there is so little of it – or at least so little of it plainly stated. Another surprise comes in the fact that in the second and third editions Newton removed *Deus* in this passage and replaced it with a passive verb: “The planets, of course, had to be set at different distances from the sun so that each one might, according to the degree of its density, enjoy a greater or smaller amount of heat from the sun”.<sup>35</sup> On the other hand, the second and third editions are by no means bereft of overt natural theology, as the *General Scholium* contains a robust – even if still relatively concise – treatment of natural theology about the cosmos encapsulated in the famous line: “This most elegant system of the sun, planets, and comets could not have arisen without the design and dominion of an intelligent and powerful being”.<sup>36</sup> Thus, it could be argued that Newton’s removal of the word ‘God’ from the passage in Book III in the second and third editions is more than compensated for in the language of the *General Scholium*.

But does this editorial amendment suggest that Newton wanted to maintain what we now call methodological naturalism in the main text of his *magnum opus* and segregate his natural theology and theology in the reflections of the appendix that is the *General Scholium* – reflections that are not meant to be integral to the book as a whole? Cohen points out that this possibility “is confuted by the facts, since Newton eliminated the reference to God in this corollary in the interleaved copy of the *Principia* in his personal library, apparently long before he had even contemplated a *General Scholium*”.<sup>37</sup> Cohen also offers a plausible explanation for this early deletion of the reference to God, namely his possible concern about the 1688 review of the *Principia* in the *Acta Eruditorum* pointing specifically to this passage. Cohen suggests: “Newton might very well have concluded that this topic either required a more considerable discussion, perhaps with

<sup>34</sup> ISAAC NEWTON, *Philosophiæ naturalis principia mathematica* (London, 1687), 415. The English translation is adjusted so as to conform to the Cohen-Whitman translation of the third edition of this passage.

<sup>35</sup> NEWTON, *Principia* (cf. above, n. 26), 814 (this statement appears in Corollary 4 of the second and third editions).

<sup>36</sup> NEWTON, *Principia* (cf. above, n. 26), 940.

<sup>37</sup> COHEN, “Isaac Newton’s *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 530.

further examples, or else should not be mentioned at all”.<sup>38</sup> What about another possibility, that God is still in the passive verb and that the *General Scholium* is a declaration of the true significance of the mathematical physics of the work, including the first edition? And, if we take Newton's words to Bentley as sincere, then is it possible that the one example of natural theology was meant as a hint to Newton's readers of how much of the rest of the book could serve the aims of natural theology? We will have occasion to return to these possibilities.

#### IV. *Theology and natural theology before the Principia (1687)*

A strict version of the theory that Newton took a ‘theological turn’ after the publication of the *Principia* in July 1687 would be made plausible by a lack of evidence of serious theological and natural theological writing prior to 1684, when the process of the composition of the book began with the famous challenge from Edmund Halley. So, how far back does Newton's theological work extend? First, it must be stressed that many of the students at Cambridge in Newton's time went on to careers as Anglican clergymen. The Protestant faith of the Bible was a standard part of the upbringing of children at that time and Newton was no exception to this rule. On top of this, Newton's formative years coincided with a period during which Puritan religion was prominent. Thus, a certain amount of sincere religious piety and biblicism on the part of a Cambridge scholar like Newton living when he did is to be expected almost, we might say, by default. We are then looking for something more significant and passionate than common piety (by this I mean that religious faith was common, not that it was homogeneous). And when we look at the decade before the composition of the *Principia* this is precisely what we find.

As part of the requirements for his fellowship at Trinity College, Newton faced a 1675 deadline to be ordained as a clergyman in the Church of England. The evidence suggests that Newton not only did not want to take holy orders, but that he was prepared to resign his fellowship

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<sup>38</sup> COHEN, “Isaac Newton's *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 530. See also *idem*, *Introduction to Newton's 'Principia'* (Cambridge, MA: Harvard University Press, 1978), 154–156. In his discussion here about the *Acta Eruditorum's* mention of Newton's reference to God in Book III, Cohen writes: “It seems likely that Newton had not originally intended to make quite so pronounced a statement about God in the midst of the propositions of Book III; in any event, he regretted having done so and accordingly altered the text in [the second and third editions]” (155). Given that Newton contemplated adding *more* theological material to this very section only a few years after the first edition was published (see my comments on the Classical Scholia below) and that we lack clarifying autobiographical statements of intention, Cohen's assertions that “Newton had not originally intended to make quite so pronounced a statement about God” and that he later “regretted having done so” may be overstatements.

to avoid it. A special dispensation from King Charles II allowed holders of the Lucasian Chair to retain their position even if not ordained.<sup>39</sup> Newton's precise motivations and the exact chain of events that led to the dispensation are somewhat murky, but we can safely rule out the possibility that Newton's evident desire to avoid ordination came from any impiety or incipient secularism – even if, devout though he was, Newton simply may have preferred his public career to be secular. It may well be that Newton's religiously-informed conscience would not allow him to become a clergyman in good faith. This could be explained by Newton's rejection of the doctrine of the Trinity as an unbiblical corruption of the true faith. Even if this was not the particular motivation, sometime in the 1670s, it seems, Newton became a heretic. Evidence of Newton's anti-Trinitarianism can be found in a massive 550-page treatise on the Book of Revelation that Newton appears to have begun writing in the mid-1670s.<sup>40</sup> While it is possible that later portions of this manuscript were composed in the early 1680s, this treatise was either complete or mostly complete before Newton began work on the *Principia*. It hardly needs to be said that the composition of a 550-page commentary on the Apocalypse does not represent ordinary piety.

Although highly significant in itself, this large treatise on biblical prophecy is not the only evidence of Newton's serious commitment to theology prior to the *Principia*. A number of Newton's theological papers date from the 1670s and 1680s, including manuscripts that deal with church history, the creeds, doctrine, prophecy and the Jewish Temple.<sup>41</sup> Three manuscript drafts of what appear to be a sermon suggest that Newton may have delivered a lay sermon at Cambridge around 1676.<sup>42</sup> Such a lay sermon might be dismissed by some as merely evidence of the ordinary or expected piety of a Cambridge scholar, but other evidence cannot. Thus, we know that Newton had intense discussions about the interpretation of the Apocalypse

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<sup>39</sup> Rob ILIFFE, “‘Very accomplished mathematician, philosopher, chemist’: Newton as Lucasian Professor”, in *From Newton to Hawking: A History of Cambridge University's Lucasian Professors of Mathematics*, ed. Kevin C. KNOX and Richard NOAKES (Cambridge: Cambridge University Press, 2003), 86–87; Ian STEWART, “The Statutes of the Lucasian Professorship: A Translation”, in *IBID.*, 462–465.

<sup>40</sup> Isaac NEWTON, National Library of Israel, Yahuda MS 1. Watermarks in the paper used in this manuscript for the most part coincide with watermarks used in Newton's personal correspondence from the mid-1670s. For the tentative dating of Newton's theological manuscripts, see Richard S. WESTFALL, “Newton's Theological Manuscripts”, in *Contemporary Newtonian Research*, ed. Z. BECHLER (Dordrecht: Reidel, 1982), 129–143 and the online manuscript catalogue of the Newton Project, which generally supercedes Westfall's pioneering work.

<sup>41</sup> See the Appendix for a more complete list.

<sup>42</sup> NEWTON, sermon or exposition on 2 Kings 17:15–16 (National Library of Israel, Yahuda MS 21; Babson College MS 437; Harry Ransom Humanities Research Center, University of Texas, Austin, MS 130). The watermarks of Yahuda MS 21 suggest a date around 1676.

at Cambridge in 1680 with Henry More.<sup>43</sup> And then there is Newton's 1680–1681 correspondence with Thomas Burnet on physico-theology and biblical hermeneutics.<sup>44</sup> This correspondence relates to Burnet's *Telluris Theoria Sacra* (1681), which used Cartesian physics to explain sacred history. We know about these exchanges because documentary evidence survives. There may have been others.

Newton's discussions with More were about biblical prophecy whereas his correspondence with Burnet touches on theological and biblical understandings of the history of the earth and the cosmos. But Newton's considerations of the theological dynamics of God's creation of the cosmos date back to his years as an undergraduate at Cambridge. Thus in his undergraduate notebook we encounter the following question: "Whither Moses his saying Genesis 1 that the evening and the morning were the first day etc do prove that God created time. Colossians 1.16 or Hebrews 1.2 τοὺς αἰῶνας ἐποίησεν expounded, he made the worlds, prove that God created time".<sup>45</sup> This comes in a section of his notebook entitled "Of the Creation", which appears after a short entry entitled "Of God" that contains a rudimentary natural theology of animal physiology.<sup>46</sup> "Of the Creation" is followed by a section headed "Of the soul".<sup>47</sup> These sections cannot simply be dismissed as theological reflections that come late in the notebook and that do not have much bearing on the natural philosophical speculations that come earlier and make up the bulk of "Certain philosophical questions". A reference to God and his creation of first matter comes near the beginning of the notebook.<sup>48</sup> In a section called "Of the Sun, Stars and Planets and Comets", Newton quotes Hebrews 1:2. A discussion of the vacuum in a section entitled "Of Violent motion" speaks of God's omnipresence through his spirit.<sup>49</sup> Therefore, even if these notes are driven by his reading, already in his undergraduate years Newton was thinking theologi-

<sup>43</sup> Rob ILLIFFE, "‘Making a shew’: Apocalyptic Hermeneutics and the Sociology of Christian Idolatry in the Work of Isaac Newton and Henry More", in *The Books of Nature and Scripture: Recent Essays on Natural Philosophy, Theology, and Biblical Criticism in the Netherlands of Spinoza's Time and the British Isles of Newton's Time*, ed. James E. FORCE and Richard H. POPKIN (Dordrecht: Kluwer, 1994), 55–88.

<sup>44</sup> Newton to Burnet, *The Correspondence of Newton*, ed. H. W. TURNBULL (Cambridge: Cambridge University Press, 1960), 2:319, 321–334; Scott MANDEL BROTE, "Isaac Newton and Thomas Burnet: Biblical Criticism and the Crisis of Late Seventeenth-Century England", in *The Books of Nature and Scripture*, 149–178.

<sup>45</sup> Query in Isaac NEWTON, "Questiones quædam philosophicæ" ("Certain philosophical questions", c. 1664–1665), Cambridge University Library (hereinafter CUL) Add. MS. 3996, f. 73. This transcription and all other manuscript transcriptions in this paper have been normalised (spelling has been modernised, abbreviations expanded, superscript letters lowered and deletions silently removed).

<sup>46</sup> NEWTON, CUL Add. MS. 3996 (cf. above, n. 45), f. 71.

<sup>47</sup> NEWTON, CUL Add. MS. 3996 (cf. above, n. 45), ff. 74–75.

<sup>48</sup> NEWTON, CUL Add. MS. 3996 (cf. above, n. 45), f. 1.

<sup>49</sup> NEWTON, CUL Add. MS. 3996 (cf. above, n. 45), f. 51.

cally about natural philosophical questions. This is not to say that he always thought theologically about natural philosophical questions, only that he did some of the time at least.

Newton began an intense study and practice of alchemy in the late 1660s, around the time he was appointed Lucasian Professor in 1669. Newton's alchemical manuscripts include discussions about the Creator and his action in the world. Thus, in argument 2 of Newton's early 1670s manuscript "Of Natures obvious laws and processes in vegetation", he writes:

The world might have been otherwise then it is (because there may be worlds otherwise framed then this). 'Twas therefore no necessary but a voluntary and free determination that it should be thus. And such a voluntary [cause must bee a God]. Determination implies a God. If it be said the world could be no otherwise than 'tis because 'tis determined by an eternal series of causes, that's to pervert not to answer the first prop: For I mean not that the – {world} might have been otherwise notwithstanding the precedent series of causes, but that the whole series of causes might from eter[n]ity have been otherwise here, because they may be otherwise in other places.<sup>50</sup>

But this was a private manuscript. Another document that is related to "Of Natures obvious laws and processes in vegetation" is Newton's 1675 "An Hypothesis explaining the Properties of Light, discoursed of in my several Papers". Although not published in his lifetime, it was read at the Royal Society in late 1675 and early 1676 and thus exposed to the scrutiny of others. In this paper about the nature of light that also contains hints of alchemical language Newton ventures into theological language. He also speaks about an hypothesised aether and his speculations about this include the following:

Perhaps the whole frame of Nature {may be nothing but aether condensed by a fermental principle} [may be nothing but various Contextures of some certain æthereal Spirits or vapours condensed as it were by præcipation, much after the manner that vapours are condensed into water or exhalations into grosser Substances, though not so easily condensible; and after condensation wrought into various forms, at first by the immediate hand of the Creator, and ever since by the power of Nature, which by virtue of the command Increase & Multiply, became a complete Imitator of the copies set her by the Protoplast]. Thus perhaps may all things be originated from aether.<sup>51</sup>

<sup>50</sup> Isaac NEWTON, Smithsonian Institution, Washington, D.C., Dibner MS. 1031B, in Betty Jo TEETER DOBBS, *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), 266. Dobbs dates the manuscript to "about 1672" (257). This and other examples of Newton's alchemical manuscripts can also be found on the website of The Chymistry of Isaac Newton (<http://webapp1.dlib.indiana.edu/newton/>).

<sup>51</sup> Isaac Newton to Henry Oldenburg, 7 December 1675, *The Correspondence of Isaac Newton*, ed. H. W. TURNBULL (Cambridge: Cambridge University Press, 1959), 1:364 (normalised transcription). This letter, along with the "Discourse of Observations" that accompanied it, was read at the 9 December 1675, 16 December 1675, 20 January 1676, 3 February 1676 and 10 February 1676 meetings of the Royal Society of London. The text of this letter was first published in Thomas BIRCH, *The History of the Royal Society of London* (London, 1757), 3:247–305. The words in this excerpt enclosed in braces are found in the original manuscript, but not in the copy in the Register Book of the Royal Society. The words in the excerpt enclosed in square brackets were added by Oldenburg to the original manuscript (TURNBULL,

Here Newton explicitly speaks of a Creator of matter and also appears to speak of the Creator's ongoing involvement in nature's fertility. Later in the same paper Newton writes:

God who gave Animals self motion beyond our understanding is without doubt able to implant other principles of motion in bodies which we may understand as little. Some would readily grant this may be a Spiritual one; yet a mechanical one might be shown, did not I think it better to pass it by. But they that like not this, may suppose Light any other corporeal emanation or an Impulse or motion of any other Medium or æthereal Spirit diffused through the main body of Aether, or what else they can imagine proper for this purpose. To avoid dispute and make this Hypothesis general, let every man here take his fancy.<sup>52</sup>

It is instructive that in 1675 Newton was both thinking about nature in theological terms and that he was happy to acknowledge this in a natural philosophical document of this sort. Also instructive is the way in which ideas in Newton's private writings could make their way into public texts.

From the same period, *De aere et aethere* shows a similar interest in God's creative role. In a statement on the phenomenon of repulsion revealed in experiments, Newton comments:

Many opinions may be offered concerning the cause of this repulsion. The intervening medium may give way with difficulty or not suffer itself to be much compressed. Or God may have created a certain incorporeal nature which seeks to repel bodies and make them less packed together. Or it may be in the nature of bodies not only to have a hard and impenetrable nucleus but also [to have] a certain surrounding sphere of most fluid and tenuous matter which admits other bodies into it with difficulty.<sup>53</sup>

Another example of physico-theological language from before 1687 can be found in Newton's *Commentarium* on the Emerald Tablet (c. 1680–84).<sup>54</sup>

But the most significant evidence of Newton's theological approach to natural philosophy and to his understanding of the cosmos comes in the

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*Correspondence of Newton* (cf. above, n. 51), 1:387 n.1). Newton had asked Oldenburg to add the words enclosed in square brackets in a letter to Oldenburg dated 25 January 1676 (TURNBULL, *Correspondence of Newton* (cf. above, n. 51), 1:414). Whatever their immediate purpose in the letter, the words "the command Increase & Multiply" ultimately come from Genesis 1:22 and 28 (where the expression in the King James Version of 1611 is "Be fruitfull and multiply"). Betty Jo Teeter Dobbs has argued that Newton is using the term "Protoplast" in the first excerpt in the sense of "first former", that is, Creator (DOBBS, *Janus Faces of Genius* (cf. above, n. 50), 107).

<sup>52</sup> Isaac Newton to Henry Oldenburg, 7 December 1675, TURNBULL, *Correspondence of Newton* (cf. above, n. 51), 1:370 (normalised transcription).

<sup>53</sup> NEWTON, CUL Add. MS. 3970 (cf. above, n. 45), ff. 652–653, translated from the Latin by A. Rupert HALL and Marie BOAS HALL, *Unpublished Scientific Papers of Isaac Newton* (Cambridge: Cambridge University Press, 1962), 223. The Halls date the manuscript to c. 1673–1675 (214). Cohen and Westfall suggest that the document was composed "around 1679" (*Newton: Texts, Backgrounds, Commentaries*, ed. I. Bernard COHEN and Richard S. WESTFALL [New York: W. W. Norton, 1995], 34).

<sup>54</sup> NEWTON, King's College, Cambridge, Keynes MS 28, translated from the Latin by DOBBS in DOBBS, *Janus Faces of Genius* (cf. above, n. 50), 276–277. It must be stressed that it is not always possible to be certain about the authorship of some of Newton's theological manuscripts.

manuscript treatise *De Gravitatione et æquipondio fluidorum*. There has been some discussion over the years about the date of composition of this important document, with some early suggestions placing it in the late 1660s or early 1670s, while more recent estimates place it around 1684 – in other words, on the eve of the writing of the *Principia*.<sup>55</sup> Whatever the date, everyone seems to agree that it was written before the *Principia*. *De gravitatione* is an elaborate document that engages with various themes of natural philosophy, including topics immediately relevant to his *magnum opus*. But it also considers God, his sovereignty over nature, his omnipresence and his role as Creator. One of the most remarkable dynamics in *De gravitatione* is the way in which discussions of God and physics blend together so seamlessly. Here is one example in a discussion about space:

Space is an affection of a being just as a being. No being exists or can exist which is not related to space in some way. God is everywhere, created minds are somewhere, and body is in the space that it occupies; and whatever is neither everywhere nor anywhere does not exist. And hence it follows that space is an emanative effect of the first existing being, for if any being whatsoever is posited, space is posited. And the same may be asserted of duration: for certainly both are affections or attributes of a being according to which the quantity of any thing's existence is individuated to the degree that the size of its presence and persistence is specified. So the quantity of the existence of God is eternal in relation to duration, and infinite in relation to the space in which he is present.<sup>56</sup>

In another comment on space somewhat later in the text, Newton asserts that “space is eternal in duration and immutable in nature because it is the emanative effect of an eternal and immutable being”.<sup>57</sup> This manuscript, whether written just before the *Principia* or a decade or more earlier, demonstrates that Newton had developed mature thinking about the theological implications of his natural philosophy, including the nature of space, prior to writing his great work, even though *De gravitatione* is at least part in dialogue with Descartes, who thus asquably helps set the agenda for Newton with respect to some of his theological considerations. *De gravitatione* also helps illuminate aspects of the *Principia*, including portions thereof that go over the same ground as *De gravitatione* but without directly mentioning God and his Providence.

<sup>55</sup> In 1991, Dobbs presented arguments for a date of composition in 1684 or very early in 1685 (DOBBS, *Janus Faces of Genius* (cf. above, n. 50), 143–146). See also MCGUIRE, “The Fate of the Date” (cf. above, n. 9), 271–275.

<sup>56</sup> NEWTON, “De gravitatione”, CUL Add. MS. 4003, in Newton, *Philosophical Writings*, ed. Andrew JANIÁK (Cambridge: Cambridge University Press, 2004), 25. Janiak dates this manuscript as “probably before 1685” (12).

<sup>57</sup> NEWTON, “De gravitatione”, CUL Add. MS. 4003, in NEWTON, *Philosophical Writings* (cf. above, n. 56), 26.

V. *Theology and natural theology after the Principia* (1687)

Roughly a decade (or more) before he began to compose his *Principia mathematica*, Newton had begun to study the Bible, theology, prophecy and church history in earnest. Further back, during his undergraduate years, there is evidence of early interest in theological questions about matter and the Creation. Thus, the theological writing that Newton produced after the publication of his great work does not represent something wholly new. There is instead a great deal of continuity. To give one relevant example, there is in Newton's manuscript corpus a treatise on the Apocalypse that contains portions written in the hands of Newton's amanuensis Humphrey Newton – the same amanuensis who served Newton while he was writing the *Principia*. As Humphrey (apparently no relation to Isaac) served Newton for five years from roughly 1685 to 1690, it is possible that the treatise was composed during the same period during which Newton wrote the *Principia*. At the very least, it was penned only shortly thereafter. The commentary on Revelation from the 1670s demonstrates that this was not the first such work from Newton's hand. The watermark clusters of the first twelve folios of Keynes MS 5, another commentary on Revelation, date to the late 1680s and the early 1690s. One cluster of watermarks (folios 4–6) are the same as those found in paper used in a draft of the *Principia* dating to 1687.<sup>58</sup> A series of other important theological manuscripts date to the late 1680s and early 1690s. These include his Theological Notebook (c. 1684–1690);<sup>59</sup> the *Theologiae Gentilis Origines Philosophicae* (1680s through early 1690s);<sup>60</sup> studies on the Jerusalem Temple (late 1680s to early 1690s);<sup>61</sup> the *Two notable corruptions* (1689–1690);<sup>62</sup> the *Classical Scholia* (early 1690s);<sup>63</sup> the *Paradoxical Questions concerning the morals & Actions of Athanasius and his followers* (early 1690s);<sup>64</sup> *Tempus et locus* (early 1690s);<sup>65</sup> and a detailed 105-page manuscript listing variant readings of the Apocalypse (1693).<sup>66</sup> This does appear to represent a veritable explosion of

<sup>58</sup> For more on this watermark, see Alan E. SHAPIRO, “Beyond the Dating Game: Watermark Clusters and the Composition of Newton's *Opticks*”, in *The Investigation of Difficult Things: Essays on Newton and the History of the Exact Sciences* (Cambridge: Cambridge University Press, 1992), 196.

<sup>59</sup> NEWTON, Keynes MS 2.

<sup>60</sup> NEWTON, Yahuda MSS 16 and 41.

<sup>61</sup> NEWTON, Babson MS 434; Yahuda MS 2.4.

<sup>62</sup> NEWTON, *Correspondence of Newton* (cf. above, n. 18), 3:83–149.

<sup>63</sup> J. E. MCGUIRE and Piyo M. RATTANSI, “Newton and the ‘Pipes of Pan’”, *Notes and Records of the Royal Society of London* 21 (1966), 108–142; Paolo CASSINI, “Newton: The Classical Scholia”, *History of Science* 22 (1984), 1–57.

<sup>64</sup> NEWTON, William Andrews Clark Memorial Library (UCLA) MS \*\*N563M3 P222; King's College, Cambridge, Keynes MS 10.

<sup>65</sup> MCGUIRE, “Newton on Place, Time and God: An Unpublished Source”, *British Journal for the History of Science* 11 (1978), 114–129.

<sup>66</sup> NEWTON, “Variantes Lectiones Apocalypticæ”, Yahuda MS 4.

theological studies and it must be stressed that some of these writings are extensive and the result of voluminous research and painstaking textual scholarship. It may be that this very busy period in theological writing was at least partly spurred on by post-*Principia* hubris or, more mundanely, the desire for additional challenging intellectual projects. But as some of it began in the late 1680s (and some of this apparently overlapped with the composition of the *Principia*) it cannot be explained as a turn to theology that was inspired by, for instance, Richard Bentley's queries.

It would be tedious in a paper of this nature to detail the many examples of theology in these writings that were produced shortly after the publication of the *Principia*. Here we will limit ourselves to a handful of select examples that help illustrate Newton's theological reflections on natural philosophy and how his theology related to his natural philosophy. One extremely revealing conclusion can be found in Newton's *The Original of Religions*:

[...] 'twas one design of the first institution of the true religion to propose to mankind by the frame of the ancient Temples, the study of the frame of the world as the true Temple of the great God they worshipped. And thence it was that the Priests anciently were above other men well skilled in the knowledge of the true frame of Nature and accounted it a great part of their Theology.<sup>67</sup>

In Newton's understanding of the original religion of the ancients, he concluded that ancient temples were models of the cosmos and, importantly, that ancient priests such as the Babylonian *magi* were both priests and philosophers of nature. What is more, for Newton these ancient priests believed that the study of nature was a component of theology, which was thus a broader field. It is hard to resist the conclusion that this account was in Newton's mind not only descriptive of the past but prescriptive of how natural philosophy should be practised in his own day.

In the early 1690s Newton was already contemplating a revised edition of the *Principia*. At this time he composed a series of scholia that he considered adding to the existing work. Because they are replete with Classical allusions and arguments that elements of the physics of the *Principia* had been embraced by ancient Greek philosophers, they are known as the *Classical Scholia*. A variant draft of the scholium on proposition IX reads:

Up to this point I have explained the properties of gravity. I have not made the slightest consideration about its cause. However, I would like to relate what the ancients thought about this [...] Quite apparently the heavens are nearly free of bodies, but nevertheless filled everywhere with a certain infinite *spiritus*, which they called God.<sup>68</sup>

<sup>67</sup> NEWTON, Yahuda MS 41, f. 7r.

<sup>68</sup> NEWTON, Classical Scholia, in Volkmar SCHÜLLER, "Newton's *Scholia* from David Gregory's Estate on the Propositions IV through IX Book III of His *Principia*", in *Between Leibniz, Newton, and Kant: Philosophy and Science in the Eighteenth Century*, ed. Wolfgang LEFÈVRE (Dordrecht: Kluwer, 2001), 241.

Here again Newton is expressing his commitment to the *prisca sapientia*, namely that the ancients had possessed a high level of knowledge that had been lost through subsequent corruption. Proposition IX from the *Principia* reads: “*In going inward from the surfaces of the planets, gravity decreases very nearly in the ratio of the distances from the center*”.<sup>69</sup> This example from the *Classical Scholia* shows that Newton considered inserting additional overt natural theological statements in the main body of his work only a few years after its first publication.

The omnipresent and biblical God of the *General Scholium* who is sovereign over the entire cosmos is already present in Newton's writing long before the second edition of the *Principia* ran through the press in 1713. Other evidence from his earlier manuscripts show that other ideas in the *General Scholium* similarly have deep roots in Newton's thoughts. In a portion of the *General Scholium* where Newton discusses the limited ability of humans to know the nature of God, he states: “*As a blind man has no idea of colors, so we have no idea of the ways in which the most wise God senses and understands all things*”.<sup>70</sup> Newton made a remarkably similar statement in the treatise on Revelation he composed around the same time or shortly after he wrote the *Principia*. The statement comes in a discussion of the nature of the New Jerusalem:

For the new Jerusalem doth not only signify a local city on Earth, but also comprehends mystically the whole assembly of Christ and his Angels with the Saints raised from the dead and reigning with him in heaven. If you ask where this heavenly city is, I answer, I do not know. *It becomes not a blind Man to talk of colours.* Further then I am informed by the prophecies *I know nothing*.<sup>71</sup>

This may seem like a trivial parallel, but it does suggest that a similar kind of phenomenalism about biblical prophecy as that revealed in his attitude to knowledge of God in the *General Scholium* was already operating around the time Newton penned the *Principia*. More substantial is another parallel between language in the *General Scholium* and speculation recorded in Newton's undergraduate notebook in the 1660s (already briefly alluded to above). There he had written: “’tis true God is as far as vacuum extends but he being a spirit and penetrating all matter can be no obstacle to the motion of matter no more than if nothing were in its way”.<sup>72</sup> This can be compared to a conclusion about God's omnipresence found in the *General Scholium*: “*In him all things are contained and move, but he does not act on them nor they on him. God experiences nothing from the motions of bodies; the bodies feel no resistance from God's omnipresence*”.<sup>73</sup>

<sup>69</sup> NEWTON, *Principia* (cf. above, n. 26), 815 (italics in the original). This text comes almost immediately after the example of natural theology found in the *Principia* and discussed above.

<sup>70</sup> NEWTON, *Principia* (cf. above, n. 26), 942. Emphasis mine.

<sup>71</sup> NEWTON, Yahuda MS 9.2, f. 139r. Emphasis mine.

<sup>72</sup> NEWTON, CUL Add. MS. 3996, f. 51 (cf. above, n. 45).

<sup>73</sup> Newton, *Principia* (cf. above, n. 26), 941–942.

Here we see a tentative musing in the undergraduate notebook that is made explicit in the mature thought of the *General Scholium* of 1713. The confident and memorable lines of the theological portion of the *General Scholium* represent a development and elaboration of earlier thinking on theology and are then much more than an afterthought.

While the first edition of the *Principia* contains very little explicit theology, the first edition (1704) of the *Opticks* contains absolutely none. Newton did of course add natural theological and theological ideas to the Queries he began to formulate with the 1706 Latin edition (and it is possible that some of this came from the encouragement of his translator, Samuel Clarke). But Newton apparently did contemplate publishing a preface in the first edition that mentioned in direct fashion God and his relationship to natural philosophy. In his draft *Principles of Philosophy* (c. 1700–1704), he asserted:

One principle in Philosophy is the being of a God or Spirit infinite eternal omniscient omnipotent, and the best argument for such a being is the frame of nature and chiefly the contrivance of the bodies of living creatures. [...] These and such like considerations are the most convincing arguments for such a being and have convinced mankind in all ages that the world and all the species of things therein were originally framed by his power and wisdom. And to lay aside this argument is unphilosophical.<sup>74</sup>

This draft preface for the 1704 *Opticks* brings together several of the themes Newton had begun to develop in his undergraduate notebook and elaborate further in the years immediately after 1687 and that we see discussed in the *General Scholium* and Queries 23 and 31 of the later editions of the *Opticks*: the omnipresence of God, the frame of nature as a powerful argument for the existence of God, the design of animal physiology and, importantly, the belief that the being of God is a principle of natural philosophy. This last position can be compared to the famous conclusion to the theological portion of the *General Scholium*: “to treat of God from phenomena is certainly a part of natural philosophy”.<sup>75</sup> Newton’s intellectual world, including both his natural philosophy and his theology, did not stand still after 1687. There is much development and further elaboration as well as continued originality. But while there appears to have been a quickening in his theological studies in the immediate wake of the publication of the *Principia*, there is no turn to theology. That passion and many of the ideas preexisted this book. And they continued to flourish afterward.

<sup>74</sup> NEWTON, “Principles of Philosophy”, CUL MS. Add. 3970.3, ff. 479r–v, cited in J. E. MCGUIRE, “Newton’s ‘Principles of philosophy’: An Intended Preface for the 1704 *Opticks* and a Related Draft Fragment”, *The British Journal for the History of Science* 5 (1970), 183.

<sup>75</sup> NEWTON, *Principia* (cf. above, n. 26), 943.

VI. *A closer look at the theology in the first edition of the Principia*

It is now time to return to the first edition of the *Principia*. In our first encounter we identified three places where theology is expressed overtly: 1) Halley's Ode (which we deemed to be of less significance), 2) the *Scholium on the Definitions* (which mentions the Scriptures) and 3) in Proposition VIII, Corollary 5 of Book III (which refers to God and natural theology). While this very short list may suggest that theology does not play an important role in the *Principia*, we also encountered other kinds of evidence, namely, theological writing before 1687, a vibrant period of theological writing immediately after 1687 and statements of authorial intention made to Bentley and Whiston that claim that natural theology was all along one of the goals of the book. In addition to these testimonies, there is the evidence of the theology in the *General Scholium* (1713 and 1726) as well as the natural theology and theology added to the *Queries of the Opticks* beginning with the Latin edition of 1706. Nor have I mentioned yet that there was also a great deal of writing on doctrine, prophecy, church history and natural theology during Newton's London years (1696–1727). Given all of the evidence, it does perhaps seem striking that there is so little theology in the first edition of the *Principia*. But have we uncovered all there is to know about the theology of the first edition? No, there is much more.

First, there is an additional reference to God and natural philosophy in Newton's "System of the World" (*De mundi systemate*), the version of Book III that Newton suppressed and did not publish with the first edition.<sup>76</sup> This document appears to have been completed before the end of 1685.<sup>77</sup> In addition to commencing with a brief argument that claims that the ancient philosophers had held to a heliocentric view of the cosmos (which also shows that one of the core ideas of the Classical Scholia was not new to the early 1690s), there is a passage near the beginning that offers a close parallel to the natural theological passage in Book III discussed above. Following an argument that "the remoter planets, for want of heat, have not those metallic substances and ponderous minerals with which our earth abounds" while the planets Venus and Mercury, "as they are more exposed to the sun's heat, are also harder baked, and more compact" that is accompanied by a description of an experiment with mercury, Newton adds this pronouncement:

And why not, if God has placed different bodies at different distances from the sun, so that the degree of heat suitable to its condition, and proper for its constitution? From this consideration it will best appear that the weights of all the planets are one to another as their forces.<sup>78</sup>

<sup>76</sup> The original Latin was printed in 1728 after Newton's death. An English translation appeared the same year.

<sup>77</sup> COHEN, *Introduction to Newton's 'Principia'* (cf. above, n. 38), 113.

<sup>78</sup> ISAAC NEWTON, *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*, ed. Florian CAJORI, 2 vols. (Berkeley: University of California Press, 1962; orig. publ. 1934), 2:566.

Since this argument is so similar to that found in the first edition of the *Principia*, because both examples are followed by a description of the same experiment with heated mercury and because the discursive 1685 “System of the World” is the first draft of the more technical Book III that appeared in the published edition of 1687, it can be treated as an earlier version of the one that made it into print. It thus hardly seems likely that this particular example of natural theology was the result of an impulsive or unguarded act by Newton. He did, after all, allow the theological statement to be published. Moreover, since the material that follows the sentence with the direct reference to God was in the first edition supportive of the natural theological statement of that sentence, then this material is still supportive of natural theology in the second and third editions of the *Principia* even after the removal of the word God.

A closer analysis of Newton’s reference to the Scriptures in the *Scholium on the Definitions* yields further illumination. Recall that Newton had added to his comments about the distinction between absolute and relative time, space, place and motion the following: “Accordingly those who there interpret these words as referring to the quantities being measured do violence to the Scriptures. And they no less corrupt mathematics and philosophy who confuse true qualities with their relations and common measures”.<sup>79</sup> Cohen’s brilliant archival work again provides a clarification from Newton’s unpublished papers. As he demonstrates in his 1969 paper, there is a similar draft of this material in a manuscript fragment from 1685 entitled *De motu corporum in medijs regulariter cedentibus* (“On the motion of bodies in regularly yielding media”). I here cite Cohen’s translation of the original Latin:

It seemed best to explain all these things rather fully so that the Reader might approach the following [material] freed from certain common prejudices and imbued with the distinct concepts of Mechanical principles. It was necessary [*replacing* I have tried], moreover, carefully to distinguish absolute and relative quantities from one another; because all phaenomena depend on absolute quantities, and yet the common people, who do not know how to abstract their thoughts from their senses, always speak of relative quantities, to the point where it would be absurd for either wise men or even for the Prophets to speak otherwise among them.<sup>80</sup>

Thus far the text, while different in wording, generally follows the main points of the published text. But what comes next provides crucial clarifications:

Whence both the Scriptures and the writings of Theologians are always to be understood of relative quantities, and he would be laboring with a gross prejudice who thence [i.e., on the basis of these writings] stirred up disputations about the philosophical [*apparently replacing* absolute] motions [or notions] of natural things. ~~It’s just as if someone should contend that the~~

<sup>79</sup> NEWTON, *Principia* (cf. above, n. 26), 414.

<sup>80</sup> NEWTON, CUL Add. MS. 3965, ff. 23–26, cited in COHEN, “Isaac Newton’s *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 527. The editorial interventions are those of Cohen, who also provides a transcription of the original Latin on p. 535 (n. 24).

Moon in the first chapter of Genesis was counted among the two greatest lights not by its apparent, but by its absolute, magnitude.<sup>81</sup>

Now it becomes clear that what Newton is particularly concerned about is the potential conflict between scriptural accounts of astronomical phenomena and the exacting and mathematical accounts provided by the science of astronomy.<sup>82</sup> Even though this clarification did not make it into the published edition of the *Principia*, this manuscript fragment reveals Newton's meaning. For Newton, such a potential contradiction with astronomy as the description of the sun and moon in Day Four of the Creation account (Genesis 1:14–19) is reconciled once one understands that the Bible here is using relative rather than absolute language. Like Augustine, Calvin and many others before him, Newton believed that the hermeneutics of accommodation allowed scriptural passages about celestial phenomena to be harmonised with the absolute descriptions provided by astronomy. Having produced what by then was arguably the most exacting account of the solar system ever produced and being himself a man of deep, biblical faith, such harmonisations were by no means incidental to Newton. Indeed, he even penned a short treatise that makes direct reference to the *Principia* and explains – with scriptural examples – how such harmonisations can be achieved.<sup>83</sup>

One of the arguments of this paper is that some of the ideas expressed in the *General Scholium* can be dated back to the time of the composition of the first edition of the *Principia* and some even before that. A close reading of the *General Scholium* reveals that Newton in some way associated

<sup>81</sup> NEWTON, CUL Add. MS. 3965, ff. 23–26, cited in Cohen, “Isaac Newton's *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 527. I have added the strike-through that Cohen describes verbally.

<sup>82</sup> As Cohen notes, Whiston understood that Newton's passage in the *Scholium on the Definitions* about the relative sense of the Scriptures was ultimately about reconciling astronomy with biblical passages about celestial phenomena, as Whiston makes this clear in his 1716 English paraphrase of the *Principia*: WHISTON, *Sir Isaac Newton's Mathematick Philosophy more easily Demonstrated* (London, 1716), 37 (COHEN, “Isaac Newton's *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 526).

<sup>83</sup> NEWTON, “An Account of the System of the World described in Mr Newton's Mathematical Principles of Philosophy”, CUL MS. Add. 4005, Sec. 7, ff. 39–42 (cf. above, n. 45). Cohen included a transcription of this manuscript in COHEN, “Isaac Newton's *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 544–548. My own transcription from the original, marked up in XML by my student Micah Anshan, is now available on the Newton Project website. See also SNOBELEN, “Not in the language of Astronomers: Isaac NEWTON, Scripture and the Hermeneutics of Accommodation”, in *Interpreting Nature and Scripture in the Abrahamic Religions: History of a Dialogue*, ed. Jitse M. VAN DER MEER and Scott H. MANDEL BROTE, Vol. 1 (Leiden: Brill, 2008), 1:491–530. Newton here is following the footsteps of men like Johannes Kepler, who, in his introduction to his *Astronomia nova* (1609), presented a forthright case for the reconciliation of heliocentrism with the Bible on the basis of the hermeneutics of accommodation, along with Galileo, whose famous Letter to the Grand Duchess Christian does the same thing in witty and memorable prose.

God's eternal duration and infinite presence with absolute time and space. In the *General Scholium* we encounter the following descriptions of God:

He is eternal and infinite, omnipotent and omniscient, that is, he endures *from eternity to eternity*, and he is present *from infinity to infinity*; he rules all things, and knows all things that happen or can happen. He is not eternity and infinity, but eternal and infinite; he is not duration and space, but he endures and is present.<sup>84</sup>

In this passage, Newton is both saying something profound about God's sempiternality and omnipresence and is explicitly advocating what we call today classical theism in contradistinction to pantheism. In addition, he is presenting conceptions about God that are also found in his theological manuscripts. In Newton's *Twelve Articles on God and Christ* (apparently dating to after 1710) he begins with this statement about God: "There is one God the Father ever-living, omnipresent, omniscient, almighty, the maker of heaven and earth, and one Mediator between God and Man the Man Christ Jesus".<sup>85</sup> This private manuscript also shows that when Newton is writing about the omnipresent God in the *General Scholium*, he is thinking of the Father alone and thus denying the coequality of the three persons of the Trinity – an antitrinitarian element of the *General Scholium* that was missed by most of Newton's contemporaries but can now be confirmed by Newton's private papers.

But this is not all. Like several other lines from the theological portion of the *General Scholium*, in the portion quoted above Newton is alluding to biblical language. The first line in the original Latin reads: *Æternus est & Infinitus, Omnipotens & Omnisciens, id est, durat ab æterno in æternum, & adest ab infinito in infinitum, omnia regit & omnia cognoscit quæ fiunt aut fieri possunt*.<sup>86</sup> There can be no doubt that Newton's descriptions of God's omnipresence are informed by his reading of the Bible. His note on space in the *General Scholium* that comes shortly after this quotation lists eight passages from the Scriptures, including Jeremiah 23:23–4, which expresses the solemn declaration: "Do not I fill heaven and earth, saith the LORD?" (KJV).<sup>87</sup> In particular, it seems likely that this passage from the *General Scholium* is alluding to a description of God found in the Book of Psalms:

LORD, thou hast been our dwelling place in all generations.  
Before the mountains were brought forth,  
or ever thou hadst formed the earth and the world,  
even *from everlasting to everlasting*, thou art God.

Psalms 90:1–2 (KJV)<sup>88</sup>

<sup>84</sup> NEWTON, *Principia* (cf. above, n. 26), 941. Emphasis mine.

<sup>85</sup> NEWTON, Keynes MS 8, f. 1r (cf. above, n. 45).

<sup>86</sup> NEWTON, *Philosophiæ naturalis principia mathematica* (Cambridge, 1713), 483 (italics in the original).

<sup>87</sup> The list of references to biblical passages treating God's omnipresence is slightly fuller in the 1726 edition than in the 1713 edition.

<sup>88</sup> The expression "everlasting to everlasting" also appears in Psalm 41:13 (cf. 93:2). Emphasis mine.

The phrase *ab æterno in æternum* in the *General Scholium* can be translated “from everlasting to everlasting” and it is hard to imagine that Newton – thoroughly conversant with the Scriptures as he was – could not have been thinking of this expression from the Psalms when he penned the relevant line in the *General Scholium*.<sup>89</sup> It is noteworthy that the very first English translation of the theological portion of the *General Scholium* was published by Newton’s follower William Whiston and that Whiston translated the relevant expression using the wording of the KJV: “He is *Eternal*, and *Infinite*, and *Omnipotent*, and *Omniscient*: that is he endures from Everlasting to Everlasting, and is present from Infinity to Infinity”.<sup>90</sup> A few short years later, Whiston used Psalm 90:2 to illustrate his belief that God’s eternity is revealed by nature: “Only we may observe, how agreeable this *Eternity* of God, here gathered from the Light of Nature, is to Divine Revelation, which assures us, that *Before the Mountains were brought forth, or even he had formed the Earth or the World, even from Everlasting to Everlasting He is God*”.<sup>91</sup> Thus it is probable that Whiston would have known that the phrase *ab æterno in æternum* in the *General Scholium* is a quotation from the Psalms. Again, it is hard to imagine that Newton was not consciously using this biblical expression.

Even without explicit proof that Newton is quoting from the Psalms when he uses *ab æterno in æternum*, it is indisputable that this expression is used of God’s eternity and that the accompanying expression *ab infinito in infinitum* is used of God’s omnipresence. It is also indisputable that this is not the first time Newton uses the second expression in the *Principia*. It already appeared in the *Scholium on the Definitions* in the first edition of 1687. It occurs in a passage about absolute space:

Thus, whole and absolute motions can be determined only by means of unmoving places, and therefore in what has preceded I have referred such motions to unmoving places and relative motions to movable places. Moreover, the only places that are unmoving are those that all keep given positions in relation to one another *from infinity to infinity* and therefore always remain *immovable* and constitute the space that I call *immovable*.<sup>92</sup>

<sup>89</sup> As *aeternus* is an adjective, the translation “from everlasting to everlasting” arguably captures Newton’s Latin better than “from eternity to eternity”, which is the phrase used both in the Andrew Motte (1729) and Cohen-Whitman English translations. It also seems likely that Newton would have been thinking of the English of the KJV when composing the Latin phrase.

<sup>90</sup> WHISTON, *Three essays. I. The Council of Nice vindicated from the Athanasian heresy. II. A collection of ancient monuments relating to the Trinity and Incarnation, and to the history of the fourth century of the Church. III. The liturgy of the Church of England reduc’d nearer to the primitive standard. All humbly offer’d to publick consideration.* By William Whiston, M.A. (London, 1713), 30.

<sup>91</sup> WHISTON, *Astronomical Principles of Religion, Natural and Reveal’d* (London, 1717), 111 (italics in original). Whiston uses a slightly altered version of his translation of the *General Scholium* in this work and in it he retains the translation “from Everlasting to Everlasting” (p. 238).

<sup>92</sup> NEWTON, *Principia* (cf. above, n. 26), 412. Emphasis mine.

There were only two entities that Newton believed were immovable. One is absolute space, as just seen. The other was Almighty God, the Father. In his *Twelve Articles on God and Christ* Newton describes the omnipresent God in precisely this way: “The father is immoveable no place being capable of becoming emptier or fuller of him then it is by the eternal necessity of nature: all other being[s] are moveable from place to place”.<sup>93</sup> And ‘immovable’ is not the only expression Newton used of God that appears in the above-quoted passage from the *Scholium on the Definitions*. The original Latin from which “from infinity to infinity” in the *Scholium on the Definitions* is translated is *ab infinito in infinitum*,<sup>94</sup> the very same four words Newton used of God’s omnipresence in the *General Scholium*. It is hard to escape the conclusion that the discussions of absolute space and time in the *Scholium in the Definitions* are informed by Newton’s developing theology of God’s eternity and omnipresence. This, naturally, tied together Newton’s concepts of absolute space and time with his understanding of God’s temporal and spatial perfections. Thus it seems that these theological ideas about space and time were already a part of the structure of Newton’s arguments in the *Scholium on the Definitions* in the 1687 edition of the *Principia*.

Any remaining scepticism about this is put to rest by some deleted words from a draft of the *Scholium on the Definitions* dated from around 1685 that demonstrates that Newton was thinking about God’s omnipresence. Here is the relevant sentence from the Cohen-Whitman translation followed by the deletion along with lacunae filled by Cohen:

It is certainly difficult to find out the true motions of individual bodies and actually to differentiate them from apparent motions, because the parts of that immovable space in which the bodies truly move make no impression on the senses. ~~For only God, who [gives motion to] individual bodies without moving and without being perceived, [can truly distinguish true motions from apparent].~~<sup>95</sup>

Cohen himself saw this example and others like it as evidence of Newton’s occasional lack of discipline:

The very existence of this fragment [...] like the other statements about God we have been presenting here, may serve as a continual reminder of how great the temptation always was for Newton to stray from the strict and narrow path of science and to meander through theological metaphysics.<sup>96</sup>

It is possible to see this cancellation in a somewhat different light. Rather than provide evidence of Newton “straying” from the true path of

<sup>93</sup> NEWTON, Keynes MS 8, f. 1r.

<sup>94</sup> NEWTON, *Principia* (cf. above, n. 26), 8.

<sup>95</sup> NEWTON, *Principia*, (cf. above, n. 26) 414; COHEN, “Isaac Newton’s *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 528 (I have supplied the strikethrough).

<sup>96</sup> COHEN, “Isaac Newton’s *Principia*, the Scriptures, and the Divine Providence” (cf. above, n. 4), 532–533.

science, might it not tell us that theological conceptions were a part of the overall structure of Newton's natural philosophy?

### VII. *The theology of the Principia: preliminary conclusions*

The first edition of Newton's *Principia* contains only the briefest references to theology and natural theology. Yet in the second and third editions Newton added a concise but detailed account of natural theology and theology along with the suggestion that this natural theology and theology relates to his mathematical physics. Curiously, there is a similar pattern in the publication history of the *Opticks*. The first edition of 1704 is even more secular in appearance than the first edition of the *Principia*: it contains no direct references to God, the Scriptures or theology of any sort. Yet, as with the first edition of the *Principia*, draft material shows that he was considering the publication of theological comments in the first edition. And, in another parallel with the *Principia*, theology was added to the later editions of the *Opticks*, starting with the Queries of the 1706 Latin translation *Optice*. There is plenty of evidence from his private manuscripts to demonstrate that Newton was a passionate believer and committed to natural theology. This is not in question. What we do not yet fully understand is why he was not more open about his natural theological commitments in the first editions of both his major works and why even in later editions he is still relatively restrained. We also know that with both books he considered material with theological elements that never made it into editions published in his lifetime. What we see is a pattern where Newton begins with cautious abbreviations and hints of his theological ideas (as in the concluding lines of Query 31 of the later editions of the *Opticks*)<sup>97</sup> and then carefully expands them in later editions, but still refraining from excess or over-exuberance. This is exactly what an observer who only had access to the published works would conclude from an examination of the various editions of both books.

The main purpose of this study is to provide a *description* of the evidence for the presence of theology in the *Principia* and its intellectual context (Newton's thought as a whole). Newton's actual theological *intentions* for the *Principia* are harder to recover and partly for this reason have not formed a major component of this paper. Nevertheless, certain questions about authorial intention inevitably arise. So, why might Newton have chosen not to include much explicit theology in the first edition of the *Principia*? And why does he add the *General Scholium* – more than half of which contains

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<sup>97</sup> See Newton's annotations on his personal copy of NEWTON, *Opticks* (London, 1717), 382, illustrated in *A descriptive catalogue of the Grace K. Babson Collection of the works of Sir Isaac Newton* (New York: Herbert Reichner, 1950), plate between 128 and 129.

profound theological themes – to the second edition of 1713? I do not presume to know the answers to these questions, but some possibilities can be suggested. In general, it seems that Newton chose to adopt a cautious stance and that to a certain extent he practised self-censorship. This is also consistent with what we know of Newton's belief in the esoteric/exoteric divide namely, that esoteric truths should be presented to the public in a limited and cautious way, or not at all. It is also possible that a certain degree of post-*Principia* hubris and greater confidence in his social station help explain the slight retreat from the earlier cautious stance.

We know with increasing accuracy what Newton believed in private about religion. Newton himself knew that he was writing a public work. Publishing a book opens up an author to scrutiny. It seems likely that Newton did not want to reveal much of his deeper theological beliefs to an international readership that, he must have suspected, would scrutinise and criticise the mathematics and physics of his work, never mind any theology published in it. In composing his book, Newton probably did not care to have his theology subjected to minute analysis and, possibly, challenged. It is also worth noting that the *Principia* was going through the press when Newton was directly involved in the political crisis surrounding the attempts of James II to re-Catholicise the English universities. But this is not the only reason for discretion, for Newton was by then a heretic by the standards of the day and thus had to be careful when venturing into theology that he did not give himself away. The more elaborate the theological discussions, the greater the possibility of objection to some of the formulations. A brief mention of the Scriptures and a 'safe' reference to natural theology, Newton may have believed, would not bring him much trouble. There is much evidence that suggests Newton was by nature a cautious man who nevertheless occasionally overcame his reticence. Newton does show more confidence and self-assurance in the second and third editions and in fact already in his revisions of the early 1690s. But this was after the work had begun to prove successful with its readership.

It may also be that the fevered period of composition of the *Principia* did not allow Newton the time to reflect fully on the theological implications of his work. Anyone who has composed a book or essay for publication knows that one generally does not think of everything by the time the writing goes to the press. This will certainly be true of this paper as well. But afterwards, when the rush to print is in the past, there is often time to reflect on and elaborate some of the ideas that are by then in print. We know that Newton did exactly this in the half-decade or so after 1687. It also seems plausible that Newton's realisation of the natural theological utility of the *Principia* grew after its first publication. This realisation was manifestly not a completely new thing, of course, for there is an unambiguous example of natural theology in the first edition, not to mention precursors to some of his later theological and natural theological ideas in writing composed before 1684. Finally, there is the question of genre. To a certain extent, New-

ton invented the genre of which the *Principia* is a representative. But insofar as the *Principia* fit into existing genres of writing, did such works of mathematical physics, mechanics and astronomy require theological dynamics? Or could Newton assume that his readers would understand that a work of natural philosophy was ultimately about God because this was the recognised goal of natural philosophy and thus explicit references of God were not required?<sup>98</sup> But this takes us beyond the scope of this article.

The beginning of Newton's theological understanding of natural philosophy can be explained at least in part by the early encounter as an undergraduate of his Protestant religion of the Bible with first the old sciences of Aristotle and then the new sciences of Kepler, Galileo and Descartes. The Lincolnshire farm boy incorporated these into his preexisting biblical, religious and strongly providentialist world view – a world view that he never lost. What we see in 1687 is a sort of snapshot of where Newton's theology was at that particular moment in the long trajectory of his thought from the mid-1660s until his death in 1727. There was much development of his theology after 1687, but many of the seeds were already sown, some as early as his undergraduate years. Newton's world view was that of a Christian who believed in the Bible, God, Creation and Providence. He was heterodox in his doctrine, to be sure, but his theism was essentially that of Protestantism and included a powerful commitment to the dominion and sovereignty of God. Thus, even if Newton had not expressed himself theologically in the *Principia*, the physics and cosmology of this work would still have formed part of this overarching world view. As it happens, Newton also did express himself theologically in the *Principia*. And this was not merely conventional piety; the reference to the Scriptures relates directly to Newton's views on scriptural hermeneutics and the reference to God comes within a specifically natural theological argument. On top of this contemporary manuscript evidence adds further confirmation of his theistic understanding of the cosmos as well as his conclusion that the physics he developed were not only consistent with this theistic understanding, but also inductively pointed to Creation and divine Providence. At some point that remains undetermined (and perhaps was not even clear to Newton), the author of the *Principia* also came to believe that his work had great natural theological utility. Despite the caution and evident self-censorship, the relative lack of express theology in the *Principia* does not alter the fact that theology is part of the structure of Newton's thought. His theologically-coloured views on absolute and relative time and space help demonstrate this. Even if Newton was exaggerating when he wrote Bentley that he had hoped others would see the natural theological utility of his work and when he similarly told Whiston that he saw the natural theological consequences

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<sup>98</sup> Cf. Andrew CUNNINGHAM, "How the *Principia* Got Its Name; or, Taking Natural Philosophy Seriously", *History of Science* 29 (1991): 377–392.

of the physics of the *Principia*, the manuscript evidence from prior to and during the composition of the work helps show that he was not – at least in general terms – uttering an untruth.

It is now time to return to our five opening questions. First, did Newton have a *considered* theological conception of “the system of the world” prior to and during the composition of the *Principia*? Newton’s notebook *Certain philosophical questions* shows that he was already thinking theologically about the cosmos in the 1660s. His manuscript treatise *De gravitatione*, written before – and perhaps shortly before – the *Principia* reveals mature and sophisticated thinking about the relationship of God to physics and cosmology. The first question therefore can be answered in the affirmative. Second, do theology and natural theology sit lightly on the *Principia*? While a superficial view of the matter may suggest that the answer to this question is yes, Newton’s strong commitment to theology and natural theology before and after 1687, along with manuscript drafts of the first edition of the *Principia*, other manuscript material and of course the *General Scholium* itself, suggest that the answer to the second question is no. Third, was there a ‘theological turn’ in Newton’s natural philosophical thought after 1687? The answers to the first and second questions, based as they are in part on manuscript evidence from before 1687, demonstrate that the answer to the third question is, strictly speaking, no – although it may be accurate to speak of a quickening in his study of theology immediately after 1687. Fourth, are natural theological readings of the Newton’s great work merely a post-*Principia* hopeful gloss by the author and his followers? Although Newton’s letters to Bentley in the early 1690s may at first glance appear to support this conclusion, we now have the benefit of evidence from both the period of the *Principia*’s composition and before. This evidence shows that while Bentley’s prompting may have stimulated and helped to clarify certain ideas on Newton’s part, he was already thinking theologically about physics, cosmology, space and time before and during the writing of his great work. Hence, the answer to the fourth question is no.

Fifth, are theology and natural theology integral to the *cognitive content* of the *Principia* or are they best described as *corollaries* of the physics therein? The answer to this two-part question is, I believe, a qualified yes to the first option. Qualifications are necessary here because while *De gravitatione*, the *Scholium on the Definitions* and the *General Scholium* point to the integration of Newton’s theological ideas with his physics, it would be going much too far to assert that this means that theology informs every sentence, mathematical demonstration and geometrical diagram in the *Principia*. Theology is in the *Principia* explicitly and implicitly here and there and perhaps in places that we have not yet discovered. Christianity is also central to the world view of Newton and most of his contemporaries. This is thus the world view that anchors the world of the *Principia*. This world view includes belief in One God who created and continues to sustain the cosmos. It also includes belief in One God who is

both transcendent over and immanent in the world and, what is more, who establishes and maintains the laws of nature. But this does not mean that every turn of phrase and every concept of mathematical physics in the *Principia* can be explained by or even always illuminated by Newton's theology any more than every turn of phrase and every concept in his theological writings has his physics as a backdrop. I would like to add a sixth question at this point. Is our understanding of Newton's *Principia* enriched and made more complete by an awareness of the theological substrata in the text? In other words, are we missing something important if we neglect the theology of the *Principia*? I hope this paper has convinced the reader that the answer to this question is yes.

There is much work yet to be done on the relationship between Newton's physics and his faith. Some of the relevant manuscripts have not been fully analysed. The Newton Project is still in the process of collecting, transcribing and – in the case of Latin texts – translating Newton's manuscripts. We need to know more about how Newton viewed the relationships between intellectual disciplines. We also lack a wealth of autobiographical material from Newton that might make our work easier. The present study merely represents an early investigation. Nevertheless, this preliminary survey of the theology of Newton's *Principia* suggests some tentative conclusions. First, many of the themes of the *General Scholium* added to the second edition of the *Principia* in 1713 were developed by Newton prior to and contemporary with the composition of the first (1687) edition of the book. Thus, these theological themes cannot all be explained as post-*Principia* metaphysical and theological reflections (or worse, as the result of dotage), nor can they be explained merely as a response to theological and natural philosophical challenges unique to the 1710s. It is true, however, that Newton produced more material on natural theology, including natural theology that impinges on the *Principia*, in the years after 1687. Thus, while on the one hand this suggests that there is a grain of truth in the proposal that Newton took a theological turn after the *Principia*, it is also the case that the composition of the first edition of his *magnum opus* is only roughly one-third the way through his writing career. Nor should it be surprising that Newton's theological thought, as with his natural philosophical work, continued to grow and develop over time.

Second, it is impossible to understand Newton's discussion of the absolute and relative senses of space, time, place and motion found in the *Scholium on the Definitions* (already present in the *Principia* of 1687) without an appreciation for Newton's *theological* ideas about God's omnipresence and eternal duration. Third, an understanding of Newton's prophetic views provides insight into Newton's cosmology as presented in the *Principia* (as shown by Kubrin and others), helping to show that it was ultimately *dynamic* and *open* rather than static and deterministic. Fourth, even if not motivated by ahistorical positivism or rational reconstructionism, attempts to secularise Newton's natural philosophy (including his *magnum opus*) re-

move his work from its context and end up distorting our understanding of Newtonianism as Newton himself saw it. The intellectual context of the *Principia* includes Newton's theological and natural theological explorations. Fifth, the presence of theological themes (including both natural theology and theology proper) in the *Principia* helps shed light on the question of the overall unity of Newton's thought. Despite Newton's respect for disciplinary distinctions and irrespective of his comment that 'religion' and 'philosophy' should be kept distinct,<sup>99</sup> Newton's theology did interact with his natural philosophy in subtle and not-so-subtle ways. Sixth, a more nuanced understanding of the *Principia* will also provide us with a richer and more detailed genealogy of modern science. Seventh, a fully contextualised understanding of Newton's natural philosophy that nevertheless also respects the importance of his physics *qua* physics helps correct modernist and popular notions of the supposed secular, Newtonian 'clockwork universe', thus demonstrating that many contemporary beliefs about Newton are distorted and mistaken.

The Newton historian's enterprise is to strive to represent Newton as he was, not how we want him to be. The availability of Newton's rich corpus of manuscripts has demonstrated that the positivistic and rational reconstructionist interpretations of Newton so common in the twentieth century do not capture the Newton of history, but rather force him into modernist categories. Newton was a natural philosopher, not a scientist. He wrote natural philosophy, not science. When, as Wordsworth put it, his mind was "Voyaging through strange seas of Thought, alone", these seas included mathematics, optics, physics, alchemy, theology, prophecy and chronology. And, for Newton, while these several 'seas' could be explored and charted independently, they were all a part of the same "great ocean of truth".

VIII. *Appendix: Theological Manuscripts Likely Written Before or Around the Time of the Composition of the Principia (1687)*

The Theological Notebook (Keynes MS 2)

*Date:* c. 1684–1690 (handwriting of amanuensis; internal evidence)

Notes from Petavius on the Nicene Council (Keynes MS 4)

*Date:* 1670s

The First Book Concerning the Language of the Prophets (Keynes MS 5, first 12 folios)

*Date:* c. mid-late 1680s (watermarks, including one cluster shared with the *Principia*)

"Twenty-three queries regarding the word ὁμοούσιος" (Keynes MS 11)

*Date:* 1680s

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<sup>99</sup> NEWTON, Keynes MS 6, f. 1r (cf. above, n. 45).

- Untitled treatise on Revelation (Yahuda MS 1)  
*Date:* mostly 1670s, with some sections possibly from 1680s (watermarks)
- Writings on prophecy, church history and the Jewish Temple (Yahuda MS 2)  
*Date:* mostly 1670s and 1680s, with some sheets from 1690s
- Notes from the Church Fathers (Yahuda MS 5.3)  
*Date:* late 1670s
- Treatise on Revelation (Yahuda MS 9)  
*Date:* mid- to late 1680s (handwriting of amanuensis)
- Notes on prophecy (Yahuda MS 10)  
*Date:* c. 1670s–1690s
- Miscellaneous theological notes (Yahuda MS 13)  
*Date:* c. 1670s–1680s
- Theologiæ Gentilis Origines Philosophicæ* (Yahuda MS 16)  
*Date:* c. 1684–1690 (handwriting of amanuensis)
- Notes on the physico-theology of the Ancients (Yahuda MS 17)  
*Date:* 1680s and early 1690s
- Fragment on the history of the Church's apostasy (Yahuda MS 18)  
*Date:* 1680s
- Sermon or exposition on 2 Kings 17:15–16 (Yahuda MS 21)  
*Date:* c. 1676 (watermarks)
- Copies of professions of faith by early Church Councils (Yahuda MS 22)  
*Date:* c. 1684–1690 (handwriting of amanuensis)
- Fragments on Church history (Yahuda MSS 28 and 29)  
*Date:* c. 1675–1685
- Notes on Greek and Roman myth related to the "Origines" (Yahuda MS 33)  
*Date:* 1680s
- Sermon or exposition on 2 Kings 17:15–16 (Babson MS 437)  
*Date:* c. 1676 (*cf.* Yahuda MS 21)
- Questiones quædam philosophicæ* (notebook) (Cambridge Add. Ms. 3996)  
*Date:* early to mid-1660s
- De gravitatione et æquipondio fluidorum* (Cambridge Add. Ms. 4003)  
*Date:* early to mid-1680s? (some date a decade or more earlier; may date from more than one period)
- Sermon or exposition on 2 Kings 17:15–16 (Harry Ransom Humanities Research Center 130)  
*Date:* c. 1676 (*cf.* Yahuda MS 21)
- "Out of Cudworth" (Clark Library, UCLA)  
*Date:* early 1680s

*Notes:* This list is not completely exhaustive and some of the dates remain tentative. Titles and estimates of dates have been adapted from the Newton Project catalogue. While the notebook *Questiones quædam philosophicæ* and the manuscript treatise *De gravitatione et æquipondio fluidorum* are not strictly speaking theological manuscripts, they do contain elements of theology and natural theology.

## SUMMARY

The first edition of Isaac Newton's famous *Principia mathematica* (1687) contains only one reference to the Scriptures and one mention of God and natural theology. Thus, there is superficial evidence to suggest that this pivotal work of physics is a mostly secular book that is not fundamentally associated with theology and natural theology. The fact that the *General Scholium* – with its overt theological and natural theological themes – was only added to the *Principia* a quarter-century later with the second edition of 1713 may also suggest that this theology came as an afterthought and is therefore not integral to the conceptual structure of the *Principia*. Moreover, the relative paucity of theology in the first edition, combined with the evidence of the appended *General Scholium* of 1713, could be used as evidence of a 'theological turn' in Newton's thought after 1687. This article uses evidence from Newton's private manuscripts to argue that there is more theology in all three editions of the *Principia* than a simple reading of the published text would imply. This article also demonstrates that the seeds of Newton's theological conception of Nature and the cosmos – conceptions that can be found in manuscripts beginning in the early 1690s, and that are acknowledged in the *General Scholium* of 1713 – are already present in Newton's private papers *prior* to 1687. Newton engaged in a great deal of theological writing after 1687, but the period of the composition of the *Principia* only marks the end of the first third of Newton's six-decade intellectual career and thus it should not be surprising to find more theology after the *Principia* than before. Nevertheless, there are important theological writings going back to the 1660s that show that Newton's strongly biblical and providentialist theology pre-dates the *Principia* and, crucially, that his theological conception of the cosmos does as well. The first edition of the *Principia*, therefore, was composed *after* Newton had begun to formulate his theology and theological understanding of the cosmos.

## ZUSAMMENFASSUNG

Die erste Ausgabe von Isaak Newtons *Principia mathematica* (1687) enthält einen einzigen Schriftbezug und nur einmal wird Bezug auf Gott oder natürliche Theologie genommen. Oberflächlich betrachtet scheint dieses zentrale Werk der modernen Physik weitestgehend säkular zu sein, ohne grundlegenden Einfluss von Theologie oder natürlicher Theologie. Das *General Scholium*, das offen von theologischen Themen und natürlicher Theologie durchzogen ist, wurde den *Principia* erst in der zweiten Auflage 1713 hinzugefügt. Auch dies scheint darauf hinzuweisen, dass dessen Theologie späterer Zusatz ist und daher nicht Bestandteil der Grundstruktur der *Principia*. Weiterhin könnte aus dem geringen theologischen Anteil in der ersten Ausgabe und dem Befund des *General Scholium* von 1713 auf eine »theologische Wende« Newtons nach 1687 geschlossen werden. In diesem Artikel werden Newtons private Manuskripte dazu verwendet, zu zeigen, dass in allen drei Auflagen der *Principia* mehr Theologie enthalten ist, als eine einfache Lektüre des veröffentlichten Textes impliziert. Zudem nimmt dieser Artikel Bezug auf Newtons Konzeptionen der Natur und des Kosmos, die in seinen privaten Papieren schon *vor* 1687 zu finden sind. Diese Konzeptionen, so das Argument, können auch in Manuskripten in den frühen 1690er Jahren gefunden werden, auf die im *General Scholium* von 1713 verwiesen wird. Nach 1687 produzierte Newton eine größere Zahl theologischer Schriften. Die Fertigstellung der *Principia* markiert allerdings nur das Ende des ersten Drittels von Newtons 60jähriger intellektueller Karriere – es sollte also nicht verwundern, dass sich nach den *Principia* mehr theologische Schriften nachweisen lassen als vorher. Newtons stark biblische und providentialistische Theologie reicht bis weit vor die Abfassung der *Principia* zurück, wie einige wichtige theologische Schriften zeigen, die bis in die 1660er Jahre zurückreichen. Dies gilt auch für seine theologische Konzeption des Kosmos. Die erste Auflage der *Principia* ist also entstanden, *nachdem* Newton begonnen hatte, seine Theologie und sein theologisches Verständnis des Kosmos zu formulieren.