INTRODUCTION: “NEWTON AND NEWTONIANISM”

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That Isaac Newton (1642–1727) holds a revered place in the history of science is rather uncontroversial. The incredible success and lasting legacy of his two chief works, the *Principia mathematica* (1687) and the *Opticks* (1704), have secured his position among the giants of Western science. Gauging Newton’s place in the history of philosophy, on the other hand, has been a more difficult and more complicated matter. There is no debating that several leading eighteenth-century intellectuals paid special attention to the growing success of Newtonian science; however, these philosophical reactions varied. Some challenged the viability of Newton’s program of mechanics by targeting his proposals of absolute space and absolute time and of a universal force of gravitation. Others championed the success of Newton’s mechanics and theory of light as a watershed of human thought and aligned their philosophies with his program of natural philosophy. Yet even among self-fashioned Newtonians, there was no univocal view of why Newton’s science was of such great philosophical importance. Some focused on his use of mathematics to study natural forces; others focused on the foundational role he granted to observation and experiment.

The terrain surrounding Newton’s own philosophical commitments is murkier still. Stretching back to his student days in Cambridge, Newton continued to struggle with some of the fundamental questions plaguing his philosophical contemporaries, including the relationship between mind and body, the nature of space and time, and the place of God in the natural ontology. However, since he never penned a systematic philosophical treatise akin to, say, Descartes’s *Meditations on First Philosophy* (1641) or Locke’s *An Essay Concerning Human Understanding* (1690), our insight into Newton’s philosophical commitments rests on relatively short commentaries that are scattered throughout his published and unpublished works. Whether these writings

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363
reveal a clear and consistent picture of a Newtonian philosophy remains a matter of debate.

In the recent past, scholars attempting to identify a distinctively philosophical outlook in Newton’s works have focused on his discussion of the methods appropriate for the study of nature. This is no surprise given the methodological pronouncements found in the concluding sections of Newton’s two scientific masterpieces: the General Scholium of the *Principia* and Query 31 of the *Opticks*. In both of these texts, Newton characterizes the methods he used to secure his groundbreaking results, and in both, he emphasizes that his achievements are the product of an “experimental philosophy.” In the General Scholium, immediately after famously asserting that he will not “feign hypotheses” regarding the cause of gravitation, Newton explains that all the propositions of the *Principia* have been “deduced from the phenomena” and “made general by induction.” He then assures his readers that the “impenetrability, mobility, and impetus of bodies, and the laws of motion and the law of gravity have been found by this method” (Newton 1999, 943). Similar remarks are offered in Query 31, where Newton reiterates his rejection of hypotheses and emphasizes the experimental grounding for his theory of light. He reports, in particular, that he established the results presented in the first two books of the *Opticks* by utilizing a method of analysis that

consists in making experiments and observations, and in drawing general conclusions from them by induction, and admitting of no objections against the conclusions, but such as are taken from experiments, or other certain truths. For hypotheses are not to be regarded in experimental philosophy. (Newton 1952, 404)

For historians and philosophers, these remarks are as telling as they are puzzling. Newton clearly promotes “experiment” and “observation” as the basis for natural philosophy. He also clearly aims to distance his experimental philosophy from the “hypothetical” philosophies of Descartes and Leibniz, whom he charges with offering no more than “imaginary arguments.” However, what is not clear is what *doing* experimental philosophy actually involves. What does it mean to “deduce” propositions about nature from the phenomena we observe and the experiments we conduct? And how is this

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1. The General Scholium was added to the second edition of the *Principia mathematica* in 1713 and retained in the third edition of 1726. Query 31 originally appeared as Query 23 in the first Latin edition of the *Opticks* (1706). It was titled Query 31 in the second English edition of 1718 and retained in the later English editions of 1721 and 1730.

2. This was stated in an unsent letter that Newton drafted for Samuel Cotes in the period immediately before the second edition of the *Principia* (1713) went to press (Newton 2004, 119–20). Cotes picks up on this theme in his Editor’s Preface to the second edition, where he emphasizes the essential differences between the method of a Newtonian “experimental philosopher” and the method of those who “take the foundation of their speculations from hypotheses” (Newton 1999, 385–86).
“deduction from the phenomena” to be squared with the process of “induction” and generalization that Newton also promotes? Further questions arise once we set Newton’s statements against the methodology that is applied in the *Principia* and the *Opticks*. For instance, how is Newton’s use of mathematical demonstrations in the first two books of his mechanics connected with a methodology allegedly grounded on experiment and observation? Regarding the mathematical treatment of motions and forces in the *Principia* and the nonmathematical treatment of light in the *Opticks*, in what sense are they both versions of the same experimental philosophy? And (perhaps the most worrisome question) how are we to reconcile Newton’s rejection of hypotheses with the notions of absolute space and absolute time which ground his mechanics but which he also admits we cannot perceive through the senses? Until we can satisfactorily answer these questions, we are left to wonder whether Newton lives up to his stated standards for investigating nature and, more pointedly, whether the methodology that Newton deems proper for the “investigation of difficult things” is practicable or even defensible.

For the better part of the past century, such questions about method have been the centerpiece of discussions concerning Newton’s philosophy, where a primary goal of many commentators has been to more precisely characterize the methods employed in the *Principia* and the *Opticks*. This focus on method has been complemented by ongoing discussions of Newton’s “empiricism,” especially in treatments of Newton’s impact on the history of philosophy. There are, of course, good reasons for this trend. As already mentioned, Newton himself draws a clear line between his experimental program and the philosophies of “rationalists” such as Descartes and Leibniz. Moreover, in the eighteenth century, the success of the *Principia* was championed as a victory for “empiricist” philosophy. In his *Lettres Philosophiques* (1733), Voltaire famously stresses the allegiance between Newton’s masterpiece and the empiricist philosophy of Locke’s *Essay*, claiming that the former destroyed the physics of Descartes’s *Principles of Philosophy* (1644) and the latter overcame the problems of Cartesian metaphysics. Other eighteenth-century empiricists explicitly appropriated a Newtonian methodology to forward their philosophical projects. The most well-known example is Hume, who aimed to extend the experimental method associated with Newton’s natural science into the realm of moral science, as he announces in the subtitle of his *Treatise on Human Nature* (1739–40): *Being an Attempt to Introduce the Experimental Method of Reasoning into Moral Subjects.*

In recent decades, there has been a noticeable and welcome change in treatments of Newton’s method and empiricism. Spurned by the appearance of several of Newton’s unpublished works during the early twentieth century,
as well as the deepening suspicions about relying on the categories of “empiricism” and “rationalism” to track the philosophical innovations of the early modern period, scholars are no longer content to rely solely on the comments in the General Scholium and Query 31 or on the remarks of self-fashioned Newtonians to gauge Newton’s place in the history of philosophy. Instead, the vast majority of current Newton scholars embrace the very “contextualist” stance that has become the norm among historians of early modern philosophy, and as a consequence, there is now a heightened sensitivity to the intellectual context in which Newton’s philosophical proposals were made. The results of this “contextualist” turn have been remarkable. Rather than simply drawing sharp contrasts between Cartesian “rationalism” and Newtonian “empiricism,” we now have more detailed analyses of how Newton’s natural philosophy compares to that of other prominent early modern natural philosophers, including Bacon, Boyle, Hooke, and Huygens. It is now also standard to use unpublished texts, such as abandoned drafts and material from correspondence, as well as Newton’s natural scientific works, to unpack the so-called empiricist commitments that underlie his published claims regarding method. Thus, the remarks concerning experimental philosophy and the rejection of hypotheses found in the General Scholium and Query 31 are no longer accepted as establishing the standard by which to evaluate Newton’s natural scientific practice or his other philosophical claims. Instead, we now place these texts against Newton’s scientific and mathematical practice and his broader epistemic and ontological commitments in order to decipher the proper meaning of his methodological claims, to determine how his stance toward investigating nature changed and developed over time, and, in general, to gain a more nuanced sense of what Newton’s “empiricism” actually involves.

Beyond offering us an enhanced view of Newton’s method and empiricism, this contextualist turn in Newton scholarship has also brought with it a deeper appreciation for aspects of Newton’s thought that were not commonly taken to be relevant to Newton’s general philosophy. As in recent treatments of Descartes, Leibniz, and other figures in the early modern canon, there is sensitivity to the interconnectedness of all of Newton’s philosophical speculations, even those that do not bear an evident resemblance to what counts as philosophy in the twenty-first century. Consequently, much of the recent literature on

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4 See the Introduction to Rutherford 2006 for a lucid overview of recent “contextualist” trends in the history of early modern philosophy.

5 See the informative Introduction to Janiak and Schliesser 2012 for more on recent scholars and scholarly works that have deepened our understanding of Newton’s method and Newton’s empiricism. See Shapiro 2004 for an excellent treatment of how Newton’s use of the term “experimental philosophy” compares to that of his contemporaries and of how his views about how best to study natural phenomena developed during the late seventeenth century.
Newton includes detailed examinations of Newton’s developing views on force, space, mathematics, God, and scripture. And in good contextualist fashion, these works take Newton to be firmly embedded in his historical and philosophical context, to be as aware of the Cartesianism and Neo-Platonism of his seventeenth-century milieu as he is of the problems reconciling the Copernican system with Church’s teachings. From these studies, Newton is revealed as an active interlocutor in early modern conversations about metaphysics, method, mathematics, and ontology, and ultimately, as a thinker who, like his contemporaries, was extending and modifying philosophical doctrines to achieve his own natural philosophical ends.6

Of course, context-sensitive approaches to Newton are not an innovation of the last few decades. Earlier in the twentieth century, eminent scholars had already begun to tread this line. Here, the names Burtt, Koyré, McGuire, Stein, and Westfall immediately spring to mind.7 But what the scholarship of today shows is that what used to be the rare and illuminating exceptions in Newton studies have now become the rule. Contemporary treatments of Newton’s philosophy take for granted that Newton was in constant and critical dialogue with his philosophical contemporaries, and these studies are guided by the conviction that no feature of Newton’s natural philosophical program can be understood in isolation from the historical and philosophical context from which it emerged. These same principles are also directing recent examinations of Newtonianism. Scholars are looking beyond Newton’s impact on the “empiricist” trends of the eighteenth century and considering the more subtle ways in which the success of Newton’s science entered the philosophical arena.

These contextualist studies of Newton and Newtonianism continue to break new ground, and the papers collected in this issue show just how exciting the current state of the art is. In their “Newton and the Mechanical Philosophy: Gravitation as the Balance of the Heavens,” Peter Machamer, J. E. McGuire, and Hylarie Kochiras consider how Newton’s ties to the tradition of mixed mathematics and simple machines enabled him to extend the basic program of seventeenth-century Mechanical Philosophy. Based on this reading, they offer a novel and more nuanced understanding of how to

6 Excellent examples of this sort of scholarship can be found in Bricker and Hughes 1990, Cohen and Smith 2002, and Janiak and Schliesser 2012. With regard to Newton’s mathematics, see the fine examples set by Bertoloni Meli 1993 and Guicciardini 2009. See also Guicciardini 2003 on the benefits of taking a contextualist approach to Newton’s mathematical research.

7 The specific works that spring to mind are Burtt’s The Metaphysical Foundations of Natural Science (1924), Koyré’s Newtonian Studies (1968), Stein’s “Newtonian Space-Time” (1967), Westfall’s Force in Newton’s Physics (1971), and the numerous papers authored by McGuire over the course of his career, including the classic “Newton and the Pipes of Pan” (1966), which he penned with Rattansi.
situate universal gravitation within Newton’s program of rational mechanics. In my “Newton and Proclus: Geometry, Imagination, and Knowing Space,” I examine Newton’s connection to seventeenth-century Neo-Platonism and the Neo-Platonism of Proclus’s *Commentary on the First Book of Euclid’s Elements*, in particular. By placing the *Commentary* into conversation with Newton’s *De Gravitacione*, I bring light to the epistemic progression that characterizes Newton’s discussion of space and emphasize the crucial role that geometrical knowledge of space plays in Newton’s general program for natural philosophy. Andrew Janiak’s “Newton and Descartes: Theology and Natural Philosophy” also sheds light on Newton’s conception of space. Janiak situates Newton’s notion of absolute space in its Copernican and theological context and adds a new and important dimension to our understanding of how the distinction between absolute/true and relative/common space enabled Newton to reconcile a physics that established the motion of the earth with scriptural passages that asserted that the earth was at rest.

The papers dealing with Newtonianism offer equally provocative results. In “Newton and Spinoza: On Motion and Matter (and God, of Course),” Eric Schliesser brings attention to the subtle ways in which elements of Newton’s mechanics, such as motion and atomism, shaped eighteenth-century criticisms of Spinoza’s natural philosophy. Schliesser traces a line of argument found in the writings of More, Clarke, and Maclaurin and offers a novel reading of the General Scholium that illuminates Newton’s possible place in this culture of anti-Spinozism. Marius Stan focuses on the reaction to Newton’s mechanics on the Continent in his “Newton and Wolff: The Leibnizian Reaction to the *Principia*, 1716–1763.” Stan examines the attempts made by Wolff and others to subvert the philosophical foundations of the *Principia* as well as their attempts to incorporate some of Newton’s major achievements in mechanics into a Leibnizian framework for natural philosophy. The portrait Stan provides enhances our understanding of the early reception of Newton’s mechanics on the Continent by bringing needed light to the philosophical conflicts and tensions that characterized the reception of Newton’s philosophy of mechanics among the Leibnizians. In “Newton and Kant: Quantity of Matter in the *Metaphysical Foundations of Natural Science*,” Michael Friedman turns attention to Kant’s distinctive place in the culture of eighteenth-century Newtonianism. Friedman attends, in particular, to the *Metaphysical Foundations of Natural Science* (1786) and urges a reading according to which Kant’s treatment of quantity of matter is connected with a general transcendental project to supply the conditions for the possibility of treating matter mathematically. As a result of Friedman’s account, we gain a deeper appreciation of the important ways in which Kant’s treatment of quantity of matter departs from Newton’s treatment in the *Principia*. Finally, in her “Newton and Hamilton: In Defense of Truth in
Algebra,” Janet Folina extends our view of Newtonianism into the nineteenth century. She shows that by viewing Hamilton’s Kantian approach to mathematics through the lens of Newton’s philosophy of mathematics, we gain an enriched understanding of why Hamilton was at pains to ground algebra on the pure form of time. As Folina’s treatment reveals, Hamilton was intent on demonstrating that algebra, like geometry, has a proper subject matter, since, like Newton, Hamilton was committed to a philosophical outlook that required that mathematics have a basis in truth.

Each of these papers is stimulating and important in its own right. Collectively, they give a clear view of how fertile the philosophical ground remains for the field of Newton and Newtonianism studies. I am incredibly grateful to each of the authors for composing rich and original papers for this occasion. I am also grateful to Stephan Blatti and the Editorial Board of the *Southern Journal of Philosophy* for giving me this opportunity to serve as guest editor and showcase the recent trends in our philosophical approaches to Newton and Newtonianism. I could not be prouder to have this issue as a part of their fiftieth anniversary celebration.

**REFERENCES**


