Routledge Studies in Renaissance Literature and Culture

MILTON AND THE NEW SCIENTIFIC AGE

POETRY, SCIENCE, FICTION

Edited by
Catherine Gimelli Martin

ROUTLEDGE

Milton and the New Scientific Age

Milton and the New Scientific Age represents significant advantages over all previous volumes on the subject of Milton and science, as it includes contributions from top scholars and prominent beginners in a broad number of fields. Most of these fields have long dominated work in both Milton and seventeenth-century studies, but they have previously not included the relatively new and revolutionary topics of early modern chemistry, physiology, and medicine. Previously this subject was confined to the history of science, with little if any attention to its literary development, even though it prominently appears in John Milton's *Paradise Lost*, which also includes early "science fiction" speculations on aliens ignored by most previous readers. Both of these oversights are corrected in this essay collection, while more traditional areas of research have been updated. They include Milton's relationship both to Bacon and to the later or Royal Society Baconians, his views on astronomy, and his "vitalist" views on biology and cosmology. In treating these topics, our contributors are not mired in speculations about whether or not Milton was on the cutting edge of early science or science fiction, for, as nearly all of them show, the idea of a "cutting edge" is deeply anachronistic at a time when most scientists and scientific enthusiasts (including Harvey and Newton) held both fully modern and backward-looking beliefs. By treating these combinations contextually, Milton's literary contributions to the "new science" are significantly clarified along with his many contemporary sources, all of which merit study in their own right.

Catherine Gimelli Martin received her PhD at the University of California, Santa Cruz. Dr. Martin's chief interests lie in sixteenth- and seventeenth-century literature and philosophy, especially in the lyric, religious, and epic poetry of the period and the development of British empiricism. Her first book on epic conventions in *Paradise Lost* won the Milton Society of America's James Holly Hanford Award, its highest honor. Her recent work expands into comparative literature, specifically French and Italian influences and connections in England. Her earlier work included Elizabethan and Jacobean drama but centered more extensively on John Donne and Francis Bacon. Forthcoming works will continue to revisit Bacon's legacy in both science (in this period better understood as empirical method in various arts) and early science fiction. Last but hardly least, Dr. Martin has explored the writings of the "first feminists" who appeared in the seventeenth century and has edited an important essay collection entitled *Milton and Gender* (Cambridge, 2004).

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Catherine Gimelli Martin (Editor) received her PhD at the University of California, Santa Cruz. Dr. Martin's chief interests lie in sixteenth- and seventeenth-century literature and philosophy, specializing particularly in the lyric, religious, and epic poetry of the period. Her first book on *Paradise Lost* won the Milton Society of America's James Holly Hanford Award, its highest honor. Her recent work on the latter two centers particularly on their French and Italian influences and connections. She has also published on Elizabethan and Jacobean drama, although more extensively on John Donne and Francis Bacon. Forthcoming works will continue to revisit Bacon's legacy in both science (in this period better understood as empirical method in various arts) and early science fiction. Last but hardly least, Dr. Martin teaches the writings of the "first feminists" who appeared in the seventeenth century and has edited an important essay collection entitled *Milton and Gender* (Cambridge, 2004).

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Preface

Like most volumes of this kind, this one has many debts to acknowledge. First, I would like to thank the organizers of the Eleventh International Milton Symposium, University of Exeter, England, in July of 2015 for their inclusion of several excellent science panels in their program. In my view Thomas Corns, Gordon Campbell, and especially Karen Edwards, our host, did an unusually excellent job of selecting and facilitating a first-rate and wide-ranging group of discussions and plenaries. More particularly, I must thank Rachel Trubowitz for organizing a science panel she ultimately could not attend and Laura Knoppers for filling in for her in her absence. In all three, of the papers in this volume are products of that session: the contributions of Stephen Fallon, Charlie Nicolls (Edwards's student at the time, now a lecturer at Exeter), and Rachel Trubowitz, although as noted above she was unable to deliver it in 2015. I must also single out Karen's very helpful assistance in recruiting Nicolls's work in place of her own potential contribution, although if possible I would have liked very much to include both.

Next and not least in order of importance I would like to thank Steve Fallon for his many, very helpful suggestions about other potential contributors and for his very positive encouragement at a point when I had all but given up on this project. His advice was astute and, in the end, extremely fruitful. Credit also goes to Leah Marcus not just for agreeing to add her work to my collection but for similar encouragement throughout the project, about which I had some initial doubts regarding my own organizational abilities. Along similar lines I would like to credit Richard Strier, who suggested other likely contributors who would have been excellent if they had only had the time to devote to the project. I have similar regrets about other potential contributors I contacted but who in the end were unable to commit to it, though there were fortunately only a few. Considering that as I write, only three years have elapsed since the Eleventh Milton Symposium, I find myself fortunate indeed to have had the privilege of editing such a wide-ranging collection of essays on a subject that has long needed serious updating, the question of John Milton's knowledge and use of seventeenth-century science in his great

cosmological epic, *Paradise Lost* and also in his Greek tragedy, *Samson Agonistes*. The reasons for that need and the potential for even more vibrant work on this subject—including its potential application to other seventeenth-century poets with scientific interests—are clearly spelled out in my introduction below.

Abbreviations and Note on Texts

Major Primary Sources

Milton, John

CPEP	John Milton: Complete Poetry and Essential Prose, eds. William Kerrigan, John Rumrich, and Stephen M. Fallon. New York: Random House, 2008.
CPW	The Complete Prose Works of John Milton, eds. Don M. Wolfe et al. 8 vols. New Haven: Yale University Press, 1953–1982.

Textual Note: Unless otherwise stated, all references to Milton's poetry *or* prose are taken from the Kerrigan/Rumrich/Fallon edition, abbreviated *CPEP* above, or to the Don M. Wolfe Yale edition of Milton's complete prose in eight volumes. The prose works in that case are cited by volume and page number separated by a colon, while all references to *Paradise Lost* and *Paradise Regained*, regardless of edition, are abbreviated as *PL* or *PR* and cited by book and line number separated by a period. All other poems are cited by short title (such as *SA* for *Samson Agonistes*) and line number. All biblical citations are from the Authorized Version, or King James Bible. In conformity with recent editorial practices and scholarship, Milton's *Christian Doctrine* (*De Doctrina Christiana)* is assumed to be an incompletely revised work composed and approved by Milton but left unpublished at the time of his death.

Cowley, Abraham

"TK"	The Tree of Knowledge. Abraham Cowley: Poems, ed. A.R. Waller. London: Cambridge University Press, 1905.
"TRS"	To the Royal Society. Abraham Cowley: Poems, ed. A.R. Waller. London: Cambridge University Press, 1905.

All other primary sources are cited in the short bibliographies following each chapter as well as in the appropriate end notes.

Introduction

"Encountering the Modern: Seventeenth-Century Science, Poetry, and Fiction"

Catherine Gimelli Martin

The subject of Milton's science, that is, the seventeenth-century science behind his cosmological epic, is by now not only a very old but also a very unstable branch of inquiry. The prime reason for Milton's centrality among scholars connecting seventeenth-century science and poetry nevertheless remains largely unchanged: while a plethora of poets closely engaged with the new theories and discoveries of their age, Milton's late masterpieces uniquely represent such a wealth of adaptations of contemporary views.[1] That fact alone justifies the current essay collection's broad focus on the period's revolutionary changes in astronomy, chemistry, medicine, and more generally, the scientific method contemporarily championed by Francis Bacon, all of which can, in turn, be applied to other poets and thinkers of both the seventeenth and eighteenth centuries. More specifically, however, this collection responds to critical disagreement from the 1930s onward over what might be termed Milton's scientific credentials. Before that time period, most critics tended to admire the breadth of Milton's empirical knowledge even if they held serious reservations about his God. Yet early twentieth-century attacks on such prominent pioneers as Bacon as neither a true scientist nor a true formulator of scientific method (by now an antiquated debate) seem to have prompted other critics to question Milton's credentials as well. They subsequently criticized both his practical and theoretical astronomies, his "supposed" visit to the great Galileo, and his failure to explicitly endorse the Copernican system promoted by the great astronomer. These charges were further reinforced by Kester Svendsen's *Milton and Science* (1956), which pronounced nearly all of the poet's knowledge scientifically "backward" or essentially "medieval."[2]

This general trend continued through the 1960s, 1970s, and 1980s, until even Galileo's obvious presence in Milton's epic began to be deemed a "satanic" intrusion.[3] Yet actual enemies of Copernicanism rarely considered heliocentrism "evil" but rather absurd, unlikely, or unbiblical, since they clearly saw the sun circling the earth and preferred Ptolemaic geocentricism. That preference was not necessarily unscientific, since both theories possessed Ancient authority. At the same time, not all Catholics and few if any Protestants applauded Pope's harsh treatment of heliocentrism's

greatest defender, as Milton most certainly knew when his *Areopagitica* portrayed "famous Galileo" as an unjust victim of censorship, a "prisoner to the Inquisition for thinking otherwise than the Franciscan and Dominican licensers thought" (*CPW* 2:538). He actually learned these particulars firsthand from Galileo's most prominent students and acolytes, who had "honored" and befriended him in Italy, where he visited the astronomer under house arrest at his son's home (*CPW* 2:537–38). Those who doubt Milton's credibility on these points frequently contend that such a visit was impossible, but not only was Galileo under very loose arrest, he received many visitors. He even wrote to his daughter that he had recently entertained a young English enthusiast at precisely the time Milton was in and around Florence.[4] Other critics question how this then-unknown Englishman would have been able to call on the famous "enemy of the Pope," but Milton's Italian connections have long since been documented. He owed most of them to his closest friend, Charles Diodati, and his Italian uncle, Eli Diodati, who translated Galileo's work into Latin and quite probably introduced him (probably by letter) to the supporters he happily encountered in the Florentine academies.[5]

Doubts about Milton's truthfulness on this score have unfortunately persisted longer than previous claims about his relative scientific ignorance, as newer scholars have largely reversed most if not all of the negative evaluations published during the early and mid-twentieth century. A few editors still ignore Alastair Fowler's learned documentations of Milton's astronomical and related scientific knowledge, but in general, his editors and critics have begun to agree that earlier studies suffered from inaccurate understandings of contemporary science, which had long been dominated by "Whiggish" or overly linear views of its apparently sudden seventeenth-century triumph.[6] Similar causes had been at work in Bacon's temporary devaluation, which have been corrected by most recent historians of science, who provide very different portraits of science's gradual and uneven ascent. Even true precursors and practitioners of the new empirical methods were frequently in error on important points. Like many other poets and intellectuals of his age, Milton both knew and appreciated the new theories and discoveries, which in some cases actually do anticipate modern science. Yet accurately evaluating this knowledge by now requires specializing in one or two of its many branches. To reflect this development, this volume is divided into three separate sections offering new insights first on Baconian theory and practice, then on astronomy and science fiction, and finally on the vitalist beginnings of modern chemistry, medicine, and matter theory. As already noted, all these disciplines were explored not just by Milton but by other poets and intellectuals of his period, although rarely as comprehensively as he did.

Two contributors to this volume, Stephen Fallon and John Rumrich, look further into the scientific future by comparing Milton's universe

to that of two slightly or much later scientists, Isaac Newton (Fallon, in section III) and Albert Einstein (Rumrich in section II). As they variously point out, no direct influence is possible in either case, although both detail striking parallels. Bacon's complex influence is examined in section I, which covers both Milton's early and late work. This collection's editor compares Milton's Baconian paradigms of education and empirical method to those of a similar if also ultimately very different Baconian, the contemporarily influential poet, Abraham Cowley. Martin ends her essay by closely comparing the biblical epics of Cowley and Milton, while Pavneet Aulakh discusses even lesser known but highly important applications of Bacon's program in *Paradise Lost*. In addition to Rumrich's discussion of divine determinism in Milton and Einstein, section II contains chapters by Rachel Trubowitz and Erin Webster thoroughly discussing Milton's responses to both Galileo's and Kepler's theories and discoveries. Marissa Behan ends this section by evaluating the likely influence of an early science fiction lunar voyage Milton could easily have read, Francis Godwin's *The Man in the Moone*. In the third section Charlotte Nicholls and Leah Marcus explain the contributions of researchers once dismissed as hermeticists, alchemists, or quasi-mystical empiricists. They quite clearly shaped not just Milton's thought but that of many other contemporaries. Fallon completes this section by closely comparing Newton's to Milton's vitalist matter theory. Although these three separate sections all follow a loosely chronological approach, it has often been impossible to maintain strict separations between influences that seem to have spanned Milton's lifetime. Simply put, his early Baconian sympathies while at Cambridge cannot be clearly disconnected from his later affiliations with the Royal Society Baconians, while Bacon's influence on *Paradise Lost* (1667), if much later than Milton's Cambridge prose, suggests even more complex affinities between the two writers. In addition, as both Martin and Aulakh observe, Thomas Sprat's *History of the Royal Society* (1667) is exactly contemporary with Milton's epic and also shares comparable ideas. Aside from astronomy, other scientific influences studied here are more likely limited to Milton's maturity, but many, including medicine, could well have begun during the precocious student's boyhood.

All the new scholarship presented here is deeply indebted to the recent historians of science who have increasingly realized that like seventeenth-century culture as a whole, practicing scientists and theorists remained steeped in traditional religious assumptions and teleologies. Despite their greater reliance on experimental methods and proofs, even the most advanced or "true" scientists retained many aspects of the late medieval outlook. Copernicus for one remained deeply indebted to quasi-mystical Neoplatonic patterns of thought, as did Kepler and to a lesser degree, Galileo, whose mechanics did not spring fully formed like Athena from the head of Zeus, by rather from late medieval

and Renaissance advances.[7] In fact, none of the scientists listed above (possibly not even Einstein, who believed in an impersonal but precise divine Law-giver and resisted many aspects of quantum mechanics) held ideas that could be called fully secular, and none published ideas solely derived from experiment. Galileo clung to Ptolemy's circular planetary orbits while Kepler held animistic ideas about comets and somewhat mystical ideas about geometry. All the same, all produced important scientific breakthroughs that accelerated during the next centuries, if not the sharp epistemological breaks theorized by both Anglo-American "Whigs" and Frankfort School historians from Max Horkheimer and Theodor Adorno to Michel Foucault.[8]All have similarly erred in proclaiming that the birth of Bacon or Descartes suddenly alienated mankind from nature and nature's God, claims ultimately influenced by Nietzsche's near-contemporary "God is dead philosophy" and the corresponding rise of secularism during the late nineteenth century.

Similar exaggerations have opposed seventeenth-century religion and science in ways inconceivable even after the "triumph" of Darwinian evolution, a theory certainly applauded by secularists but appropriated by contemporary theologian-scientists as well.[9] True, we now find ourselves living in a far more secular society than anyone living in the seventeenth-century could possibly have imagined, but just as the increasing rehabilitation of Lucretius failed to undermine Christianity then, so now post-Einsteinian theories of the universe have kept alive considerable wonder at its mysterious origins and structure, black holes and dark matter included.[10] Ironically, while Milton's epic may not have openly adopted the Copernican theory of the universe, it too clearly relies on concepts derived from Lucretian atomism, and his Chaos in many ways anticipates not just an evolving universe but black holes. His archangel Raphael may consider human cosmology "quaint" from the divine standpoint, as in many ways it was, but significantly, the narrator cleverly consigns Ptolemy's universe to the dustbin of his Paradise of Fools.[11] Thanks to the work of Karen Edwards, we can no longer suppose that Milton's biology, botany, and zoology were truly backward although they were not truly modern either, and thanks especially to John Rogers and Stephen Fallon, it is no longer possible to claim Milton's ignorance of atomism or other important ramifications of the "new philosophy."[12] While it goes without saying that many literary details remain open to interpretation, it is now clear that overly simplistic evaluations of seventeenth-century science do not provide an accurate background against which to evaluate Milton's late or even his early poetry. Moreover, in *Paradise Lost* particularly, his ideas were certainly not fully "mystical" in comparison to the "mechanist" scientists of his era, who themselves frequently turned to the vitalist philosophies that attracted him.

This new understanding is equally important in evaluating other poets and prose writers of the period, but that subject is sufficiently vast that

it would take far more than a single volume to cover it. Here there has only been room to compare Milton's empirical knowledge with that of another scientific poet, Cowley, and his plural worlds with those fictionalized by the now rather obscure Bishop Francis Godwin. Ideally a far larger number of poets and fiction writers ranging at least from John Donne and Andrew Marvell to John Dryden, Lucy Hutchinson, and Margaret Cavendish should be included in a sequel to this volume, but that is a task we must leave to other scholars. Yet even as they stand, our selections are fully defensible. Aside from his Royal Society credentials, Cowley appears here because he is the only other major poet besides Milton to attempt a comparably ambitious biblical epic in their period, and while his effort died still-born, the reasons why his epic failed help us better understand why and how Milton succeeded. Godwin's *The Man in the Moone* was far more successful in his own day and for at least a century afterward, so a closer look suggests some likely and revealing influences on Milton.

Before proceeding further, it will be necessary to supply at least a partial explanation of why evaluations of Milton's scientific poetry and cosmology have so widely varied over time. Several very large-scale factors have been at work here, including the fact that literary criticism is a relatively new profession that at first attracted many (if by no means all) literati either hostile to or resentful of science. Even before C.P. Snow discussed this problem in his famous Rede Lecture on "The Two Cultures" (Cambridge, 1959), scholars had begun to segregate themselves into either the sciences or the humanities, in part due to ever-growing scientific complexity and specialization.[13] At the same time, they tended to assume that such segregations were "normal" and to project them backward onto the very beginnings of modern science, when in fact, well after the Royal Society was founded, it contained only a handful of professional scientists, while theology, natural philosophy, and humanistic studies were still often practiced by the same people. Even Galileo's problems with the Pope were not primarily caused by his theological opinions, but by challenging his old friend's authority. Another important, if relatively obvious, factor is that Milton's first commentators shared and far better understood both his scientific references and his unique ability to make them evoke epic "sublimity" and wonder. Then as long afterward, observational proof of the universe's heliocentric structure was not available (that had to wait until the mid-nineteenth century), but Milton made up for his culture's current lack of factual information in a variety of impressive ways.[14] First, he adopted Bacon's "Ockhamist" approach to Genesis, where creation does not begin or end in a literal week, but continues to undergo profound moral and physical change, both negative and positive. Second, his greatly expanded poetic universe allowed early Newtonians to imagine expanses they could otherwise

only abstractly grasp through mathematics, and not through observational evidence very much stronger than Galileo himself had produced, which in itself was not conclusive.[15]

Nevertheless, well-informed readers long recognized that Milton's speculations were really only possible against a Copernican background, for as David Knight observes, in the Ptolemaic system there could be no real analogy between the moon, planets, stars, and the earth, and "no reason why they should be inhabited except by spiritual beings quite different from us." Yet once "Galileo saw the mountains of the Moon with his telescope," calculated their height, described its craters, and "interpreted the faint light on the dark part of the Moon…as thrown there from the Earth…then the analogy between the Earth and Moon became much closer." Jupiter's moons provided still another analogy between the earth and the other planets, which might be the abode of rational beings, while our sun became a star and other suns "might even be expected to have planets themselves."[16] Adopting these analogies, Milton's moon, earth, and other planets are all solid, compact, opaque bodies utterly unlike the diaphanous crystal or glass spheres posited by the older cosmology. Yet modern literati were usually unmoved by "innovations" that they by then understood as simple facts. At the same time, of course, Milton's universe naturally supports both the traditional Christian belief in God as final cause and the traditional argument from design accepted by all known scientific practitioners of his day.[17] Even this attachment to final causes is not strictly an early modern habit of mind, however, since as Knight and others observe, even now it continues in semi-disguised form in many branches of scientific inquiry, including the current search for extraterrestrial life.

Of the scientific subjects separately considered below—Baconian method and its applications, modern cosmology, and vitalist chemistry and medicine—none were taught during Milton's years at Cambridge University. Obviously, then, they must have formed part of the postgraduate studies he describes undertaking soon afterwards. His *Second Defence* explicitly cites mathematics and music (*CPW* 4.1:614), while the younger poet of *Il Penseroso* longs to learn cosmic and other hermetic "secrets." Milton's interest in the Baconian project of replacing Ancients with Moderns is another youthful preoccupation, as both his Cambridge Prolusions and an early Latin poem clearly indicate. The latter remain commonly overlooked works, but there is actually little if any editorial disagreement on their modern or Baconian sympathies. Milton's *Naturam non pati senium, or "Nature does not suffer old age"* clearly takes the side of the Moderns in defending the Baconian George Hakewill's idea that neither "Mother earth" nor Moderns are undergoing any decay, nor have done so since Adam's fall, a current topic of academic debate in which Donne had previously taken the opposite side.[18] The Yale editor of Milton's important prose tracts on education and freedom

of inquiry, Ernest Sirluck, has thoroughly detailed Milton's many direct or indirect quotations of Bacon in his early prose works, including *Of Education*, *Areopagitica,* and even some of his divorce tracts. Later, perhaps after his blindness effectively removed him from political service, he seems to have studied chemistry, medicine, and vitalist matter theory, perhaps through friends similarly pursuing new developments in these fields, although *Of Education* already mentions medicine as a subject he taught to his pupils.

Yet strangely enough, many scholars still deny that Milton was or could be a true Baconian. William Poole is a prominent example, while Jonathan Sawday has recently argued that *Paradise Lost* demonizes both Galileo and the Royal Society Baconians.[19] Galileo's frequent appearance in Satan's vicinity clearly lies behind the latter, often repeated charge, but it can perhaps be more easily resolved than the broader one about the Baconians. Galileo's telescope in fact wrongly perceives Satan as a sunspot after he lands on the sun, but in a deeply ironic sense, that would also be right: he darkens all light. As for Galileo's connection to hell, in the Italian academies Milton frequented in 1638–39, roughly four years before he celebrated him in *Areopagitica*, Galileo was justly famous as the only mathematician to have precisely graphed Dante's *Inferno*. No wonder then that he performs a similar "truth function" in Milton's hell, where his telescope correctly perceives the moonlike-size of this gigantic "Resister's" shield. This imagined service is important, because even after the Fall no humans appear in hell except (fictively) the blind poet and the astronomer, who intermittently serves as visionary guide in somewhat the same ways that Dante's Virgil does. As for the telescope itself, it is so "non-evil" that it is actually the opposite of Satan's truly "devilish" invention, the fiery, concealed cannons he uses to temporarily (and unfairly) defeat the good angels. True, some contemporaries did believe that telescopes were false instruments, as Margaret Cavendish for instance claimed, but even she finds them useful in winning the epic battle described in her *Blazing World*, no doubt because while initially controversial, telescopes were already proving quite useful in sea battles such as she describes.

Once we realize that Galileo is not the only new astronomer to appear in Milton's *Paradise Lost,* his supposed hostility to this science begins to appear even more unlikely. Milton's dual interests in music and mathematics would very probably have led him to Kepler's most speculative work, *Harmonice Mundi,* which describes the divine geometry of the universe. Obsessed with the idea that God's universal design was built upon an "original archetypal model based on regular solids," he also believed there were profound "harmonic reason[s] not only for the detailed planetary distances but also for the…orbital eccentricities," all of which testified to God's glory. Originally planning to become a theologian, like Milton only a little later, Kepler was partly drawn

to cosmology by the new comets and stars suddenly appearing in the late sixteenth and seventeenth centuries.[20] Milton himself witnessed the comet of 1618 in the same year that Kepler's *Harmonice Mundi* was published, which he could certainly have read in Latin. Later, his close friendships with three German "intelligencers" who would be closely connected to the Royal Society, Samuel Hartlib, Henry Oldenburg, and Theodore Haak, may well have made him aware of the great German astronomer's new astrophysical laws, derived in part from detailed planetary observations gained from the world famous Tycho Brahe.[21] To date, however, only the late William B. Hunter and Erin Webster in this volume seem to have explored the Kepler connection, partly because unlike Galileo, Milton did not mention Kepler directly. Yet *Paradise Lost* clearly does mention the comet of 1618, which like the nova of 1604 ("Kepler's star") was closely connected to the German in the popular mind. The second comet appeared just before Milton's tenth birthday, and Kepler later wrote an influential book on it, *De cometis libelli tres* (1619).[22] This book was particularly remarkable for contradicting Galileo's belief that comets were "mere" optical illusions and, from a new philosophical perspective, for justifying the older view that they were both real and real portents of evil, although also occasionally of good. In Book 2 of *Paradise Lost,* however, the 1618 comet is clearly an evil omen associated with Satan's journey toward earth, which providentially foreshadows Satan's role as both a false prodigy and actual agent of malign intervention. Like Sir Thomas Browne, the young Milton almost certainly witnessed the blazing comet of 1618, but even if he did not, it was so widely discussed that he could vividly recall it many years later.[23] Arriving just before his tenth birthday, it may even have seemed a personal omen or ambiguous portent of his future ability to combat evil with good.

In any case, Milton's careful description of Satan's resemblance to the long, fiery comet that had appeared in the constellation Ophiuchus (the "Serpent Bearer") in 1618 is undeniably significant. It specifically describes Satan's fateful confrontation with his previously unknown son, Death, who threatens him with (what else?) death. Facing him,

> Incensed with indignation Satan stood
> Unterrified, and like a comet burned,
> That fires the length of Ophiucus huge
> In th' Arctic sky, and from his horrid hair
> Shakes pestilence and war. Each at the head
> Leveled his deadly aim; their fatal hands
> No second stroke intend, and such a frown
> Each cast at th' other, as when two black clouds
> With heav'n's artillery fraught, come rattling on
>
> (*PL* 2.707–16)

Here Milton apparently recalls the gigantic comet later appearing in the northern sky above London, which bore the same "sword-in-hand" that comets were often described as carrying. In this case, however, the comet is Satan, who bears his weapon against his own progeny, a literal black hole more threatening than Chaos. Death carries his own a "dart" or dagger so that both cosmic opponents resemble deadly thunder clouds darting pointed weapons instead of lightening.[24] Satan differs only in having his long fiery comet tale extend throughout the entire length of the appropriately serpentine constellation, as the real 1618 comet did. As Hunter points out, that role further predicts his fatal transformation into a serpent later in the poem, but since the actual comet was only barely visible in London, Hunter further speculates that Milton turned to Kepler's theory of comets (a widely read treatise) and his description of the supernova of 1604 within the same work. This surmise seems borne out by Satan's second meeting with Death and his mother Sin in Book 10 just before he triumphally ascends his "divine throne" in hell, suddenly appearing as the new star that many astronomers (including Kepler) placed over Bethlehem at Christ's birth. Of course, this false "epiphany" only underscores Satan's opposing status as a futile supplanter of both the Father and his true Son, a fate foretold through more astronomical symbolism quite probably gleaned from Kepler.

Yet scientific symbolism is even more deeply interwoven into *Paradise* Lost than this sole example suggests. At the beginning of Book 10, God himself suddenly appears in heaven from behind his "secret cloud" and with "thunderous" voice announces mankind's fall, although he also comforts his saddened angels (*PL* 10.32–33) by promising immediately to send "Man's friend, his Mediator, his designed/Both ransom and Redeemer voluntary," to whom he has mercifully transferred "All judgment" in heaven, earth, and hell. (*PL* 10.60–61, 57). At virtually the same moment in hell, Satan arrives "disguised" as the Father of his cohort while instead acting an evil comet or false nova.

> At last as from a cloud his fulgent head
> And shape star-bright appeared, or brighter, clad
> With what permissive glory since his fall
> Was left him, or false glitter: all amazed
> At that so sudden blaze the Stygian throng
> Bent their aspect, and whom they wished beheld.
>
> (*PL* 10.449–54)

The demons' joy in their false Mediator is naturally short-lived as Satan and all his crew immediately turn into serpents upon accepting his deeply ironic invitation to "enter now into full bliss" (503). The entire scene then becomes ripe with images of false new stars or suddenly blazing comets, which, like real ones, are doomed to perish in their own