

UNFRIENDLY SKIES: SCIENCE, SUPERSTITION, AND THE GREAT COMET OF 1680

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Abstract

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In this dissertation, I analyze a range of epistemological and religious arguments for and against the fear of comets, as articulated in pamphlets and polemics following the comets of 1680-82 in the Spanish and English Empires. These works appeared in England, Spain, North America, and the Viceroyalties of New Spain and Peru. Against recent scholarship, I argue that the religious and political diversity which drove the “vulgarization” of comets in England was less important in other regions than technical disputes over the foundations of astrology, or long-standing religious distinctions between licit and illicit interpretations of wonders.

After an introduction, four thematic chapters explore responses to the comets of the 1680s in England, Spain, North America, and Spanish America respectively. In chapter two, I show how the politico-religious appropriation of the comet led to the association of comet-interpretation with vulgar segments of society. In subsequent chapters I show that the political prodigy-mongering found in England was, in the Spanish empire, controlled through censorship of the press and a Catholic tradition of strict separation between miracles and wonders. This shared intellectual tradition led

the conversation of the comet to hinge on fairly technical aspects of natural philosophy and astrology, which constrained the possible meanings of the comet. Chapter Four shows that the same division between licit and illicit interpretation of comets operated in the Puritan context of New England. Chapter Five elaborates on the Catholic background established for Spain by showing how broad religious trends intersected with local circumstances of patronage and norms of argument in shaping the debate in Spanish America. Finally, the conclusion reflects on how the diversity of questions at stake in the last debate over the meaning of comets in the 1680s changes our understanding of the decline of prodigies, wonders, and superstition more generally.

For my parents, and for Leopold.

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CHAPTER 1:

INTRODUCTION

1.1 The Heavenly Monster

On the evening of 12 December 1680, John Evelyn looked out of his London chamber window toward the place where the sun had just disappeared behind the horizon. Evelyn “saw a meteor of an obscure bright color, very much in shape like the blade of a sword, the rest of the sky very serene and clear.” Though as a member of the Royal Society and a natural philosopher of some renown, he understood perfectly well that comets arose from natural causes, he still worried over the object’s sudden and terrible appearance. “I pray God avert his Judgments!” Evelyn wrote in his diary. “We have had of late several comets, which, though I believe appear from natural causes, and of themselves operate not, yet I cannot despise them. They may be warnings from God, as they commonly are forerunners of his animadversions.”¹ Across the Atlantic, Increase Mather observed the “Perriwig’d Herald” through the English-made telescope that the governor of Connecticut colony, Jon Winthrop, had given to Harvard College a few years before. He preached two sermons under the comet, urging his flock to repent before God cast down his judgment. If Mather harbored any doubts about the severity

¹John Evelyn, *The Diary of John Evelyn*, ed. Austin Dobson (London: Macmillan and Co. Limited, 1906), III.65–66.

of God's punishment, it had evaporated by the time the comet reappeared after rounding the sun, "the colour of blood" and "shaped like a burning sword, or a Besom [i.e., a broom]," with a tail stretching as much as fifty degrees across the sky, a few days later.² In 1682, just eighteen months after the Great Comet disappeared from the sky, another comet, not quite as spectacular but still far larger and brighter than any comet seen by most people alive today, seemed to reinforce the urgency of whatever message the first comet had sent.

Neither man expressed much surprise at the appearance of such an object. Mather, alongside many of his colleagues in Massachusetts, had watched with dismay as the Bay Colony, and especially Harvard College, had slid into sin and depravity in the 1660s and 1670s. Mather expressed hesitation, however, in assigning the comet a specific meaning:

Thus we have seen what Judgments and Calamities, Fearful Sightings in Heaven are commonly Presages of. As for that Sign in Heaven now appearing (which hath occasioned me to speak this word at this time) what Calamities may be portended thereby . . . I shall not say: but leave unto God and time to discover. Only, in general, we have cause to fear, that sweeping Judgments are thereby signified; that the Lord is coming down from Heaven with a long Beesom of Destruction, which shall sweep away a world of Sinners before it.³

In England, the comet appeared at the height of the Exclusion Crisis, when the Protestant public reeled at the possibility that Charles II's brother, James, an open

² Increase Mather, *Heavens Alarm to the World, Or, A Sermon Wherein is Shewed that Fearful Sightings and Signs in Heaven are the Presages of Great Calamities at Hand* (Boston: Samuel Sewall, 1682).

³³ Mather, *Heavens Alarm to the World, Or, A Sermon Wherein is Shewed that Fearful Sightings and Signs in Heaven are the Presages of Great Calamities at Hand*.

Catholic, might take the throne upon the king's death. In 1678, anti-Catholic fervor had been stirred up by the false discovery of a Catholic plot to speed the succession along by assassinating Charles. Memories of the Popish Plot remained strong and hot in the fall of 1680, as Parliament entertained a bill that would exclude James from the succession. Surely such a spectacular comet could not be without relevance in the battle for religious control of England.

Another royal capital, presided over by another Charles II, also took notice of the comet. The year 1680 has already been marked out as a watershed in Spanish history, especially by historian John Elliott. On the one hand, 1680 marks the "nadir of the seventeenth-century crisis in the Spanish economy and in Castilian power."⁴ Charles, the last of the Spanish Habsburgs, had inherited his family's bodily misfortunes. From early childhood, it had been apparent that the king was feeble-minded, and he was so plagued by sickness and by would-be cures from all corners that he earned the nickname "*el hechizado*," "the bewitched one." By the time the comet appeared, Spain had gone from, arguably, the premier European power at the turn of the seventeenth century to a politically marginal backwater on the eve of the eighteenth.

On the other hand, 1680 marks the year that Elliott sees Spain's fortunes improve. One of the lynchpins of a recovery in Elliott's eyes was the re-emergence of a thriving natural-philosophical community in Spain. In Madrid, Luis Aldrete y Soto, a courtier, Inquisition official, and the self-styled creator of the alchemical Elixir of Life,

⁴ J Elliott, *Imperial Spain, 1469-1716* (London, England; New York, N.Y., USA: Penguin Books, 1963), 173.

saw the comet as a sign of good fortune for Spain. He assured the sickly King Carlos II that His Majesty was in no personal danger, since the connection between kings and comets was a pagan superstition propagated by astrologers and did not accord with “true philosophy.”⁵

Far to the southwest, Don Diego Rocha, a judge in the *Audiencia* of Peru, observed the comet’s trajectory from Lima. In a letter to his son, which he published, Rocha, using Aristotle’s meteorological theory of comets, warned of the earthquakes that would surely follow the comet, and also of false “prophets and astrologers” who would claim to offer specific predictions of God’s punishment. Unlike Harvard, which at forty seemed in danger of collapsing, the universities of Peru and Mexico had matured into stable and productive institutions in the century and a half since their foundation. In Mexico, the vitriolic pamphlet war between the Jesuit Eusebio Kino, newly assigned from Austria to New Spain, and Carlos Sigüenza y Góngora, professor of mathematics at the University of Mexico, over the theological and astrological validity of comet prognostications, attracted attention from all over the Americas.

The stories above represent a small fraction of the responses observers of the comet left in writing. Hundreds of observations, all made within weeks of one another, but thousands of miles apart, survive. They show the range of questions early modern observers asked when they saw a comet in the sky. Their interests did not fall neatly into categories. Not only did mathematical astronomy and judicial astrology surface in a

⁵ Luis Aldrete y Soto, *Discurso del cometa del año de 1680* (Madrid: Lucas Antonio de Bedmar, 1680).

single document, but even short, four-page pamphlets on the comet might engage theological, pastoral, literary, historical, political, medical, geological, and legal concerns.

In the seventeenth century, comets came in unprecedented numbers and in unprecedented sizes, provoking apocalyptic speculation among both Catholics and Protestants. December 1680 brought the most spectacular comet of all, sparking pamphlet wars and prophecies of doom throughout Europe and the Americas. Yet, as the comet passed and the century came to an end, the world, stubbornly, did not.

Those who begged their countrymen to repent found themselves on the defensive as prodigy after prodigy passed without a clearly apocalyptic disaster. The succession of large comets before 1680, and the anticlimax that followed, prompted many observers in Spain, Mexico, Peru, New England, and England to ask whether God spoke to mankind in nature at all. Unlike learned treatises by theologians or mathematicians, such comet pamphlets showcased the worries of lawyers, bureaucrats, courtiers, penny astrologers, and soldiers, who articulated their beliefs with striking clarity.

This study maps out the intellectual, religious, social, and political beliefs that motivated people to comment on comets in the 1680s across regions of the world that have very different places in our contemporary narratives of the rise of modern science and the decline of wonders. Using these works from Spain, England, New England, Mexico, and Peru, I reconstruct the debate over the comet of 1680 as it unfolded across two empires. By analyzing responses to a single event observed across the world, this

dissertation will provide a comparative snapshot of the wider debates over superstition, miracles, and wonders at a moment of rapid change in the late seventeenth century. The comet touched off a transatlantic and cross-confessional conversation, not only among natural philosophers but among the learned and even the unlearned public, about God's role in a natural order quickly coming to be defined in terms of a New Science.

I will address three questions about the comet debate. First, it will attempt to map the boundary between legitimate speculation about the comet's meaning and "superstition" in these debates. Second, it will explore the authors' reasons for holding their positions on that question, and their motivations for participating in the debate at all. Who, in other words, was drawn to comment on this "monstrous wonder" in the sky, and why? What questions did they ask? Finally, this study asks how a comparison among these different regions, and the connections among them, sheds light on conventional conceptions of the "decline of superstition."

1.2 Comets in the History of Science

Comets attracted enormous publicity in the early modern period, most of it bad. Like eclipses, the appearance of a "new star" or a "bearded star" prompted speculations in coffee houses of plague, death, and war, and could occasionally spark rioting in the streets. In the seventeenth century, no fewer than six major apparitions occurred, each of them accompanied by a tumult of pamphlets and treatises from penny-almanac writers and country preachers as well as distinguished professors of mathematics and

astronomy. Kepler, Galileo, Newton, and, of course, Edmund Halley wrote the best-known and best-studied of these comet tracts, but their contributions represent only a small slice of the literature produced by and for a public captivated by these disruptions in the heavens.

Hundreds of tracts survive from the seventeenth century. In the Spanish empire, for example, fully 30% of printed works treating astronomical topics in the seventeenth century are comet-tracts, and twenty-one of these responded to the comets of 1680 or 1682.⁶ In Latin America, ten treatises were printed (with all but two surviving in some form). North America produced six, spanning genres from sermons to poetry to almanacs, as well as some manuscript material, and two letters on the comet from the Caribbean were preserved and published in London almanacs. England produced thirty-eight works dedicated specifically to the comet, not including the dozens of other works, cited throughout Chapter 2, that mentioned it in an astrological, literary, or religious context. More sources, especially private correspondence, can be reconstructed from authors' habits of naming their correspondents and mentioning observations received from friends in distant places. Yet these sources remain underutilized both by historians of astrology, who generally focus on almanacs, and by historians of the early modern "culture of wonders." One of my aims in this dissertation has been to integrate a small part of this voluminous material into recent scholarship on both astrology and on wonders.

⁶ Victòria Rosselló Botey, *Tradició i canvi científic en l'astronomia espanyola del segle XVII* (Valencia: Universitat de València, 2000), 101. Rosselló counted 28 but included the Latin American tracts.

Scholars of seventeenth-century astronomy have long recognized the importance of comet-literature. Since the eighteenth century, these works have been mined for astronomical calculations and, more commonly, for indications of the spread of Copernican, Cartesian, and Newtonian thought. For the most part, such studies dismissed works like those described above, whose authors concerned themselves primarily with predicting the comet's ill effects. Such is the approach suggested by the title of the only other dedicated monograph on the comet of 1680, Howard Robinson's *The Comet of 1680: A Study in the History of Rationalism* (1916).⁷ It conceived of the debates I will study entirely as superstitious relics of misplaced religiosity. This tone is largely reminiscent of an earlier study, that of Andrew Dickson White.

In his *History of the Warfare between Science and Theology*, White included a substantial chapter on comets. He was one of the first to use the fortunes of the "providentialist view" of comets, namely, the view that comets cause or signal disaster, as an index for the decline of superstition more generally. White attempted to show how modern science, specifically Newtonian physics and Halley's comet theory, dislodged this older theological view quite suddenly after the comet of 1680. The shift from the "providential" to the "scientific" view of comets was not, according to White, a process of simple displacement, but rather one of active conflict. His *Warfare*, the *locus classicus* for the Conflict Thesis of the relationship between science and religion, argued that writers such as Increase Mather and John Edwards fought to suppress new

⁷ H Robinson, *The Great Comet of 1680: A Study in the History of Rationalism* (Northfield, Minn., 1916).

conceptions of celestial motion.⁸ Though scholars have thoroughly re-examined this view, the political and religious motivations of the proponents of the providential view remain poorly understood.

The work that most defines the contemporary historiography of comet-lore is Keith Thomas' *Religion and the Decline of Magic*. "Modern science," in Thomas' view, could claim only partial credit for the decline of astrology, and comet-lore with it, in English learned culture. More recent scholarship has brought increasing nuance to this view.⁹ A host of social and religious factors contributed to a gradual reclassification of such beliefs as "vulgar" and unsuitable for polite conversation. New scholarship has confirmed that astrology suffered similar setbacks in France, thanks largely to the satirical interventions of Fontenelle.¹⁰ The same seems to have occurred in the Netherlands due to religiously-motivated attacks from both the conservative Calvinist Voetian party and their Cartesian and Arminian rivals. Comet-prophecy, in these narratives, is a victim of astrology's fall from intellectual favor.¹¹

Thus, the comet of 1680—the brightest to light the skies in a thousand years—appeared in a time of astrological crisis. In France, the Netherlands, and England,

⁸ Lawrence Principe's recent textbook, *The Scientific Revolution : A Very Short Introduction*, 2011, assesses White's contribution to the Conflict Thesis. See also Ronald Numbers, *Galileo Goes to Jail and Other Myths about Science and Religion* (Cambridge Mass.: Harvard University Press, 2009).

⁹ Especially William E. Burns, *An Age of Wonders: Prodigies, Politics, and Providence in England, 1657-1727* (Manchester: Manchester University Press, 2002); Patrick Curry, *Prophecy and Power: Astrology in Early Modern England* (Princeton N.J.: Princeton University Press, 1989).

¹⁰ Hervé Drévilion, *Lire et écrire l'avenir: l'astrologie dans la France du Grand Siècle, 1610-1715* (Paris: Editions Champ Vallon, 1996), passim.

¹¹ Jorink, *Reading the Book of Nature in the Dutch Golden Age* (Brill, 2011), 123-175.

astrological ideas had disappeared from discussions of natural philosophy. Newton and Halley calculated trajectories and published their results with no mention of God or portent. In the Netherlands, Balthasar Bekker and Pierre Bayle published responses to the comet that not only failed to offer predictions, but enthusiastically undermined the foundations of portent belief, astrology, and a full spectrum of related “superstitions.” Despite the persistence of such ideas among the vulgar and the pious, the notion that comets heralded the wrath of God had become scientifically sterile and unfit for polite society. In Keith Thomas’ memorable phrasing, “the clergy and satirists chased [astrology] to its grave, but the scientists were unrepresented at the funeral.” It is the scientist’s withdrawal, rather than the satirist’s or clergyman’s, that Thomas picks out as the point of no return for the “decline of magic.” Despite considerable refinement, Thomas’ remains the standard narrative for that decline.

1.3 Historiographical Problems

Yet the cases with which I began this proposal suggest major inadequacies in this narrative. Seeing comet-literature in purely astronomical or astrological terms obscures the questions that authors of this literature meant to address, which often had little to do with astrology or natural philosophy. A comet’s supposedly dire effects might be explained in purely natural ways; this was the tack Aristotle took. Moreover, the question of what a comet *is* could be a theological one, with little relation to the wrangling over trajectories and orbits that preoccupied mathematicians. For many early modern writers, a comet was *essentially* a sign, or a portent, or even a miracle—that it

might consist of fiery exhalations or reflected sunlight or some other material seemed, well, immaterial.

Whether comets do or do not constitute signs from God was not strictly an astrological question. Some of the authors cited at the beginning of this chapter denigrated astrology and its practitioners in the course of their discussion of the comet's effects. Astrology was a tool for predicting a comet's effects, but hardly the only one. Scriptural interpretation, history, and philology bore the brunt of the predictive burden, along with natural-philosophical analysis. When the "Great Comets" of 1680, 1681, and 1682 attracted the attention of clergy, government officials, and university professors as well as of astrologers and mathematicians, they touched off polemics that forced all of these commentators to present their arguments for the legitimacy of these predictive tools with unusual clarity. The comet deserves study as a historical moment in which observers around the world, in the midst of changes in science, religion, and politics, tried to forge a new understanding of nature and its wonders.

The early modern "culture of wonders" has attracted a great deal of scholarly attention in the last two decades. Much of this work owes a debt to Continental scholarship, in particular the "historical epistemology" of Gaston Bachelard, Georges Canguillem, and Michel Foucault. The work that has come farthest in conceptualizing the culture of wonders is *Wonders and the Order of Nature*, by Lorraine Daston and Katherine Park. Daston and Park explore a range of phenomena, including the birth of "monsters," rocks and seashells shaped like men or animals, and natural-magical processes, that early modern people combined within the concept of the "wondrous."

These phenomena constituted an ontological category between the natural and supernatural, the *preternatural*. Preternatural events did not come about through special acts of God, as supernatural things did, but did not fall into the “Order of Nature,” that is, the usual course of events, Aristotle’s “Nature as it is always and for the most part.” Daston and Park argue that, in the seventeenth century, the category of the preternatural decayed, and classes of phenomena formerly understood as preternatural had to be reconceived as either natural or supernatural.

Comets, since antiquity, had been placed in all three categories: natural (Aristotle, for example, or Seneca), preternatural (Augustine, Melanchthon), and miraculous (Luther, Voetius). It is only after 1680, however, that “natural” became the only accepted label for comets in learned society. This shift, the argument goes, stemmed from a new conception of God. Supernatural, “miraculous” explanations came to be seen as unworthy of a God who created an orderly world that ought not to require constant tweaking—a belief seen among Protestants such as Boyle and Paley and among Catholics such as Malebranche and Descartes. Natural philosophy, which emerged largely from the study of wonders, assimilated them into the natural order and, eventually, the Laws of Nature.

The explanation Daston and Park give, narrowly focused as it is on grand epistemological shifts, is not entirely satisfactory. But, like Thomas’ work, it has sparked specialized studies on the concept of wonders and on their local social, intellectual, and religious contexts. This study will engage with the culture of wonders as described by Daston, Park, and others, but on a more local level. The comet ignited debates that

forced participants to articulate their epistemological positions with almost unprecedented clarity across a wide social spectrum. They revealed that comets were not merely understood as wonders, but also monsters, and signs—and also, crucially, as natural objects and as celestial ones. They thus form a unique object of study, allowing for a cross-sectional and comparative assessment of related questions in theology, wonders and teratology (the study of monsters), judicial astrology, mathematical astronomy, cosmology, and meteorology.

1.4 A Comparative Cometography

In Thomas' narrative above, England, France, and the Netherlands take center stage. In this account, the astrological explosions during the English Civil War and the Thirty Years' War on the continent, which spurred the production of almanacs and political astrology, explain in large part why astrology came to be seen as vulgar. The spread of mechanistic theories helped to undermine the philosophical foundations of astrology and comet-lore. Yet the heartlands of the Counter-Reformation, where chairs of astrology remained in universities until the 1730s and Copernicanism and Newtonianism failed to take hold until the turn of century, do not fit this narrative.¹²

¹² For the early history of the Enlightenment in Spain, see Jonathan Israel, *Radical Enlightenment: Philosophy and the Making of Modernity, 1650-1750* (New York: Oxford University Press, 2001); Ramón Ceñal Lorente, "Cartesianismo en España: notas para su historia (1650-1750)," *Revista de la Universidad de Oviedo, Facultad de Filosofía y Letras*, no. VI (1945): 5–97. On the Scientific aspects, see Víctor Navarro Brotóns, "Astronomy and cosmology in Spain in the Seventeenth century: the new practice of astronomy and the end of the Aristotelian-Scholastic cosmos," *CSIC-UV: Instituto de Historia de la Medicina y de la Ciencia López Piñero*, 2014; Rosselló Botey, *Tradició i canvi científic en l'astronomia espanyola del segle XVII*.

Spain and Spanish America make no appearance at all in the vast majority of works cited above, despite their political and economic importance in the seventeenth century.¹³

In these, as in most works on the comparative history of science, the achievements of Spanish men and women of letters meet with summary dismissal or are passed over, hardly missed, in silence. In the 1930s, Lynn Thorndike, one of the most sympathetic scholars of pre-Newtonian astronomy, observed that, in Spain, “there seems to have been a more favorable attitude toward the occult sciences than elsewhere in Western Europe, and less of an inclination to account for all magic as diabolical.”¹⁴ Thorndike looks to this magical strain in Spanish thinking as one cause for Spain’s later backwardness. His appraisal, among most laudatory of the early Anglophone historians of science, reflects one common characterization of Spain’s intellectual atmosphere: riddled with superstition and the occult, a hostile place indeed for those bent on serious debate. In the history of science, scholars have only begun to reassess this view.

In this dissertation I will suggest alternative narratives that account for the near-universal mistrust of astrologers and increasing skepticism about man’s ability to predict a comet’s future effects. In a Catholic context, this skepticism took a form quite distinct

¹³ Early in the century, Robinson’s monumental study, *The Great Comet of 1680: A Study in the History of Rationalism* neglected Spain. Notable exceptions, tellingly, tend to feature comets. I am not the first to suggest comets as superlative vehicles for comparative study, though to my knowledge I am the first to include Europe. See especially C Johnson, “‘Periwigged Heralds’: Epistemology and Intertextuality in Early American Cometography,” *Journal of the History of Ideas*, 2005; Ralph Bauer, “Los grandes cometas de 1680/1681 y la política del saber criollo en la Nueva España y la Nueva Inglaterra,” *Revista Iberoamericana* LXXV, no. 228 (2010): 697–715.

¹⁴ Lynn Thorndike, *History of Magic and Experimental Science* (8 vols., New York: Columbia University Press, 1923-1941), IV: 323. Hereafter cited as *HMES*.

from that in England, one deeply concerned with preserving the plausibility of miracles while avoiding “pagan” superstition, and with providing an orthodox reading of the Book of Nature. These problems occupied the greatest Catholic thinkers in the period—and Protestant, as well. They form a central concern for Suarez, Malebranche, and Pascal, to say nothing of Leibniz and Spinoza. In New England, the epistemology of superstition hammered out beneath the comet foreshadowed the religious and philosophical battles that would rage twelve years later during the Salem Witch Trials.

A final historiographical problem emerges from the privileging of “scientists” over other segments of learned culture in most accounts of the decline of comet-prophecy, astrology, and “superstition” more generally. Given that popular belief in all of these things lingers even today, the historiographical question must be limited to their disappearance from elite culture, however we define “elite.” Members of the Royal Society make up only a small part of those who shaped public opinion in England or France in the later seventeenth century, and it is not clear why the disappearance of a phenomenon from that small group should constitute its “real” demise. Patrick Curry, tellingly, entitles his chapter on astrology after its disappearance from scientific culture “Life after Death.”¹⁵ Why, however, should historians hold natural philosophers up as the lynchpins of epistemological acceptability at this early date?

¹⁵Curry, *Prophecy and Power*.

1.5 Outline

Since England has been the model for studies of the decline of belief in the dire effects of comets, it is fitting to establish the categories historians have used to analyze this process in England as a basis of comparison before moving on to the other regions. The English debate over the comet was, above all, political. England, at the time, found itself embroiled in the political-religious disputes of the Exclusion Crisis and the Popish Plot. These two controversies ensured that the comet was appropriated as a politically significant object as soon as it appeared in the sky. However, learned gentlemen with university educations such as those in the Royal Society largely excused themselves from the vicious public debate, keeping their speculations about the natural or providential effects of comets private. Yet even among the elite, writers such as the minister John Edwards argued for the continued importance of providentialism and prodigies in public religious life.

In Spain, the political and journalistic institutions that drove the fierce pamphleteering in England were missing, and Chapter 3 reveals a conversation dominated by university-trained teachers of medicine, mathematics, and astrology. Despite some manuscript circulation of the books of Descartes and other proponents of the New Science, Spanish intellectuals remained rooted in an Aristotelian cosmos and a Ptolemaic astronomy. Meanwhile, the political prodigy-mongering found in England was, in Spain, controlled through censorship of the press and a Catholic tradition of strict separation between miracles and wonders, which could be interpreted naturalistically. This shared intellectual tradition led the conversation of the comet to

hinge on fairly technical aspects of natural philosophy and astrology, which constrained the possible meanings of the comet. Within these constraints, however, astrologers could adjust their interpretation to their needs, forecasting health for the sickly Spanish king. Spanish authors also confronted skeptics, who attacked the natural philosophical foundations of astrology and the theological arrogance of those who sought to know the future, which belonged to God alone.

In Latin America and New England, the debates were far more constrained in their numbers and in their geographical scope—though, like their contemporaries in Europe, American observers eagerly consumed news of the comet from far and wide. Chapter 4 shows how writers in British North America interpreted the comet as a providential sign. Increase Mather's *Kometographia* was not published until 1684, and so it represented Mather's reflections on the beliefs about comets and other prodigies that he heard espoused in his congregation as the comets shined overhead years earlier. During the actual appearances of the comets in 1680-81 and 1682, responses in New England tended toward one of two poles: the sparsely descriptive, characteristic of almanac-writers, and the polemical, characteristic of hellfire-and-brimstone sermons. What stood out to Mather from his vantage point in 1684 was the growing volume of skeptical voices, those who wished to eliminate or severely curtail the importance of prodigies in public religious life. As an aspiring natural philosopher himself, Mather aimed to use his expertise to nip such excessive skepticism in the bud by gathering all the evidence for the action of prodigies in centuries past and to show their continued relevance in New England.

This concern for the historical record of comets and their effects characterizes the most important treatise printed in Latin America as well. In Latin America, a single publication, the *Philosophical Manifesto Against Comets* by professor of mathematics Carlos Sigüenza y Góngora, set the tone for the debate. Sigüenza's skeptical attack on comet providentialism focused largely on the credibility of the historical evidence brought to support the idea that comets cause particular disasters. Defenders of providentialism upheld the authority of this historical record, as well as empirical evidence of the physical and medical effects that comets could cause.

In all regions, learned writers agreed that the comets operated through natural causes even if they had a final cause that was ultimately moral. The difference was one of emphasis. In both Spain and Latin America, writers on the comet concerned themselves far more with the natural, or secondary, causes of the comet and with its natural, measurable effects. Prognostication, when it occurred, was almost always constrained by astrological rules or by methods of comet divination developed by Ptolemy and Pliny, and tended to be more of an afterthought.

In England and New England, the opposite was true; the religious, moral, and political purpose of the comet was most important. England was, in many ways, an outlier. The primary reason for this was the presence of a large group of unregulated politico-religious partisans who quickly appropriate the celestial interloper for their own purposes. Since this outlier has shaped the way we as historians think about wonders and superstition more than any other, I will begin there.

CHAPTER 2:

FANATICKS, CATHOLICS, AND ATHEISTICAL SPIRITS

2.1 Introduction

Three ominous figures haunted the English political imagination in the late seventeenth century: the fanatic, the Catholic, and the atheist. The fanatic, the Protestant non-conformist who refused to submit to the official Anglican Church, called to mind the chaos of England's recent Civil War, with its Ranters, Diggers, and Fifth Monarchists praising the death of the king in order to make way for Christ's true kingdom. The Catholic threat seemed nearer to hand, conjuring fears of French, Spanish, or Italian domination and plots to overthrow the restored monarchy, put a Papist on the throne, and cast England back into idolatry. The atheist threat seemed the least dire, perhaps, but the writings of Thomas Hobbes and others made it clear that members of the respectable English elite could be seduced away from the true faith and made to propose moral outrages in the name of philosophy.

All of these represent some form of false religion, and each name could be lobbed at theological or political enemies. The "godly" Quakers and other non-conformists accused the established church of crypto-Catholicism, and pointed to the very real presence of Popery in the midst of the royal household itself. Establishment Anglicans dismissed these worries as the preoccupations of vulgar and ignorant fanatics.

Those who moved among the philosophical elite, whether at the more non-conforming Cambridge or the more high-church Oxford, shared a revulsion for the excesses of atheism, which took the disdain for religious “enthusiasm” too far, removing God from public life altogether. Those accused of atheism, on the other hand, often responded that they aimed only to purge the faith of ritual and idolatry left over from Catholicism, Judaism, or other forms of “perversion.” English public life tumbled along these three axes—fanaticism/non-conformism, Catholicism/High-Church Anglicanism, and atheism/deism—irregularly for the rest of the century.

Amid these divisions, social and political organization in England continued to change; politics had become a pastime for the masses, who expanded political activity from factions within the court to political “parties” whose ideologies were understood (on some level), proselytized, and ridiculed in the streets and coffee-houses of London. Those whose enemies called them “fanaticks” aligned themselves with the Whigs, the alleged “Catholicks” went with the Tories, and those accused of “atheism” tended to fall somewhere in between.

Patrick Curry and William Burns have pointed to the birth of party politics as the driving force behind the decline of astrology and the culture of wonders in England.¹⁶ Especially since the Reformation, pious men and women had seen wonders as potentially political objects, bringing God’s judgment of sinners into the public eye. Astrology, too, had a long history within politics; famously, John Dee and Johannes

¹⁶ P Curry, *Prophecy and Power*; Burns, 185-86 and *passim*.

Kepler earned part of their living making political predictions for rulers.¹⁷ By the late-seventeenth century, however, political astrology had garnered an audience well beyond the court. Pamphlets about marvelous occurrences and their political meanings circulated far and wide. In England, speculations about wonders and astrology had accompanied much of the violent political action during the Civil War.¹⁸ After the Restoration, supporters of the monarchy distanced themselves from this kind of prophecy-mongering, and the restored government regulated astrologers heavily to prevent subversive content from going to press. Gradually, the association among astrology, wonders, and political rabble-rousing led respectable elements of society to disavow such things.¹⁹

The comet, as a wonder and an astrological object, appeared at the intersection of these trends, and provided a focal point for intense debate about the meaning of a wonder, who might exercise the authority to interpret it, the political messages it might carry, and the dangers of interpreting wonders politically at all. In line with these long-term trends, the debate over the comet in England split primarily along party lines, and

¹⁷ Kepler thought some aspects of astrology to be superstitious, but did accept that God sometimes used celestial bodies to send messages. Sara Schechner Genuth, *Comets, Popular Culture, and the Birth of Modern Cosmology* (Princeton: Princeton University Press, 1997), 100–02; Edward Rosen, “Kepler’s Attitude toward Astrology and Mysticism,” in *Occult and Scientific Mentalities in the Renaissance*, ed. Brian Vickers (Cambridge: Cambridge University Press, 1984), 253–272; Thorndike, *HMES* 7:19, 23–25. For Kepler’s views on the astrological aspects of comets in particular, see Johannes Kepler, *De cometis libelli tres* (Augsburg, 1619), especially 104–105. HM Carey, “Courting Disaster: Astrology at the English Court and University in the Later Middle Ages,” 1992.

¹⁸ Christopher Hill, *The World Turned Upside Down; Radical Ideas during the English Revolution* (New York: Viking Press, 1972). Ann Geneva, *Astrology and the Seventeenth Century Mind: William Lilly and the Language of the Stars*, vol. 1 (Manchester: Manchester University Press, 1995); Bernard Capp, *Astrology and the Popular Press: English Almanacs, 1500–1800* (Faber & Faber, Limited, 1979).

¹⁹ Burns, *An Age of Wonders*.

was characterized by natural philosophers' refusal—sanctioned by the conventions of the Royal Society—to engage in public speculation about the political meaning of the comet, though some did so in private.²⁰ In England, more than any other region in this study, authors failed to agree on the fundamental questions worth asking about comets. This led to two largely non-overlapping conversations: one that limited itself to the comet's motion, and one, much broader and more lively, that connected the comet to political and religious events.

Because the roots of this division can be found in the period immediately after the Restoration, Section 2.2 of this chapter explores the aftermath of the comets of 1664-1665, in which authors deployed early forms of the partisan arguments seen in the 1680s as well as the versions of skeptical arguments that would influence that later debate most. Having laid this foundation, Section 2.3 first introduces the social and material institutions that affected the debate over the comets in the 1680s: the political situation and the press. The excitement over the Great Comet stemmed largely from its appearance at a time of political turmoil in England, in the midst of the Popish Plot and the Exclusion Crisis. Meanwhile, the lapse of restrictions on the press in 1679 contributed to the exceptional variety and subversiveness of much of the press about the comet.

Sections 2.4 and 2.5 examine the two distinct conversations about the comet in more detail, beginning with discussions and private meditations by those affiliated with

²⁰ Prominent members of the Society such as John Spencer and Thomas Sprat made it clear in their early apologetics for the Royal Society that part of its aim should be to dispel enthusiasm, including the multiplication of prodigies. See Burns, 65-80.

the new institutionalized experimental science of the Royal Society. Public discussion in the Society remained confined to the mathematical and astronomical questions of the comet's path and whether the comets of December 1680 and January 1681 were the same object or two distinct ones. Privately, however, members of the Society and their correspondents expressed more complex opinions about the meaning of the comet and its relationship to God's will and to human moral behavior on earth. This is especially true for Isaac Newton, who, at the time of the comet's appearance was formulating a sacred history of the Earth in line with both natural philosophy and with his elaborate and heterodox interpretation of sacred scripture, including scriptural prophecy. Newton transformed the comet from a sign of God's judgment or a communication of God's will into an instrument for the maintenance of the universe, related to the salvation of humankind only through its privileged position as the ultimate destroyer of the physical world.

Section 2.5 moves from the speculations of natural philosophers to a much broader discourse that took as assured the comet's status as a communication from God. Unlike in the 1660s, those in the 1680s who argued that the comet *had* a moral purpose agreed, for the most part, on the nature of that purpose. Most were Whigs and took the comet as a judgment against Catholicism and those who supported it within England. Yet this is not entirely a case of "vulgar" versus "elite" culture; John Edwards' *Cometomantia* offered an extended argument from a Cambridge divine for seeing comets and other wonders as communications from God. Edwards' project showed that the elite adoption of a non-providentialist view of comets did not proceed without

criticism. Natural theology, which praised comets as occasions for meditating on the wonder of God and as reminders of divine glory, emerged as dominant among learned Englishmen and women by the end of the century as members of the Royal Society sought natural knowledge that was free of religious division and conflicts. Yet Edwards and others warned, rightly as it turned out, that freeing natural knowledge of its moral content would remove God, in crucial ways, from public life.

2.2 Echoes of Disaster: The Comets of 1664-65

In the 1660s, both proponents and opponents of the Restoration took the comet's appearance as a sign, but skeptical voices also arose to question them; many of these arguments reappeared in the 1680s. One series of publications produced an unusually large impact on the landscape of postwar prodigy interpretation. In 1661, a tract titled *Mirabilis Annus, or a History of the Monstrous Tidings of This Year 1661 from August Last*, appeared without the name of an author or publisher in London.²¹ The dates in the title marked the first year following the Restoration of Charles II. *Mirabilis Annus* described a series of monsters and prodigies and interpretations of them. These were almost universally apocalyptic in tone, suggesting the imminent demise of the monarchy as Whore of Babylon.

The tract shortly spawned two sequels—*Mirabilis Annus the Second*, and *Mirabilis Annus the Second Part of the Second Year's Prodigies*—that garnered

²¹ The authoritative account of postwar wonder-literature, to which this section owes a great deal, is Burns, 12-45. *Eniaytos Terastios, Mirabilis Annus, or The Year of Prodigies and Wonders, Being a Faithful and Impartial Collection of Several Signs* ([London], 1661).

immediate attention from readers and from the government.²² The pamphlets' wide audience should come as no surprise; the *Mirabilis Annus* tracts constituted only a particularly scandalous and bold contribution to a genre that had thrived before and during the Civil War and Protectorate. The Restoration government launched an extensive investigation to discover who had printed the subversive pamphlets. They met with little success, and it was these tracts, along with other subversive material, that led to the establishment of the Licensing Act in 1662 and the appointment of Roger L'Estrange, who had sought to suppress the original tract, as Licensor.²³

Both the comets of 1664-65 and the comet of 1680 came at inconvenient times for the monarchy and its supporters. The Popish Plot and the Exclusion Crisis fanned the flames in 1680, as we will see below. In the 1660s, Charles II was still a new king wary of those who wanted a return to a republic. He was vulnerable; he had just launched a war against the Dutch. A few years' hindsight gave additional fuel to the king's enemies, since the Dutch war proved disastrous and the most dreadful prophecies about the comets of 1664-65 seemed to come true with the devastating plague and fire of London just a year later. Supporters of the king found themselves hard-pressed to spin the comet and subsequent disasters as anything but divine judgments against the restored monarchy.

²² *Mirabilis Annus Secundus; Or, the Second Year of Prodigies* ([London], 1662); *Mirabilis Annus Secundus or the Second Part of the Second Year's Prodigies* ([London], 1662). On the government's response, see Burns, 35-38.

²³ Burns, 38; Roger L'Estrange, *A Modest Plea Both for the Caveat and the Author of It. With Some Notes upon Mr J. Howell, and His Sober Inspections*. (London, 1661), 11-15; Roger L'Estrange, *Considerations and Proposals in Order to the Regulation of the Press Together with Diverse Instances of Treasonous, and Seditious Pamphlets, Proving the Necessity Thereof* (London, 1663), 16.

In his celebrated poem recounting the plague and fire of London and the (still ongoing) Dutch war, John Dryden, a Royalist, had the navy seen off by celestial heralds:

To see this fleet upon the ocean move,
Angels drew wide the curtains of the skies;
And heaven, as if there wanted lights above,
For tapers made two glaring comets rise.²⁴

The awkward appearance of two comets so close to a monarch's accession and the departure of a fleet forced Dryden to turn traditional comet lore on its head. The poetic use of a *superstitio populi* by a court poet for the explicit purpose of bolstering the king's image should be noted, since, as will be seen below, by 1680 such deliberate invocation of prodigies, even in poetry, would become highly unusual for a Tory.

Like his fellow poets across the Atlantic, Dryden took a few stanzas to muse on the comets' nature and to address the sublunar/supralunar controversy. But aside from the familiar descriptions of the comet as Aristotelian exhalations or Tychonic moving stars, Dryden offered a third curious explanation for the comets' appearance, one tying it not to the Dutch war but to the person of Charles II, who had taken the throne in 1660:

Whether they unctuous exhalations are,
Fired by the sun, or seeming so alone:
Or each some more remote and slippery star,
Which loses footing when to mortals shown,
...
Or one, that bright companion of the sun,
Whose glorious aspect seal'd our new-born king;
And now a round of greater years begun,

²⁴ John Dryden, *Annus Mirabilis, the Year of Wonders, 1666 an Historical Poem Containing the Progress and Various Successes of Our Naval War with Holland, under the Conduct of His Highness Prince Rupert, and His* (London: Printed for Henry Herringman, 1667), stanza 16.

New influence from his walks of light did bring.²⁵

The “sun whose glorious aspect seal’d our new-born king” referred to a prodigy story that originally circulated in 1630, after Charles’ birth.²⁶ According to the story, a “noon-day star” had appeared in the sky on the king’s birthday. When Charles did re-enter London as king in April 1660, he did so on his birthday, a move orchestrated to fulfill what had been portended at his birth. Supporters of the Restoration marshaled all sorts of prodigies to support the legitimacy of the new king, but Dryden specifically connected the noon-sun story to the two comets in the 1660s.

Thus, the comets of 1664-65 immediately became symbols, alongside many other prodigies, of heavenly approval of the new king. But Dryden likely composed his own interpretation of the comet specifically in response to others that circulated in pamphlets and broadsides throughout England. These tended to be far less flattering to the new monarch and owed an explicit debt to the *Mirabilis Annus* pamphlets. William Burns, in *Age of Wonders*, has shown how the *Mirabilis Annus* affair cast a long shadow over the fortunes of prodigy interpretation in England.²⁷ The pamphlets were referenced explicitly in anti-providentialist and anti-apocalyptic tracts throughout the rest of the

²⁵ Dryden, *Annus Mirabilis*, stanzas 17-18.

²⁶ Schechner, 84. Versions of the story are recounted in Abraham Cowley, “Ode, Upon His Majesties Restoration and Return” [31 May 1660], in *Verses Written Upon Several Occasions* (London, 1663), 22-37; Edward Matthew [Karolou trismegistou epiphania], *The Most Glorious Star, or Celestial Constellation of the Pleiades, or Charles Waine, Appearing, And shining most brightly in a Miraculous manner in the Face of the Sun at Noonday at the Nativity of our Sacred Sovereign King Charles 2d* (London, 1660); Aurelian Cook, *Titus Britannicus: An Essay of History Royal: In the Life & Reign of His Late Sacred Majesty, Charles II of Ever Blessed and Immortal Memory* (London, 1685), sig. A8r.

²⁷ Burns, 12-45 and 99-100, though Burns argues convincingly for the affair as a turning point in associating prodigies with political subversion in the context of the Restoration.

1660s and 1670s.²⁸ Though many supporters of the monarchy, like Dryden, as well as moderates on both sides, continued to use prodigies to serve their political ends, the *Mirabilis Annus* affair provided concrete evidence for the power of Civil War-style prodigy-mongering to incite resentment against the government. Tories had this influence foremost in their minds when the comet appeared in 1680.

The *Mirabilis Annus* papers prompted skeptical responses as well. In 1663, John Spencer delivered a sermon at Cambridge on the subject of vulgar belief in prodigies. He developed this into a longer treatise that he published as a *Discourse concerning Prodigies*.²⁹ In the wake of the comet of 1665, he printed a second edition, amending the title: “to which is added a short Treatise concerning Vulgar Prophecies.” Spencer argued forcefully against the appropriation of comets for political and religious causes without due scriptural study. He emphasized the study of secondary causes, i.e., causes available to human inquiry, rather than attributing all causation immediately to the divine. This emphasis on secondary causes, rather than providential ones, likely emerged from his intense studies in history at the time. The study of secondary causes had become a theme in the Renaissance explorations of history Spencer read, which used classical

²⁸ For example, J. B., *The Blazing Star, Or, A Discourse of Comets, Their Natures and Effects* (London: Printed for Sam. Speed, 1665), 7. Even in the eighteenth century, Daniel Defoe explicitly connected a terrible storm in 1703 to the signs listed in *Mirabilis Annus* and quoted large sections of the pamphlets themselves, indicating just how well-known these publications remained almost a half-century after their first appearance. Daniel Defoe, *The Storm Or, A Collection of the Most Remarkable Casualties and Disasters Which Happen'd in the Late Dreadful Tempest, Both by Sea and Land*. (London: Printed for G. Sawbridge and sold by J. Nutt, 1704).

²⁹ John Spencer, *A Discourse Concerning Prodigies Wherein the Vanity of Presages by Them Is Reprehended, and Their True and Proper Ends Asserted and Vindicated* ([Cambridge?]: Printed by John Field for Will. Graves, 1663).

models in order to emphasize the political and personal causes of events to the deliberate exclusion of invocations of divine intervention.³⁰

However, he showed a clear awareness of the dangers of moving too far in the direction of skepticism, and offered an elegant description of the thin line that the religious teacher must walk when speaking of wonders. "As we must not loose [sic] our Philosophy in Religion, by a total neglect of second causes and turning superstitious," he wrote, "so neither must we loose our Religion in Philosophy, by dwelling on second Causes, till we quite forget the First and become profane."³¹ In 1680, Spencer still taught at Cambridge, and one of the most prolific commentators on the Great Comet, John Edwards, wrote in part to argue that Spencer had gone too far and had, indeed, "become profane."

Yet other anti-providentialists in the 1660s proved less cautious in eliminating the moral meaning of comets. A work that exercised considerable influence on those English-speakers who commented on the comet of 1680 was Thomas Browne's *Pseudodoxia Epidemica, or Vulgar Errors*, which appeared in 1646 and went through at least five other editions before 1680.³² Browne settled the question of whether God communicated through comets by keeping references to the divine to a minimum and recasting belief that comets cause disasters as superstition.

³⁰ For an extended discussion of Spencer's historical study and its relation to his work on prodigies, see J Gascoigne, "'The Wisdom of the Egyptians' and the Secularisation of History in the Age of Newton," *The Uses of Antiquity*, 1991, 177.

³¹ Spencer, 43; also quoted in Gascoigne, 178.

³² Thomas Browne, *Pseudodoxia Epidemica: Or, Enquiries into Very Many Received Tenents, and Commonly Presumed Truths* (London: Printed for the Assigns of E. Dod, 1669).

Rather than provide a religious meditation on the subject as Spencer did, Browne attacked the natural-philosophical soundness of the astrological argument for why comets should affect the earth. After presenting the theory that comets arise partially as a result of planetary conjunctions, Browne asks, “since it is found that many from whence these predictions are drawn, have been above the Moon, why may they not be qualified from their Positions and Aspects which they hold with Stars of Favourable natures?”³³

In this passage, he explicitly addressed the fact that recent astronomical research with telescopes had proven conclusively that at least some comets emerged above the moon. As celestial objects, they ought to be subject to the same rules about astrological influence as other heavenly bodies—influence which could prove positive or negative according to the planets’ positions. Through this questioning of the astrological coherence of the theory of comets, Browne argued that a truly consistent astrological interpretation should open up the possibility that comets bring good fortune, as well as bad. Astrologers tended to accept this argument, and even used it to their advantage, arguing that comets could be signs of good fortune for their patrons or their favored political parties, though, as we will see, this strategy proved more common in Spain.

Destabilizing the uniformly ominous meaning of comets was a key point for many commentators on the comet of 1680, including Pierre Bayle and Carlos Sigüenza y Góngora, whose treatises both spoke of rescuing the vulgar from the fear of comets.

³³ Browne (1658), 286-287.

Those who wished to dissuade the public from taking any heed of comets, such as Browne, argued against their monolithic reputation as harbingers of evil in order to introduce significant doubt into any attempt to discern their meaning. Most, however, found the meaning of the comet clear—it was a warning to England, which was in danger of slipping back into Catholicism.

2.3 England under the Comet

In January 1681, England's astrological scene looked dismal. William Lilly, the patriarch of Civil War anti-royalist prophecy, who had diligently (and correctly) predicted the victory of Cromwell's armies in the 1640s and whose almanacs and plainly-worded introductory astrology textbooks had shaped a generation of prognosticators, had died shortly after the comet appeared. His friend George Smalridge published a poem lamenting that Lilly had left the country undefended just as a comet and its accompanying political upheaval came to menace England:

This message 'twas the blazing comet brought;
I saw the pale-fac'd star, and seeing thought
(For we could guess, but only LILLY knew)
It did some glorious hero's fall foreshew:
A hero's fall'n, whose death, more than a war,
Or fire, deserv'd a comet: th' obsequious star
Could do no less than his sad fate unfold,
Who had their risings, and their settings told.
Some thought a plague, and some a famine near;
Some wars from France, some fires at home did fear:
Nor did they fear too much: scarce kinder fate,
But plague of plagues befell th' unhappy state
When LILLY died. Now swords may safely come
From France or Rome, fanaticks plot at home.
Now an unseen, and unexpected hand,
By guidance of ill stars, may hurt our land;

Unsafe, because secure, there's none to show
How England may avert the fatal blow.³⁴

Without Lilly's foresight, England would fall prey to "France or Rome" or "fanaticks" plotting at home. Lilly's successor in spirit, the vehemently Royalist crypto-Catholic John Gadbury, whose name had become synonymous with astrology itself, looked about to be hanged as a Papist traitor. He had been accused of casting the King's nativity, and thereby trying to forecast his death, a seditious act.³⁵ His widely-rumored Catholicism only contributed to a broad and fierce anti-Catholic fervor that took hold of England in the early 1680s.

Two events dominated the political landscape of England in this period: the Exclusion Crisis, in which radical Protestants sought to exclude the Catholic heir from the throne, and the Popish Plot, in which alleged Catholics were accused of trying to assassinate Charles II in order to hasten the accession of his Catholic heir, James II. Both events came to a head as the comet appeared in the sky. The extensive press networks abroad, the politicized domestic press, and the temporary elimination of restrictions on

³⁴ [George Smalridge], *An Elegy Upon the Death of Mr. William Lilly the Astrologer* (London, Printed for Obadiah Blagrave, 1681).

³⁵ Gadbury's allies struggled to defend him while he languished in prison. In one defense, the anonymous author accused an "impudent pamphleteer" of writing sensationalist, libelous news in order to earn money, and insisted Gadbury remained "a true Protestant in the sence of the Church of England Episcopally governed," rather than a Catholic as his opponents accused. His defender wrote that Gadbury's charity was missed by his neighbors while he remained in prison. "Nay, in the very prison where he now is, he to my knowledge give them physick for asking, and hath relieved them liberally with provision, so that the poor and oppressed who are there confined have received comfort by his afflictions." *Antikairoz: Or, An Ansvver to That Late Bundle of Malice, Stuft with Envy, Error, and Ignorance: And Sent into the World with the Title of Observations upon the Strange and Wonderful Prophecies of John Gadbury* (London : [s.n.], 1679), 4.

publishing subversive material molded the character of public discourse under the comet.

2.3.1 The Exclusion Crisis and the Popish Plot

In this period, the two parties that would subsequently dominate politics began to form.³⁶ The Tories championed a “high” (their opponents would say Popish) Church of England and argued for the usual succession of the House of Stuart, no matter what faith the heir apparent might profess. From 1678 to 1682, all of English royal politics hinged on this last point, as the open Catholicism of heir to the throne, Charles’ younger brother James, re-ignited old anxieties of Popish domination. Fears of a French-style, or, indeed, Spanish-style, clampdown on Protestant worship drove a vicious opposition movement through a series of acute crises, peaking in the 1680s. The Tories engaged in a fierce struggle with a diverse range of opposition groups known as Whigs. Whigs were often nonconformists, worshippers who did not follow the prescribed theology and practice of the Anglican Church. The Whigs also upheld anti-establishment sentiments

³⁶ The establishment of permanent parties in this decade was first explored in J Jones, *The First Whigs: The Politics of the Exclusion Crisis, 1678-1683*. (London, New York: Oxford University Press, 1961); Kenneth Harold Dobson Haley, *The First Earl of Shaftesbury* (Oxford: Clarendon Press, 1968). More recent studies, especially Jonathan Scott, *Algernon Sidney and the Restoration Crisis, 1677-1683* (Cambridge: Cambridge University Press, 1991), have complicated the usefulness of these party labels given the difficulties of isolating concrete lines between them. On the problems of using “Whig” and “Tory” identity as an explanatory device, I am in agreement with Scott. However, these labels have persisted in the literature of the early 21st century because of their usefulness in identifying distinct, though diverse, ideologies. I use the terms in this way, and offer this analysis as an inquiry into the historical actors’ attempts to negotiate the limits of these ideological discourses, and as a testament to the diversity within the camps that would later solidify into Tory and Whig.

that chimed discordantly with Tory memories of the recent Civil War and broad worries about the volatility of the London crowds.³⁷

The Exclusion Crisis, as the attempt to prevent James from inheriting the throne was known, came about largely because of widespread fears over a Catholic plot to assassinate Charles II. This “Popish Plot” began in 1678 when a well-connected English clergyman, Titus Oates, claimed to have details of an assassination plot and brought it to the attention of the king. Charles himself remained skeptical, but anti-Catholic members of Parliament pressed the case. The plot was eventually revealed as a fiction and Oates later sentenced for perjury, but not before the courts sent twenty-two people to the gallows. But in late 1680, the comet found England at the peak of the crisis over James’ succession and in the midst of fears of this Catholic plot. Observations of the comet appeared in the prodigy pamphlets that flew off the presses in almost unprecedented numbers after 1678, when censorship rules slackened and the crisis began to heat up.

2.3.2 The Press in England

The political situation occupied patrons at coffee houses and taverns, and the comet became part of the talk of the day. One pamphlet actually described one such conversation leading to the “discovery” of a lost prophecy of Merlin. The anonymous

³⁷ The state of the London crowds—“crowd” has replaced “mob” since Rudé’s treatment of the riots of the eighteenth century emphasized the pejorative use of the latter term—has been a matter of fierce debate in recent decades. Harris, *London Crowds in the Reign of Charles II: Propaganda and Politics from the Restoration until the Exclusion Crisis* has argued for high adult male literacy rates and a populace with an exceptional degree of political agency, not to be passively manipulated by propaganda from above. His study of the Tory “counter-propaganda” of Nathaniel Thompson raised the question of a popular Toryism, “Toryism from below,” which has influenced the literature on prodigies and apocalypticism.

author recalled that, “upon occasion of a Discourse concerning the late Comet at a Coffee-house in Guilford, a Gentleman now dwelling there, said, he had a Paper in his house ten years past. . .and at the request of some present, went and fetched this Prophecy, and read it to them.”³⁸ The pamphlet went on to recount the prophecy, which contained political content not unlike pamphlets on the comet itself.

This passing reference to a casual conversation—though it may have been a literary device rather than an actual record—at least brings our attention to the mass of observations on the comet that lie beyond the reach of this study. As a newsworthy phenomenon visible to the naked eye, the Great Comet elicited much oral commentary that passed through the sieve of the documentary record. What remained in the pages of pamphlets and diaries reveals only a slice of the conversation over the comet, filtered through the social and material processes surrounding literacy and print, and this must be kept in mind as we move through the sources.

The following analysis of the earliest reactions to the comet in England serves both to introduce the role of the English press in shaping the debate over the comet and to highlight a second position which this study, by virtue of its methodology, must leave out: indifference. Many, perhaps most, English people saw the comet and went about their business, feeling far more pressed by the struggles of wage work, domestic labor, politics, commerce, litigation, or the innumerable problems that might trouble one’s everyday life in 1680. Indifference presents special challenges for the historian, since

³⁸ *Merlin Reviv’d, Or, An Old Prophecy Lately Found in a Manuscript in Pontefract-Castle in York-Shire*, 1681.

historical investigations necessarily rely on those words written by people who cared enough about a subject to write them.

Sources that mention the comet explicitly afford only indirect access to this indifference. Comets getting short shrift in international newspapers was one manifestation of general indifference to the astrological or religious significance of the comet among some readers. Yet this example remains ambiguous. Simply expending valuable space mentioning the comet in a one- or two-page relation printed in tiny type shows at least a slight demand for news of such events from the reading public. But despite the indifference of some, the comet elicited excited reactions from many, and those responses to the comet spanned the social spectrum. The remainder of this chapter will analyze the beliefs and commitments of those who did respond to the comment in print or in their private musings.

European observations of comets made their way to England in various newspapers before the object itself appeared to the naked eye. In 1682, the *Loyal Protestant and True Domestick Intelligence* announced the sighting of what would become known as Halley's Comet on Thursday, September 28. The paper noted that in Rome, the Italian correspondent had "every night seen a Comet in the West, and Astrologers are very busie to know the meaning."³⁹ Yet the correspondent immediately moved on from this tidbit, finishing the sentence with "the Nunzio is not yet nominated,

³⁹ *The Loyal Protestant, and True Domestick Intelligence, Or, News from Both City and Country* (London: Printed by Nath. Thompson next the Cross Keys in Fetter-lane, 1681), Thursday, Sept 28, 1682, 2.

that is to carry the Sanctified blankets to the Duke of Burgundy. . ."⁴⁰ For the same comet in 1682, the *Observer*, a Tory paper in dialogue form, had its protagonist dismissively ask, "What says the Comet to the next Lord-Mayor?" but his Whig demurs to answer, moving briskly on to other news. The comet of 1680 itself garnered even less interest from the international papers of the day; other newspapers simply mentioned that the comet was seen, with no further mathematical or astrological detail.⁴¹

One pamphlet, specifically written about the comet of 1680, alluded to the lack of interest in early news of the comet. The anonymous author admitted that "little credit was given unto such rumors, or notice taken here of this Celestial Prodigy" hovering over Europe, "till Providence was pleased to order the same to appear very perspicuously in the Horizon of the Great and Honourable City of London" on 11 December from five o'clock to seven o'clock in the evening.⁴² Yet the writer viewed this as a lamentable circumstance, and a transient one. Once the comet did appear in England, the writer recounted, it was easy to find "many thousands of judicious and very Intelligent Eye Witnesses, who with Surprise and an awful Consternation, beheld the

⁴⁰ *Loyal Protestant and True Domestick Intelligence*, 2.

⁴¹ See: *True Protestant Mercury or Occurrences Forein and Domestick*, (London: Curtiss, April 16 1681); *Protestant (Domestick) Intelligence or News Both from City and Country*, (London, March 1, 1681), 1; *London Gazette*, (London, Feb 21, 1681).

⁴² *A True Relation and Description of the Strange and Prodigious Blazing Comett Seen in the Heavens by Many Thousands of People in London and Westminster, on the 11th and 12th Days of This Instant* (London: Printed for Benjamin Harris at the Stationers Arms in the piazza under the Royal Exchange in Cornhill and Enoch Prosser at the Rose and Crown in Sweetings-Rents at the east end of the Royal Exchange, 1680), 3.

[comet] . . .”⁴³ Londoners outside astronomical circles paid little attention to rumors of the comet until the weather cleared and revealed it to their own eyes.

This is not entirely surprising; Londoners had long since become accustomed to evaluating news from the Continent in real time. By 1680, they enjoyed access to a variety of short newspapers or relations, which offered weekly synopses of events from Calais to Ceuta to Moscow. These relations often touted explicit political allegiances—for example, the *Loyal Protestant and True Domestick Intelligence*—and cast light on the machinations of perceived Popish armies or goings-on among the Jesuits. News of the comet first appeared in these newspapers, as one small piece of news attached to a letter from, say, Germany or France. As the passage quoted above suggests, however, the comet rarely took a starring role in these international “intelligences.” Even those associated with radical Protestantism simply recorded that the comet was seen in a particular city, with no mention of how the populace responded or what local astrologers might make of it.⁴⁴ Once the comet became visible, however, the response could hardly be called indifferent.

The immense publicity the comet did receive in England arose from the scale of publishing facilities in the country and from their relative lack of government oversight in the early 1680s. Party politics received its shot in the arm from the array of printing presses operating throughout London and the rest of the country. The vitality of the

⁴³ *A true relation and description of the strange and prodigious blazing comet* (1680), 3.

⁴⁴ See: *True Protestant Mercury or Occurrences Forein and Domestick*, April 16 (London: Curtiss, 1681); *Protestant (Domestick) Intelligence or News Both from City and Country*, March 1 (London: 1681), 1; *London Gazette*, Feb 21 (London: 1681).

English press distinguished it from Spain, whose investment in newspapers and broadsides proved far less precocious.

It is the lushness of the English press, with dozens (even hundreds) of almanacs and thousands of pamphlets released each year, that explains one of the obvious asymmetries within this study. In England, almanacs sold at the rate of 40,000 copies per year in the 1660s, yielding approximately two almanacs for every five households.⁴⁵ In Spain, the next largest source-base among our regions, fewer than thirty pamphlets on the comets of 1680 and 1682 survive, and no almanacs. This is one reason why the scholarship on England, especially English astrology, has proved so rich, and why the decline of English astrology and English comet-lore has been studied to the near-exclusion of other regions.⁴⁶

England was not without its own restrictive laws on the press. After the Restoration, Parliament passed the Licensing of the Press Act, which required all printed material to receive the approval of the Royal Licensor. In 1679, this Act expired. William Burns, a historian of wonder literature, has observed that the expiration resulted in an “outpouring of oppositional material from the presses, including the first non-governmental newspapers to appear since the Restoration, in a situation reminiscent of

⁴⁵ Schechner summarizes the state of the English press and the relevant bibliography, 66.

⁴⁶ Notable exceptions have already been mentioned, but among them are Eric Jorink, *Reading the Book of Nature in the Dutch Golden Age, 1575-1715* (Leiden: Brill, 2010); Drévilion, *Lire et écrire l'avenir: l'astrologie dans la France du Grand Siècle, 1610-1715*; Tayra Lanuza Navarro, “Astrological prognostications in seventeenth-century Spain,” in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 73–86.

the collapse of censorship during the Civil War.”⁴⁷ As Burns notes, the spate of publications that appeared after the lapse of the Licensing Act “not only provided a foothold for previously-curtailed anti-Tory literature, they also “included a great deal of prodigy and other supernatural material.”⁴⁸

The Royal Licensor himself played a part in the story of the Great Comet, and makes a good case study for the intersection of the press and politics in comet literature. Roger L’Estrange had served since the 1660s as the Royal Licensor, a position that he used to target subversive astrologers and prodigy writers.⁴⁹ Comets proved a thorn in the Licensor’s side each time they appeared. L’Estrange gained his appointment as Royal Licensor partly as a result of the outpouring of prodigy tracts in the 1660s, including the anti-Restoration prophecies about the comets of 1664-1665 described above.

William Lilly fell afoul of L’Estrange because of a passage in the draft of his 1670 almanac, which connected the appearance of a small comet to the death of tyrants.⁵⁰ This trope could be found in dozens of well-respected classical works.⁵¹ Yet coming as it did from Lilly’s pen, it raised L’Estrange’s ire. The Licensor saw it as a threat to the state

⁴⁷ Burns, 22.

⁴⁸ Burns, 22.

⁴⁹ L’Estrange’s persecution of prodigy-writers in general, beyond comets, is addressed in Burns, 38 and 105-6.

⁵⁰ For Lilly’s career and his history with government prosecution, see Geneva, *Astrology and the Seventeenth Century Mind*, and Capp, 57-59.

⁵¹ Schechner summarizes the uses of comets as tokens of doom in Classical literature in Schechner, 20-26.

with the potential to arouse fears in Lilly's readership—Lilly's fiercely-Whig *Mercurius Anglicus* enjoyed one of the largest readerships of all English almanacs in the 1660s and 1670s.⁵² Lilly escaped the accusation as he had done many times since the Civil War, but his experience showed how L'Estrange, as a representative of the crown, diligently pursued even the barest hint of anti-monarchical comet prognostication.⁵³ But after the Act lapsed in 1679, L'Estrange lost his customary position, and by late 1680 he faced such hostility in London that he took refuge abroad.

While L'Estrange waited across the channel, his political opponents, freed from constraints on their printing businesses, attacked him in print. Among these attacks we find a satirical pamphlet purporting to be a letter to L'Estrange in exile from a "friend" (the pamphlet is less than subtle in its suggestion of homosexuality) in England. The "letter" ends with a raucous rhyme daring L'Estrange to defend Popery now that God had put a comet in the sky as a judgment against the Licenser and his ilk:

Now Crack-fart Roger, let your Crack-farts Fly
The Tell tale Comet, Scribble out oth' Sky. . .
Go on and Scribble, till the Gallows find
You out of Breath, the Halter stops your Wind.⁵⁴

⁵² Capp (1979), 57-59.

⁵³ Lilly recounts his many scrapes with censors in his memoirs, published posthumously by his friend Elias Ashmole in the early 18th century. William Lilly, *Mr. William Lilly's History of his Life and Times, 1607, to 1681, written in the 66th year of his age to his worth friend Elias Ashmole* (Charles Burman, ed. London: J. Roberts, 1715).

⁵⁴ "H.B.," *A True Copy of a Letter, Intercepted, Going for Holland Directed Thus for His, and His Wives, Never Failing Friend Roger Le Strange at the Oranges Court with Care and Speed, Hast, Hast, Post Hast* (London: Printed for H.B., 1680), 2.

A year later, however, L'Estrange returned to London where he founded a new paper called the *Observer*, a popular Tory answer to the upwelling of Whig publications. The *Observer* took the form of a dialogue between "Trimmer," a hapless Whig, and "Observer," a world-wise Tory. In 1684, L'Estrange jumped on the opportunity to ridicule comet-belief when he learned of the publication of a history of comets and their prodigious effects by Increase Mather in Boston.⁵⁵

On 5 April 1684, L'Estrange had Trimmer the Whig appeal to "Mr. Mather of New England," a learned authority on comets, to upbraid his adversary for a lack of faith in providence. "You have no more opinion of Providence," Trimmer accused his opponent, than to think "the world were Govern'd at Hap-Hazzard," saying that "Blazing Stars, Prodigies, Comets, Portents, and Signs in the Heavens, go for Nothing with you."⁵⁶ Trimmer's adversary, *Observer*, was none too troubled by this charge. In fact, *Observer*/L'Estrange leveled the charge for the express purpose of dismissing it as foolishness, and Mather with it. L'Estrange's poor estimation of his American contemporary was echoed by Sir Leoline Jenkins, who referred to Mather as "'that stargazer, that half deluded man."⁵⁷

L'Estrange's experience as a target and a persecutor of comet prophecy highlights the attention the government paid to the comet and showcases the resistance of astrologers and prodigy-writers to the process of regulating the press.

⁵⁵ For a detailed analysis of this work, see below, ch. 4.

⁵⁶ *Observer* 2:40 (April 5, 1684), 1r. Burns also addresses this episode, 105-06.

⁵⁷ *Mather Papers*, 528.

When the Licensing Act was in effect, astrologers and prodigy-writers took part in an ongoing negotiation of boundaries between what could be said or implied and what could not. These negotiations took advantage of the ambiguities inherent in the early modern English marketplace, where writers often found their works pirated, altered, and reprinted without permission. But when the Licensing Act lapsed in 1679, these arguments over authorial credibility moved from private proceedings before a council into the printed book itself, and establishment censors such as L'Estrange found themselves vying for credibility alongside those whom they had previously been able to silence.

Silence itself proved a valuable weapon for those who opposed the political appropriation of comets. One group in particular, the astronomers of the Royal Society, simply refused to engage publicly with the notion that comets had a political meaning or indicated God's political favoritism. This public silence had its roots in the 1660s with skeptical treatises such as those of Spencer and Sprat, who disavowed judicial astrology and political prodigy interpretation, doubly excluding providential accounts of comets from official Society discourse. Despite this public silence, prominent members of the society, including Isaac Newton, revealed more ambiguous attitudes toward comets in their private papers.

2.4 Long Shadows, Familiar Stories

The most important institutional framework for observation of the comet in 1680 was the diverse and dispersed network of observers in the Royal Society, which

had been founded in 1660. The comet captured the attention of Society members, but by and large the official records of the Society recorded only speculation about the comet's path, avoiding any mention of divination or the future effects of the comet. Because members of this group tended to see prognostications about the comet as astrological as well as religious in character, one of the most important factors influencing beliefs about the comet was the widespread ambivalence about the claims of astrology. Yet comet divination touched on the lives of various Royal Society members in a number of ways, despite remaining outside the acceptable realm of speculation within the public gatherings of the Society.

Multiple members of the Royal Society responded to the comet, including its most famous observer, Isaac Newton. As Simon Schaffer's work with Newton's manuscripts has shown, comets occupied a central role in Newton's cosmology. For Newton, comets commanded not only astronomical, but also eschatological interest. Newton, like many participants in the "vulgar" political debates in London, saw comets as instruments of God's providence. Crucially, however, this was a very different kind of providence than that articulated by learned and unlearned advocates for seeing comets as signs. In one sense, Newton was a providentialist, but he did not see comets as communications from God for the moral instruction of man. He kept even this lesser version of providentialism private until the early eighteenth century, but this private speculation provides insight into the motivations and beliefs of those opposing the public interpretation of a comet as a message from God.

2.4.1 The Comet and the Royal Society

Evidence is thin for speculation about comet divination in the meetings of the Royal Society itself. In one of the chief documents outlining the mission of the young Society, the *History of the Royal Society*, Thomas Sprat emphasized the dangers of allowing the unlearned to interpret prodigies and wonders.⁵⁸ He wrote in 1667, just two years after the last major comet. Sprat did not deny the existence of prodigies; rather, he stressed the need for trained natural philosophers to be acknowledged as the sole qualified interpreters of them. Such an order would prevent “false interpretations of Providences and Wonders” which occur “when we either make those to be Miracles that are none, or when we put a false sense on those that are real.”⁵⁹ A further mistake that applied especially to comets occurred “when we make general effects to have a privat aspect, or particular aspects to have some universal signification.”⁶⁰ In 1680, Robert Hooke presented an extract of Johann Heinrich Voigt’s *Cometa matutinus et vespertinus*. In that work, Voigt quoted from Luther on God’s wrath and predicts the end of the world in 1696, and asserts that failure to take heed of the comet, or to understand it as a prodigy, was a sign of atheism.⁶¹ Yet the official records of the

⁵⁸ Thomas Sprat, *History of the Royal Society* (London, 1667), 349–63.

⁵⁹ Sprat, 358.

⁶⁰ Sprat, 358. Also quoted in Burns, 69. For Sprat’s ideas about prodigies more generally, see Burns, 69–70.

⁶¹ Thomas Birch, *The History of the Royal Society of London for Improving of Natural Knowledge, from Its First Rise In Which the Most Considerable of Those Papers Communicated to the Society* (London: Millar, 1756), IV: 74. Johann Heinrich Voigt, *Cometa matutinus et vespertinus* (Hamburg, 1681). Robinson treats this work in detail in *Great Comet*, 40–43. See Schechner, 119–120 for an extended discussion of the reception of cometary tracts with prophetic content at the Royal Society and in the *Journal des Sçavants*.

meeting decline to mention this aspect of Voigt's tract, and Hooke's own work on comets in the 1670s did not discuss any effects of it on the earth, supernatural or otherwise.⁶²

Private documents revealed a more complex attitude toward the comet than the official silence on divination might suggest. As a member of the Royal Society, John Evelyn was well aware of its disregard for superstitions. Nonetheless, he gave some credence to the historical accounts of comets and their effects, if only as a sign of God's judgement.⁶³ In his diary entry for 12 of December 1680, he reported looking out his window to see a "meteor of an obscure bright color, very much in shape like the blade of a sword, the rest of the sky very serene and clear."⁶⁴ By noting the sword-like shape of the comet, Evelyn revealed how his observations were structured according to the Plinian classifications with which he would have been familiar. In the next breath, Evelyn linked the 1680 comet to one in 1640, a portentous date. "What this may portend God only knows," he wrote, "but such another phenomenon I remember to have seen in 1640, about the trial of the great Earl of Strafford, preceding our bloody Rebellion."⁶⁵ In the Plinian system, a sword-like comet signified war; Evelyn clearly understood this and,

⁶² See Schechner, 119-120, for an extended discussion of the reception of cometary tracts with prophetic content at the Royal Society and in the *Journal des Sçavants*. Robert Hooke and James Yonge, *Lectures and Collections Made by Robert Hooke. . . Cometa, Containing Observations of the Comet in April, 1677. . . Mr. Boyle's Observation Made on Two New Phosphori* (London: J. Martyn, 1678).

⁶³ On Evelyn as a providentialist within the Royal Society, see Burns, 77-78.

⁶⁴ John Evelyn, *The Diary of John Evelyn*, ed. Dobson (London, 1906): III.65-66.

⁶⁵ Evelyn, 65-66.

even if he saw no truth in the simple associations Pliny offered, he seemed to give at least a little credence to the historical fact of a comet occurring on the eve of war.

He confirmed this at the end of the entry, concluding with a revealing reflection on his beliefs about the natural order and God's communication with the world. "I pray God avert his Judgments!" he exclaimed, going on to explain that, "we have had of late several comets, which, though I believe appear from natural causes, and of themselves operate not, yet I cannot despise them. They may be warnings from God, as they commonly are signs of his animadversions."⁶⁶ Evelyn's short analysis carefully walked the line between alternative conceptions of the comet. By articulating his conviction that comets did not operate under their own power, he dismissed the idea—widespread, as we shall see, in Spain and Latin America—that comets exerted occult but natural powers on the world in order to cause death, disease, and famine. However, he did not go as far as to say they lacked all meaning.

In the first view, the comet displayed God's providence in only the weakest of ways, since an omniscient and omnipotent God must have created the world in such a way that the comet would appear at a particular place and time. But secondary causes—the occult powers of the comet itself and of the celestial bodies—were entirely natural and were the only necessary sources for predicting the comet's effects. This conception reified Nature and largely removed considerations of divine punishment from the interpretation of the comet—though, even in this view, the correct response

⁶⁶ Evelyn, 66.

would be to pray for God to divert the harmful natural effects. Yet by affirming that they appeared from natural causes, Evelyn also disavowed the other extreme, found among less educated commentators in England, that held the comet as entirely supernatural, coming directly from God.

Evelyn took a middle way, seeing the comet as a natural object but one not devoid of moral meaning. By affirming that he did believe comets arise from natural causes yet admitting that, even so, he “cannot despise them,” it seems that Evelyn saw some degree of conflict between these propositions. This suggests that he had been exposed to the idea that comets, as purely natural objects, ought to be “despised” as having no moral value, as not representing any kind of communication from the divine. This belief was widespread within the Society itself, through writers like Spencer and Sprat, and in the literature that he may have read in Latin or in English translation from the continent, such as Gassendi.⁶⁷ He rejected this notion, seeing in the historical record of comets sufficient reason to believe that God did mean them as signs of impending judgment.

2.4.2 Newton and the Comet

When the comet appeared in 1680, its motion naturally occupied the most celebrated astronomers in England. The subject of their argument, however, was not the meaning of the comet but the possibility of mathematically describing the path it took through the sky and fitting it with theories of orbital mechanics. Among those most

⁶⁷ Pierre Gassendi, *The Vanity of Judiciary Astrology, Or, Divination by the Stars* (London: Printed for Humphrey Moseley, 1659).

keenly observing it were Isaac Newton and his close correspondent, John Flamsteed, keeper of the newly-created Royal Observatory at Greenwich.

Most astronomers in England and abroad believed the comet was actually two separate objects.⁶⁸ It was Flamsteed who proposed that the comets of November and December 1680 might be one and the same body moving around the sun instead of two distinct objects moving in linear trajectories. He suggested that the sun might be acting as a magnet, first attracting one pole of the comet and then repelling the other.

Newton opposed this theory on both physical and astronomical grounds. On the one hand, he rejected the premise that hot bodies like the sun produced a magnetic force. On the other, he did not agree with Flamsteed's account of the comet's trajectory, which had the comet changing direction in front of the sun. As late as April 1681, Newton wrote to Flamsteed, saying, "to make ye comets of November & December but one is to make that one paradoxical."⁶⁹ Newton had worked out a cursory version of his theory of planetary motion, but did not attempt to apply it to the "comets," because as transient, temporary bodies, comets must move in straight lines.

The notion that permanent objects moved in closed orbits while impermanent ones shot through the solar system in straight lines permeated seventeenth-century

⁶⁸ Detailed analyses of the debates over the nature of the comet in England can be found in Schechner, chs. 9 and 10; Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (Cambridge: Cambridge University Press, 1980), and especially Schaffer, Simon. "Newton's Comets and the Transformation of Astrology," in *Astrology, Science, and Society* (1987): 219-43.

⁶⁹ Newton to Flamsteed, 16 April 1681, Newton Correspondence (2:363-67), 364. A detailed account of Flamsteed's theory of comets can be found in Schechner, 9.

scientific circles.⁷⁰ This association preceded Descartes, who provided the most famous articulation of it in his vortex theory, and the idea was present in Kepler's writings.

Hevelius, a mid-century authority on comets, affirmed that "a perennial object gyrates in an orbit, but objects which are going to be destroyed, on the contrary, are thrown in straight lines."⁷¹ Within the English astronomical community, Seth Ward's

Cometographia (1668) also addressed this idea. Ward argued against any kind of circular orbit for comets since they are known to be ephemeral, not permanent, objects.⁷²

Newton's quest to fit the motion of the "comets" of 1680 into straight-line paths stemmed from assumptions about the fundamental distinction between permanent and impermanent objects that had persisted in various guises from Aristotle.

Yet after much wrangling with rectilinear paths, failure forced Newton to consider alternative kinds of motion for the comet. Private documents revealed Newton's struggles as he began to change his mind. A draft of a letter in the spring of 1681 explored the path a comet might take under the influence of some magnetic force in the sun. He had begun to consider the possibility that comets might move like planets. Yet in 1681 he was not apparently ready to share his thoughts even with Flamsteed, who had been pressing for a non-linear orbit for comets for some time. He expurgated these musings from the version of the letter that he eventually sent to

⁷⁰ For a detailed examination of the question of closed orbits and permanence, see Schaffer, 136.

⁷¹ Schaffer, 220.

⁷² Stephen Shapin describes the exchanges over the comet of 1664-5 at length in *A Social History of Truth*, 272-275. Seth Ward, *De Cometis ubi de Cometarum. . . nova Cometarum Theoria, novissimi Cometæ Historia: cui subjuncta est Inquisitio in Ismaelis Bullialdi Astronomiæ Philolaicæ fundamenta* (Oxoniae, 1653).

Flamsteed, and continued publicly to insist that the comets of November and December were different objects.⁷³

Gradually over the course of the early 1680s, however, Newton's opinion did change. The key manuscripts here have proven difficult to date with precision, but sometime before 1683 he settled on the idea that comets moved in closed orbits and that what appeared in 1680 had indeed been a single object. Finally, the 1684 treatise *De Motu* presented his theory of universal gravitation in a mature form, though Newton neglected to give credit to Flamsteed for the idea of comets in closed orbits.⁷⁴ This theory earned its public recognition, of course, with the 1687 publication of the first edition of the *Principia*. Comets could hardly be considered tangential to the project in that work; Newton considered the comet theory in the *Principia* a vital test case for his theory, reportedly calling the section on comets in Book III "the most difficult in the whole book."⁷⁵

With the publication of the *Principia*, comets had taken their place in a complete theory of universal gravitation that would stand relatively unchanged until the twentieth century. In later editions of the *Principia*, Newton included Edmund Halley's calculations of the path of the comet of 1682 (Halley's Comet). In 1705, finally, Halley published the

⁷³ Newton to Flamsteed, *Newton Correspondence*, 2:361, 363-367.

⁷⁴ Newton, *De motu corproum in gyrum* (1684), U.L.C. MS Add. 3965.7, fols. 55r-62r. Comets are addressed in problem 4, scholium, on fol. 60r.

⁷⁵ This statement was reported by David Gregory, "In the new Edition of Newton's Philosophy these things will be done by the author," memoranda, ca. July 1694, in *Newton Correspondence* 3:385.

prediction that the comet of 1682 would return in 1748.⁷⁶ The successfully-predicted return brought about Seneca's prophecy of an astronomer who could predict the appearance of comets and take the wind out of the sails of idle doom-mongers. Like the comet, the narrative would come full circle, replacing astrological prognostication with scientific prediction.

2.4.3 Reforming Newton

Of course, describing how Newton's and Halley's calculations of cometary orbits came to be does not directly address the question of superstition. Upon closer examination of the evidence, historians have emphasized that, even within the narrow realm of cometary theory within the Royal Society itself, discussions of the meaning of the comet, and of its natural effects and its place in divine providence, persisted. Simon Schaffer has picked out the 1680s and 1690s as a period crucial for redefining the meaning of comets for natural philosophers and astronomers, arguing that in these years, "Halley and Newton did not reduce the moral and theological function of comets. They made them an integral part of a natural philosophy of whose task was to locate the restorative, transformative and prophetic effects of astronomical signs."⁷⁷

Schaffer's work with Newton's manuscripts has uncovered how Newton's cometary theory emerged alongside of his speculations on biblical chronology and of a complete and closed "system of the world" beginning in the late 1670s. Furthermore,

⁷⁶ Edmund Halley, *A Synopsis of the Astronomy of Comets* (London: Printed for John Senex, next to the Fleece Tavern, in Cornhill, 1705).

⁷⁷ Schaffer, 219.

Newton and his correspondents did not remain isolated from the political and religious conflicts of the day. As Simon Schaffer has argued, “the immanence of Papism prompted much of Newton’s prolific work on church history and prophecy in the 1680s.”⁷⁸

Throughout the 1670s and into the 1680s, Newton formulated the foundations of his theological worldview, in which comets played a key role. According to Newton, the new theory of universal gravitation did not represent a triumph for a progressive science—on the contrary, it was a recovery of the *true* natural philosophy, which had been practiced in the days after Noah by the Chaldeans. This perfect natural philosophy, symbolized for Newton by the practice of putting a fire in the center of a temple as an emblem of a heliocentric universe, had suffered humiliation and corruption at the hands of generations of idolaters, including Jews and Christians. The doctrine of the Trinity represented the supreme idolatry, and Newton left no doubt about his contempt and hatred for the Roman Catholic Church, which had enshrined the false doctrine of the Trinity and debased natural philosophy.⁷⁹

What had comets to do with this system? Most of the detailed information we have on this point comes from conversations Newton had with friends and followers in the early eighteenth century.⁸⁰ Still, remarks in draft versions of the *Principia* showed

⁷⁸ Schaffer, 220.

⁷⁹ Margaret J. Osler and Paul Lawrence Farber, *Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall* (Cambridge University Press, 2002); John Hedley Brooke and Ian Maclean, *Heterodoxy in Early Modern Science and Religion* (Oxford University Press, 2005); Westfall, *Never at Rest: A Biography of Isaac Newton*; DB Haycock, *William Stukeley: Science, Religion, and Archaeology in Eighteenth-Century England*, 2002.

⁸⁰ Most pertinent to Newton’s understanding of comets is John Conduitt, [Account of a conversation between Newton and Conduitt] (7 March 1724/45), Keynes Ms. 130.11, King’s College

that Newton had put together the rudiments of his theory about the place of the comets in his recovered Chaldean natural philosophy by the mid-1680s. This occurred at the same time that many others grappled with questions about the role of comets in God's universe. In these remarks, which he struck from the final version of the 1687 edition of the *Principia*, Newton portrayed the world as a kind of living vegetable, with a vital force circulating throughout the solar system. Quite apart from the clockwork universe that later Newtonians would thank him for creating, Newton's personal conception of the world-system was organic and vital in deep ways—and, as Leibniz saw to his horror—it was apt to run down.

According to Newton, a system that could run down left space for divine intervention.⁸¹ Leibniz, in his famous Clarke correspondence with Samuel Clarke, saw this as evidence that Newton viewed God as an inept creator whose systems lacked perfection and required tinkering. But for Newton this was precisely the point—God operated constantly in the universe through the laws of motion, but did not leave the

(Cambridge, UK), Conduit memorandum printed in Edmund Turnor, *Collections for the History of the Town and Soke of Grantham, Containing Authentic Memoirs of Sir Isaac Newton, Now First Published from the Original Mss. in the Possession of the Earl of Portsmouth* (London: Printed for W. Miller by W. Bulmer and Co., 1806), 172.

⁸¹ This is not to say Newton's God was a "God of the Gaps," apparent only in occasional interventions into the natural order of things. Rather, for Newton, divine existence and divine action underpinned the function of the laws of nature. This was true for Catholic thinkers also, for whom God is of course logically and metaphysically prior to any regularities in nature and must continually re-create the world moment to moment in order to maintain its being. Yet Newton rejected much of the intermediate causal structure of the Catholic model of the universe, especially ideas about a self-governing Nature, seeing these as idolatrous. He also proposed the idea that absolute space and time existed within God's "sensorium."

laws to run the universe by themselves. The latter proposition of a world perfectly capable of running itself amounted to idolatry in Newton's eyes.

The perturbations in the universe came from comets. Newton argued that comets emerged as pseudo-planets with highly eccentric orbits, which brought them near to the sun and to the other planets, producing slight but devastating instabilities in the whole system. Yet they also brought life by falling into the sun and restocking its fuel. The comet of 1680, Newton mused, passing so much closer to the sun than any other known comet, would surely be the next to meet this fate. Later in life, in a conversation with a biographer, he reportedly speculated that comets "replenish the sun (which must waste by the constant heat and light it emitted), as a faggot would this fire, if put into it (we were sitting by a wood fire), and that would probably be the effect of the comet of 1680 sooner or later."⁸²

Again, though, the comet's function remained ambiguous, bringing life to the sun and death to the earth. Still speaking of the comet of 1680, Conduitt recalled that Newton "could not say when this comet would drop into the sun; it might perhaps have five or six revolutions more first; but whenever it did, it would so much increase the heat of the sun, that this earth would be burnt, and no animals in it could live."⁸³ The comet that caused such terror in the general populace, then, was for Newton a far more menacing object, likely to destroy the entire world and all life upon it—but

⁸² Conduitt, 1r.

⁸³ Conduitt, 1r.

mechanically, through heat, rather than through God's hand or through occult transmissions of celestial influences.

Newton, however, left room in his conjectures for a way out of the catastrophe. "When I asked him how this earth could have been repeopled," Conduitt wrote, "if ever it had undergone the same fate it was threatened with hereafter by the comet of 1680; he answered, that required the power of a creator."⁸⁴ Newton even speculated that such a "Reformation" of living things might have happened in the past, when another comet fell into the sun, but refused to elaborate on such "conjectures." Still, it is clear that a dynamic universe upheld by the general providence and the occasional direct intervention of God owed much of its dynamism to the action of comets, which affected the fate of the cosmos and of mankind.

According to Newton, comets played a vital part in the maintenance of the cosmos. In that sense, they remained instruments of God's providence. But this providence was a far more distant kind of providence than that assumed by political authors on the comet. There was little to no *moral* value in a comet's appearance in Newton's scheme. Comets served God to set the universe aright, but pious Christians on the earth should not see them as communications from God about the specific details of man's progress toward salvation or damnation. Newton, of course, did not remove all communication between God and the world; his careful analysis of scriptural prophecy yielded hints of what was to come, but these insights could come from scripture alone,

⁸⁴ Conduitt, 1v.

not wonders in the world. For many who sought meaning in the wonders of the heavens, this was an unacceptable slide toward atheism.

2.5 Anti-Catholic Sentiment

The comet became a prop in the Popish Plot from the moment of its first sighting. Israel Tongue, one of the major players in the Popish Plot, published the *Northern Star*, a treatise connecting the comet to the events of the plot, and dozens of authors followed suit.⁸⁵ In one anonymous pamphlet, the author professed not to be surprised at the appearance of such a large comet, writing, "indeed, what Prodiges of Villany have we not lately seen discovered amongst us? Hellish Miscreants, under pretence of advancing Catholick Religion, plotting and practising most horrid Treasons, Assassinations, effronted Perjuries, and all kind of Wickedness?"⁸⁶

The author, however, had not resigned himself to terrible consequences from the comet. He held out hope that, through true repentance, England could avert the doom the comet signified. He invoked previous occasions on which God provided a heavenly sign for the guidance, rather than the punishment, of his people: "but we hope and may assuredly believe (if our crying Sins do not divert it) that God, whose Adorable Providence of Old, by Signs and Wonders delivered his Chosen Israel out of Egypt" will avert the disaster.⁸⁷ The author tied the biblical pillar of fire, which led the Israelites

⁸⁵ Tongue, *The Northern Star* (London 1680).

⁸⁶ *A True Relation*, 7.

⁸⁷ *A True Relation*, 8.

through the desert, directly to the political situation prevailing in England and to the comet, writing,

as [God] hath in so miraculous a manner detected and defeated the Malice of our Popish Adversaries against our King and Religion, so he is graciously pleased to signifie by this Celestial Pillar, that he is still ready to Conduct and Support us, and will certainly deliver us from the Machinations of all those spiritual Egyptians, who study and strenuously endeavor to involve us in Idolatry and Slavery.⁸⁸

By setting the comet in the biblical context of the book of Exodus and the flight out of Egypt, he established the comet not only as a threat, but as a sign of hope for the overthrow of the Catholics, the “spiritual Egyptians.” Thus we see that even in an explicitly providential context, the comet had become unmoored from its traditional meaning as an unequivocally bad sign.

In a pamphlet called *The Petitioning-Comet*, the author, “Democritus” undermined attempts to re-interpret the meaning of the comet of 1664. He was just one of many Whigs who took advantage of the fact that, in England, predictions of dire effects after the comet of 1664 had proven correct on a horrific scale in the form of the great fire and great plague of 1666. “The *Blazing-Star* before the late Civil Wars,” wrote Democritus in 1680,

as well as those two dreadful Comets before the last Plague, and Fire of London, may (considering the present ill state of this unhappy Nation, and sinful People) give us just occasion to fear at least no better an Event, after this so much a worse Comet, than has ever yet appear’d; unless Providence grants that happy Union

⁸⁸ *A True Relation*, 8.

of Protestants, and Exclusion of Papists, which all good men, that are not so themselves, must ever wish and pray for.⁸⁹

Democritus thus appealed to history, especially the appearance of a comet so close to the plague and fire of London in 1666, to justify the fear of comets. This would be a strategy other malefactivists in the Spanish and English-speaking world turned to again and again, as they faced challenges not only by politically-minded writers who sought to appropriate the comet for their own ends, but from those who saw religious reasons for arguing that comets could signify positive effects—or those who believed they were not signs from God at all.

Yet Democritus' assertion that a comet could only signify disaster was again mitigated by his insistence that such disasters came only at God's pleasure, and God could cancel them if he wished. The comet, then, had the potential to signal not only an ominous threat of divine wrath, but also the possibility of divine grace and of victory over the enemies of true religion. Democritus closed his pamphlet with this line of thought, arguing that the comet should be interpreted as a warning from God directly to the sitting Parliament:

but if the New Parliament (for whose Convention so many good men pray) continue long to sit, I fear not but the STAR will lose its virulence and malignancy, or at least its portent be averted from this our Nation; which being the humble request to God of all good men, makes me thus entitle it, A Petitioning-Comet.⁹⁰

⁸⁹ Democritus, *The Petitioning-Comet Or, A Brief Chronology of All the Famous Comets and Their Events, That Have Happened from t,he Birth of Christ, to This Very Day: Together with a Modest Inquiry into This Present Comet*, 11.

⁹⁰ *The Petitioning-Comet* (London: 1681), unpaginated letter from the author to the printer.

Democritus was not alone in seeing the comet as a warning for Parliament, as a plea and warning for change rather than a sign of certain doom. This was the power of the comet—it did not merely warn of disaster, but, properly interpreted, represented a chance for repentance and salvation, if only those in power would take heed.

On the other hand, those wishing to dismiss the claims against the king and the put the whole anti-Catholic affair behind them saw the comet as a sign of a divided kingdom, at risk of perishing in sin. John Fell, Bishop of Oxford, gave a sermon to Parliament on 22 December expressing this sentiment. Fell believed God was warning England not of a Papist conspiracy, but rather with disastrous political divisions that threatened the integrity of the State.

The punishments the comet foretold, if any, would fall on Whig rabble-rousers rather than those seeking to restore order. “This is evidently our case,” Fell preached, “and do we not see a writing on the wall, like that described in the book of Daniel. . .that God has numbred our Kingdom and finisht it, that we are weighed in the balance and found wanting, and that our Kingdom is divided and given unto Strangers?”⁹¹

Fell pointed to the comet as a sign of this dire political division, asserting—quite audaciously in light of the flurry of differing opinions flying around the country—that the comet’s meaning was clear:

We need not look out for a master of Magicians to decipher or unfold the writing, tis so plain that he who runs may read it. This

⁹¹ John Fell, *A Sermon Preached before the House of Peers on December 22 1680 Being the Day of Solemn Humiliation* (Oxford: Printed at the Theater, 1680), 8.

is the Comet that blazes in our Sky; and threatens Ruine and Destruction to us, beyond the abodings of Astrology.⁹²

But, despite Fell's insistence, the meaning of the comet was not plain to see, as the intense conflict around the comet and the Popish Plot showed. Fell would have been in the minority among his fellow learned Tories for simply insisting that the comet *had* a meaning at all. Fell's sermon hinted at a resistance among some segments of the learned elite, especially clergymen, to the anti-providentialism championed by the Royal Society. It was this resistance that prompted John Edwards, in 1684 after the debate over the comet had settled down, to offer the longest reflection on the meaning of the comet in England. His treatise, the *Cometomantia*, extends to over 150 pages, and offers a polemical critique to what he saw as the rising tide of atheism.

2.6 Defending Prodigies

The work of John Edwards, a Calvinist clergyman, showed that the marginalization of prophecy did not escape criticism, even from the learned. Edwards resided in Cambridge and had been educated at St. John's College. In the early 1680s he was serving as minister at St. Sepulchre's in Cambridge.⁹³ He had earned some fame for his high Calvinist teachings and is most known for his criticism of atheism in general and John Locke in particular in *Some Thoughts Concerning the Several Causes and Occasions of Atheism* (1695), *Socinianism Unmasked* (1696), *The Socinian Creed* (1697), and *A Brief*

⁹² Fell, 8.

⁹³ For further discussion of Edwards (one of the few in secondary literature), see Schechner, 116-117.

Vindication of the Fundamental Articles of the Christian Faith (1697).⁹⁴ In the 1680s, the threat of atheism was already forefront in Edwards' mind. He saw the danger in failing to see a comet as a communication from God. For Edwards, seeing comets as signs of God's mere presence, rather than God's pleasure or displeasure, could not be sufficient.

John Spencer, the author of one of the most influential anti-prodigy tracts who still, in 1684, resided at Corpus Christi, was likely among his targets. Edwards knew Spencer's work against prodigies, and near the end of the century he would criticize Spencer's account of the ancient Jews.⁹⁵ In the *Cometomantia*, Edwards was especially troubled by members of the clergy who undermined a vision of an active, interventionist God. Spencer had the upper-hand in terms of political and religious authority, perhaps explaining why Edwards chose not to call him out by name.⁹⁶ It also seems plausible that Edwards had come across Pierre Bayle's work in French, though, again, Edwards did not cite him directly.

Edwards deliberately invoked the language of the new science, if not its conclusions, taking pains to assure the reader that he "abandoned all confidence and presumption in this present inquisition, but withal I despaired not of attaining to true notions and sentiments."⁹⁷ In the preface to the reader, he wrote that he did not doubt

⁹⁴ C. J. Robinson, "Edwards, John (1637–1716)" in Rev. Stephen Wright, ed., *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 2004).

⁹⁵ Gascoigne, 173.

⁹⁶ Spencer, *A Discourse Concerning Prodigies*. For additional evidence that Edwards meant to attack Spencer, see Gascoigne, 207, n. 23.

⁹⁷ John Edwards, *Cometomantia, A Discourse of Comets* (London: Printed for Brab. Aylmer, 1684), "Preface," 2r.

“but it will be an evident conviction to all sober minds of the presaging Nature of Comets.”⁹⁸ He dedicated the treatise to Seth Ward, astronomer and Bishop, for his expertise in astronomy and especially comets.⁹⁹ Furthermore, he purported to dismiss the authority of the ancients and of other men, saying, “I have a great fancy for Rabbi Achiva’s Advice, ‘Do not blindly adhere to what others have maintained. Brag not of other Mens Inventions.’ ”¹⁰⁰

Edwards aimed, above all, to distinguish his work from “credulous” predecessors, who took the prodigious nature of comets for granted rather than proving it through rational and empirical argument. Taking pains to assure his readers that he would not yield to ancient authorities constituted a main part of this strategy.

He also tried to position himself within contemporary rational discourse by asserting that he had “avoided the imputations which generally lies upon those who handle this subject, viz. their fond and idle way of pointing peremptorily at such and such particular events which shall certainly follow the appearance of comets.”¹⁰¹ The “idle” linkage between a comet and a particular outcome was, for Edwards, fraught with difficulty and those who had done it incorrectly left the whole providential theory of comets open to criticism. Again, Bayle may have been the unspoken enemy here, but it was just as likely that Edwards feared the historical criticism of Gassendi or Lubienietzki,

⁹⁸ Edwards, “Preface”, 1r.

⁹⁹ Edwards, unpaginated epistle dedicatory.

¹⁰⁰ Edwards, “Preface,” 2v.

¹⁰¹ Edwards, “Preface,” 3r.

a mid-century author of comet-catalogs who issued a detailed critique of the histories of comets and events.¹⁰² As we will see in subsequent chapters, Edwards was not alone: it was the body of historical evidence that attracted some of the most incisive criticism of the providentialist view.

Despite Edwards' protest on this front, the treatise did rely, for the most part, on the testimony of ancients and moderns—but he sought to highlight the disagreements between them, and thus to sow doubt as to their authority. Part III of the treatise consisted of the usual survey of ancient and modern authors, but Edwards excused himself for this: “for though I confess I never thought the cause of truth was to be decided by majority of votes, yet in this case I dare venture to put it to the poll.”¹⁰³ The “truth” in this case was the providential nature of comets, which he proved by a *skeptical* argument, arguing that the failure of astronomers to reach definite conclusions about the nature and origin of comets offered indirect proof of their status as wonders beyond the epistemological reach of the human mind.

Edwards began, like many critics of providentialism, with the traditional division between comets as signs and comets as causes. Gassendi and Bayle both famously argued that they could be neither, but Edwards refused to yield this point. In order to prove that comets are both signs *and* causes, he began with an inquiry into their nature. He took great pains to establish that learned astronomers cannot agree on even the

¹⁰² Stanisław Lubienietzki [Lubieniecki], *Stanislai de Lubienietz Theatrum cometicum daubus partibus constans* (Amsterdam: Typis D. Baccamude Apud F. Cuperum, 1666).

¹⁰³ Edwards, 3.

basic details of the nature of comets, much less their origin.¹⁰⁴ After a long inquiry into the contemporary confusion of opinions regarding their origin, their situation above or below the moon, and their motion, he proposed to argue “that they are a sort of phaenomena which were made to puzzle the world, and that their strange nature signifieth to us their more strange events.”¹⁰⁵ The disagreements and “the variety of their opinions. . .undeniably prove to us, that the things they search into are rather to be admired than explained.”¹⁰⁶ The increasing frequency of comets, too, attracted Edwards’ attention. “If,” he wrote, “I prove that these strange lights are boding. . .I cannot see but that we shall be very much concerned.”¹⁰⁷

The failure of astronomers to find the truth about comets provided Edwards with one of his chief arguments that they were providential. He listed many moderns who, like Seneca, gave up trying to find the ultimate causes for comets and proposed some hidden power that animated them. Saying that it would have been easy for these men to put forward a hypothesis, since they were “the chief favourites and confidants [sic] of Nature,” he observed that “this was not the course they took, but they suspended their judgments, and nothing but mighty dissatisfaction and amazement appear in their

¹⁰⁴ Edwards, 4-14.

¹⁰⁵ Edwards, 35.

¹⁰⁶ Edwards, 51.

¹⁰⁷ Edwards, 48.

writings; and instead of being positive and decretory, they confessed themselves silenced and puzzled.”¹⁰⁸

This “puzzled silence” before the mystery of providence was, for Edwards, a supreme virtue. Here was no late scholastic arguing for certain knowledge from first principles. He counseled epistemological humility in the face of humanity’s greatest minds’ failure to agree upon the most trivial and apparent details about comets. But Edwards’ argument was not mere fideism. Edwards’ theological belief that God used comets to punish and communicate with the world required that such communication must be *clear*, and therefore apparent to human understanding. In contrast to Bayle, who famously argued that if God used comets to communicate, he had done a terrible job, since comets had been the cause of immense confusion and idolatry, Edwards aimed to show that God communicated clearly for those trained to understand.¹⁰⁹

God worked through secondary causes in order to convey messages to believers on earth, and these secondary causes could be investigated with precision. For Edwards, the connection between comets and their effects was natural. To say otherwise, he asserted, would be to deal in magic or idle divination, no better than the idolatrous oracles and fortune telling of the pagans. To avoid charges of magic and divination, he argued that “the things which lead us to the knowledge of future events must have a natural connexion with the things they are said to point at, or else they may justly be

¹⁰⁸ Edwards, 59.

¹⁰⁹Pierre Bayle, *Miscellaneous Reflections, Occasion’d by the Comet Which Appear’d in December 1680. Chiefly Tending to Explode Popular Superstitions. Written to a Doctor of the Sorbon, by Mr. Bayle* (London: Printed for J. Morphew near Stationers-Hall, 1708).

reckoned to be vain and fantastic.”¹¹⁰ Edwards did not shy away from asserting that comets could be physical causes of terrible effects. “I assert then that comets signify both naturally and arbitrarily, that is, in themselves, and likewise by divine institution. Whether you consider them Physically or Theologically, they are certain indications and signs of future evils.”¹¹¹

The certainty of this proposition was vital for Edwards. While what comets *were* and where they came from was in doubt and lay beyond human knowledge, what comets *did* to the earth could not be in doubt. Edwards located the precise nature of this natural connection in a comet’s heat and its ability to poison the air of earth. “If it once be admitted that comets distemper and inflame the air . . . it will necessary follow, that a barren soil, and the corrupting and blasting of the fruits, must be the products of them.”¹¹² Edwards offered no direct argument for admitting this proposition, but seemed to accept it, quite correctly, as one of the few points of agreement among astronomers ancient and modern.

From this “necessary” proposition, Edwards derived most of the traditional effects of comet lore: “and from these will naturally ensue dearth, scarcity and famine. And as the inevitable effect of both, we much expect sickness, diseases, mortality, and more especially the sudden death of many Great Ones.”¹¹³ Edwards provided a natural

¹¹⁰ Edwards, 62.

¹¹¹ Edwards, 61.

¹¹² Edwards, 65.

¹¹³ Edwards, 65.

explanation for the unlikely phenomenon of comets “targeting” monarchs and men of state, relying on the weakness of their bodies. The bodies of the “great” “are sooner and more easily hurt than others, for their delicate feeding, and luxurious course of life, and sometimes their great cares and watchings, which weaken and infeeble their bodies, render them more obnoxious than the vulgar sort of people.”¹¹⁴ Yet the comet’s effects on the body spread further within the population, affecting even the common sort. “By their noxious and infections irradiations, mens bloud is apt to be height’ned into fevers . . . and all malignant distempers, and even into the most contagious diseases.”¹¹⁵ Because of this, “the consequence of a raging pestilence from a comet is very easie and natural, if not almost necessary.”¹¹⁶

Until this point, Edwards’ argument would fit comfortably within a standard distinction between “natural” and “judicial” astrology (though at this point he limited himself to comets and excluded astrology). He addressed the effects of comets on the climate and on living bodies but left politics and other matters subject to the human will aside. This was a distinction that Edwards made later in the treatise, but in his discussion of comets as natural causes, Edwards did not refrain from assigning comets as natural causes of political events. Their power in this case, however, derived entirely from their effects on physical bodies. “For from what hath been said before, viz. that they portend the death of princes, it follows, that they probably bode great changes and vicissitudes

¹¹⁴ Edwards, 65.

¹¹⁵ Edwards, 66.

¹¹⁶ Edwards, 66.

in kingdoms, in reference to religion and other matters.”¹¹⁷ Furthermore, their effects on the common people contributed to the changes in states. “From the inflamed spirits of men, caused by a distempered air, wars and tumults, broils and seditions naturally proceed.”¹¹⁸

As for their status as signs, Edwards fell back on Plinian classifications, arguing that the appearance of the comet represented the effects that would follow them. “Their figure is representative of that which is meant by them.”¹¹⁹ The effect was emblematic, symbolic; “sometimes they display themselves in the shape of besoms, as if they taught us by that homely emblem, what we ought to doe, viz. to remove our defilements and pollutions.”¹²⁰ He addressed objections to this view, but, again, his argument rested on the authority of the ancients. “It will be said,” he admitted, “that some devout fools will make things to be like any thing they please. But then I desire to know whether the old pagan philosophers were a sort of religious fools [sic].”¹²¹

Edwards also discussed comets as theological signs, but he made important distinctions between supernatural and natural signs. “I know,” he wrote, “God sometimes speaketh to the world by supernatural signs, without making use of second causes, and even against the course and order of Nature. These are Divine Signs

¹¹⁷ Edwards, 67.

¹¹⁸ Edwards, 67.

¹¹⁹ Edwards, 73.

¹²⁰ Edwards, 73.

¹²¹ Edwards, 74.

only.”¹²² Comets, on the other hand, did operate through secondary causes, as Edwards had just taken great pains to show. Edwards insisted that “the same things may be natural causes and effects, and yet divine tokens.”¹²³ Like others engaging in this line of argument, Edwards invoked the rainbow, which in Genesis 9:13 God put above the clouds as a sign to the people, but also as an operation of secondary causes, which were well-studied.¹²⁴

Edwards accused those who opposed a providentialist interpretation of comets of “carry[ing] on the Plot of Atheists and Epicures to root out the Notion of a God, to extirpate Providence, to debauch mens lives and manners, and to blot out the sense of another world.”¹²⁵ For Edwards, the proposition that comets mean nothing at all strains credulity. He argued that “It is downright sottishness to think that these are set up for vain shews and useless sights. It is unworthy of Providence to defend this.”

However, his final argument appealed again to skepticism and to epistemological humility. “Lastly, If all that hath been said amounts not to a Demonstration. . . . that Comets are Signs of impendent Evils,” he wrote,

yet this ought to be remembered, that no Man can be certain that they *signifie Nothing*. . . It will be best for us to look upon them as *such* [i.e., as signs], and then, if we are mistaken, it will be on the

¹²² Edwards, 81.

¹²³ Edwards, 81.

¹²⁴ Edwards, 81.

¹²⁵ Edwards, 131.

safest side, and we shall err with the wisest and soberest Persons.¹²⁶

This argument, which Sara Schechner Genuth has aptly termed a “version of Pascal’s wager,” cut to the heart of the matter. If comets meant nothing, the pious man lost nothing by amending his ways, praying for mercy, and dutifully preparing for plague and disaster at the sight of one. If, however, God meant them as signs to the world and a believer did not heed them, he stood in sin and defiance of God.

Practically speaking, the response of the godly person ought to be to remember God’s presence, reform her own sins, and pray for forgiveness. This was not so distinct from the views of skeptics such as Gassendi or even Newton, for whom the sight of a comet ought to be a reminder of the glory of God. However, the practical similarities obscured a much more fundamental difference in the visions these men had of the divine relationship with the world. For Newton, God did not communicate directly with creatures through wonders or any means other than scripture (with the possible exception of certain miracles). The extent of God’s concourse with humans was to ensure the moment-to-moment existence and functioning of the universe, to endow humans with free will, and perhaps to see to the governing of the afterlife and the ultimate resurrection.

For Edwards, such a vision seemed bleak indeed. Edwards, and the rest of those who saw the comet as a communication from God, favored a God that constantly interacted with the community of believers on earth. The relationship between an

¹²⁶ Edwards, also quoted in Schechner, 102.

individual and God was living, intense, and mutual. He would not go so far as to say that anyone, regardless of training, had the authority to discern genuine communication from God and to interpret it—this was where he differed from many of the unlearned pamphlet writers—but he did think that prayerful and skillful scriptural study can reveal the proper interpretation and allow the clergy to call for the proper intervention into sinful community life. This contrast between a God who communicated with the world through wonders and a God who allowed wonders to appear “in vain,” for reasons unrelated to the immediate moral needs of the community of believers, appeared again and again in discussions about the comet throughout the Atlantic world.

2.7 Conclusion

In the late 19th century, Andrew Dickson White dedicated a portion of his *History of the Warfare of Science with Theology* to comets. White argued that the gradual dismantling of superstitions about comets constituted one of the major triumphs of the scientific method over the dangerous, shadowy forces of religious belief. He aptly titled his chapter, “from ‘Signs and Wonders’ to Law in the Heavens.” In this piece he told a story about early modern universities and religious leaders systematically suppressing scientific explanations of comets in order to maintain their power. For White, the persistence of belief in comets as portents indicated a religious conspiracy against scientific inquiry.

Many historians in the twentieth century have already shown the evidential poverty of White’s story, but they have followed him in placing the debate over comets

in a privileged place. Comets continue to serve as a barometer for the transition from what might be termed the Baroque intellectual sphere to the early Enlightenment.¹²⁷ This more recent work has emphasized the broader social and political forces affecting views on comets, especially the “vulgarization” of astrology and of prophecy. Most histories of science have focused on the work of Newton and Bayle, while histories of astrology and wonders emphasize the longer story of astrology’s decline toward the end of the century.¹²⁸ This chapter supplements this new, more nuanced narrative by examining the English debate over the comet of 1680 in more depth. This detailed inquiry into the progress of the debate over the comet places the debate itself within its more immediate context.

Bracketing these longer-term historical stories brings out the complexity of the participants’ positions, their values, and their commitments. Within the debate, we see astronomers, political pamphleteers, and clergymen all struggling to assert their own authority to interpret the meaning of the comet. These struggles were not always explicit; whole groups of natural philosophers asserted their authority through silence,

¹²⁷ Few cite him directly except as a symptom of the excesses of the “Conflict thesis,” but, regarding a persistent conspiracy to eliminate natural philosophical explanations of comets from the universities, see the following texts for alternative narratives. C. Doris Hellman, “A Bibliography of Tracts and Treatises on the Comet of 1577,” *Isis* 22, no. 1 (1934): 41–68; Keith Thomas, *Religion and the Decline of Magic: Studies in Popular Beliefs in Sixteenth and Seventeenth-Century England* (New York: Charles Scribner’s Sons, 1971); L Daston and K Park, *Wonders and the Order of Nature, 1150-1750*, 2001.

¹²⁸ For the former, see Daston and Park, *Wonders and the Order of Nature, 1150-1750*; Euan Cameron, *Enchanted Europe: Superstition, Reason, and Religion 1250-1750* (Oxford: Oxford University Press, 2010); Stephen Gaukroger, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity, 1210-1685* (Oxford: Oxford University Press, 2006).; for the latter, see Thomas, *Religion and the Decline of Magic: Studies in Popular Beliefs in Sixteenth and Seventeenth-Century England*; Capp, *Astrology and the Popular Press: English Almanacs, 1500-1800*; Curry, *Prophecy and Power*; Schechner, *Comets*; Burns, *An Age of Wonders*.

refusing to engage with the debate over meaning at all. Among those who did try to interpret the comet, disagreements turned not only on emerging disciplinary differences as the practices of astrology and astronomy diverged, but on fundamental assumptions about the nature of God, providence, and nature. Some authors on the comet argued for a God that communicated constantly with his creatures on earth through signs. According to these writers, signs in the heavens and on earth played a part in their ongoing relationship with God and Christ. Others saw God more remotely, as the primary cause of all natural action on earth and beyond it. The relationship between God and the comet was, then, merely causal rather than semiotic.

Ultimately, however, this analysis supports the conclusions of Patrick Curry, Sarah Schechner Genuth, Lorraine Daston, and others: the debate over the comet in England did center on political concerns and split along party lines. In this sense, the debate over the comet remains an episode in the early history of popular politics in England and of the growing gap between vulgar and elite.

This analysis makes use of categories that scholars have developed in the last four decades to understand changes in beliefs in the late seventeenth century. The “vulgarization” of wonders, and the association of prophecy with astrology on the one hand and radical politics on the other, led natural philosophers to defend the boundaries of respectable science by dismissing prophecy as well as astrology. The comets in the early 1680s bring out these longer trends in a spectacular fashion. This episode shows clearly how a wonder came to be defined by nascent party politics and beliefs about appropriate behavior and licit subjects of inquiry by an elite struggling to

define itself. Religious conflicts, sometimes unstated, about the nature of God and God's communication with the world, were drawn into these longer-term processes of fragmentation.

Yet this model of political fragmentation and the growing gap between “high” and “vulgar” culture, however well it may fit England, does not map on to Spain, Latin America, or England's own American colonies. These regions lacked both the well-defined political parties we see in England and an institution that excluded astrology from natural philosophy, as the Royal Society did. They also operated in a very different intellectual world. The Cartesianism and mechanism popular among the English elite found little following in the other regions, allowing alternative conceptions about what a comet *was* to change the discussion about what a comet *meant*.

The religious contexts, too, were different, and in general the other regions showed far less religious diversity than England does. However, as the remaining chapters will show, the fundamental question about whether God communicated with the world through wonders—and whether humans commanded the tools to properly understand that communication—stood at the forefront of many authors' treatises on the Great Comet. Different contexts affected the debate over the comet; what happened in England was not replicated elsewhere. Our first comparison—and perhaps the most striking contrast with England—takes us from the politically fragmented, religiously and philosophically diverse streets of London, with its abundance of unregulated presses, to the Catholic, financially impoverished, philosophically isolated realm of Spain.

CHAPTER 3:

PROPHETS AND WATCHMAKERS: THE COMET OVER SPAIN

The Peripatetics and Epicureans hold that comets don't signify anything . . .

Yet, this world being a watch so well ordered by Divine Providence, it seems impious to affirm that a thing so great as a comet . . . happens by chance.

Luis Aldrete y Soto, *Defensa de Astrología*, 1681

3.1 Introduction

Don Luis Aldrete y Soto's invocation, in the same breath, of the mechanist metaphor of God-as-watchmaker and the visible workings of divine providence may sound discordant to the historian's ear. Aldrete, a mysterious figure from Málaga who gained a following at court from those who believed in the universal healing powers of his "Water of Life," passionately defended the rationality of the universe and the God-given ability of the human mind to discern the signs that God had placed for man to read. His views were not representative of the Spanish debate over the comet, as we shall see, but his emphasis on the "readability" of the Book of Nature was echoed by the majority of commentators in Spain.

The Spanish took the comet philosophically. I mean this in the colloquial sense that they did not seem to receive the comet with the same apocalyptic angst that many English (and New English) authors displayed. For some Englishmen, comets marked chapters, not sentences, in the Books of Nature and Grace. They heralded momentous change and required prayer, repentance, and political action against the enemies of God. For the Spanish, with few exceptions, comets were greeted as exclamation points in the celestial history of the world—emphatic, but pedestrian. The promises that interpreters of the comet made were modest: a dead king somewhere in Europe, a new heir, an earthquake. While English comet pamphlets spoke with alternating religious fervor (most common among Whigs) and fierce ridicule (more common among Tories), most Spanish pamphlets read with all the zeal of a weather forecast.

But the Spanish took the comet philosophically in a more literal sense, too. Where religious or comic sentiment occurred, it served philosophical arguments for or against the rationality of fear of comets. Authors critiqued not only the natural-philosophical, political, or religious arguments of their opponents, but their logical soundness and implications. They also picked apart the historical validity of claims about comets and their effects, so that disputes about comets often turned into disputes about reading and interpreting historical texts. Crucially, the debaters often worked as professional astrologers, and the historical or logical soundness of arguments about what the comet meant hinged on technical points of astrological theory.

The first third of this chapter sets out the intellectual milieu prevailing in late-seventeenth century Spain. Part II follows the traditional divisions of the parts of

cometography: physical astronomy, mathematical astronomy, and astrology. The controversies over wonders in and after 1680 had their roots in growing confusion over these issues, and understanding some technical points of dispute will be necessary in order to understand the problems with interpreting the comet. As in England, nearly every writer accepted that the stars and planets exercised some influence over human affairs—the issue was whether human beings could discern those influences through astrology or some other means.

Part III of this chapter explores critiques of the foundations of astrology, and astrologers' responses to those critiques. It addresses two main questions. First, were astrological methods sufficient to understand how celestial influences affected human affairs? Second, to what extent could humans, using reason and disciplines such as astrology and theology, distinguish genuine communications from God from mere superstition? These two foundational problems led writers in many different directions. Some attempted to verify a relationship between comets and events by exploring the historical record; some appealed to biblical passages about signs; some explored epistemological questions in medicine and compared them to the problems brought about by astrology. This chapter explores the tangled paths writers took in the debates over the comets in 1680-81 and 1682-83, and attempts to clarify what was at stake for early modern observers in Spain.

3.2 Part I: The Intellectual Milieu of Late-Seventeenth Century Spain

If any place had a reason to fear a comet in 1680, it was Spain. The words historians have used to describe this period in Spanish history include “decline,” “crisis,” “fall,” “humiliation,” the nadir of Spanish imperial power. That summer, the Crown finally revaluated the copper coinage in response to years of desperate financial strain. The revaluation caused prices to drop precipitously, further destabilizing Spanish households and guilds, which had fought rising prices for decades.¹²⁹ The country still reeled from the unexpected death, in 1679, of Juan of Austria, whom many at court had seen as a savior.¹³⁰ Delicate alliances at court remained in flux since Juan had banished the Queen Mother, who had controlled the appointment of *validos*, first ministers, since the start of Carlos II’s regency in 1664.¹³¹ In the year after Juan’s death, with the Queen Mother safely ensconced in a convent, the Duke of Medinaceli had consolidated his position as *valido* and turned his attention to the ponderous bulk of Spain’s financial woes.¹³² Hundreds of would-be reformers termed *arbitristas* submitted plans for staunching the wounds in Spain’s body politic, ranging from improvements in management of the sheep-ranching industry to encouraging the cloth trade in the

¹²⁹Jaime Contreras, *Carlos II el Hechizado: poder y melancolía en la corte del último Austria* (Madrid: Ediciones Temas de Hoy, 2003), 202-209.

¹³⁰ Henry Kamen, *Spain in the Later Seventeenth Century, 1665-1700* (London/New York: Longman, 1980).

¹³¹ Contreras, 196-97.

¹³² Contreras, 202-209.

crown of Aragón.¹³³ Medinaceli, responding to perceptions of the Queen Mother and her ministers as frivolous in their accumulation of luxuries, counseled austerity.

The king celebrated his nineteenth birthday five days before the German astronomer Kirch first sighted the comet in the eastern sky. The summer before had proven eventful for his court. Persuaded by Medinaceli's calls for fiscal restraint, he regretted that he could not take his young French bride (they married in 1679) away from the Alcázar palace in Madrid to the shaded arcadian gardens at Aranjuez, his usual summer residence.¹³⁴ Stuck in Madrid, he decided—apparently of his own accord, an unusual act for the sickly monarch—to make a show for the people. In June, he orchestrated a massive *auto-de-fé*, one of the largest in Spain's history. After a procession of the worthies of Spain, from Medinaceli bearing the banner of the Holy Office of the Inquisition to the lowest neighborhood confederations, many criminals received sentences in the galleys, several dozen were burned in effigy, and some thirty people, including a family with their elderly grandparents, were burned alive on the night of June 30, 1680.¹³⁵ It was, in all respects excepting its extraordinary size, a typical *auto-de-fé*.

¹³³ On *arbitrismo*, see Ruth MacKay, *"Lazy, Impudent People": Myth and Reality in the Writing of Spanish History* (Cornell University Press, 2006).

¹³⁴ Contreras, 208-209.

¹³⁵ An account of the *auto de fé* was published in 1680 by José Olmo, *Relacion historica del auto general de fe, que se celebrou en madrid este año de 1680, con asistencia del rey n.S. Carlos II y de las magestades de la reina n.s. y la augustissima reina madre*, ([Madrid]: vendese en casa de Marcos de Ondatigui familiar del Santo Oficio à la Plateria junto à San Salvador impresso por Roque Rico de Miranda, 1680).

Curiously, given the volatility of the crowds in Madrid, the kinds of condemnations of vulgar beliefs and vulgar politics we saw in England were absent from the comet treatises. No one expressed a fear of riots or of mass superstition in print, and few bothered to condemn “vulgar” belief. Of course, this does not mean that such sentiments did not circulate orally, in the *tertulias* [gatherings] of the wealthy or the guildhalls of artisans. But no broadsides fanned the flames. The absence of a discourse about vulgar superstition leading to political instability is important for this study because it marked a major departure from the printed discourse seen in England and the Netherlands.

Part of the difference between Spain and England with regard to the comet arose from the distinct intellectual milieu in each region. The most striking difference appears when we focus on the natural philosophy prevalent among the learned. England, of course, churned with philosophical speculations from the continent, especially those of Descartes, Gassendi, and the mechanical philosophy. In Spain, the works of Descartes remained almost entirely unknown even in 1680, and, despite the presence of Paracelsian corpuscularists, true mechanical philosophy remained rare. Yet it is important not to overstate this difference.¹³⁶ Likewise, it would be improper to characterize Spain as homogeneously “scholastic.” A wide variety of philosophical approaches circulated in late-seventeenth century Spain—though nearly all could be

¹³⁶ Mar Rey Bueno, “Los paracelsistas españoles : medicina química en la España moderna,” in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 41–55; Miguel López Pérez, “Ciencia y pensamiento hermético en la edad moderna española,” in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 57–72; Mar Rey Bueno, *Los señores del fuego : destiladores y espagíricos en la corte de los Austrias* (Madrid: Corona Borealis, 2002).

called, in some measure, Aristotelian—and important disputes over medicine, astronomy, and, especially, epistemology set the stage for the embrace of continental learning that would culminate in the foundation of the Royal Society of Medicine in Seville in 1700.¹³⁷

3.2.1 Circulating Knowledge

The *Regia Sociedad*, or the Royal Society of Medicine, founded in Seville in 1700, emerged from a wave of enthusiasm for the new philosophy propagating through Spain. We must ask about the medium of this propagation: what were the sites of learning in late-seventeenth century Spain? This section explores the places where people might have talked about, or observed, a comet, from universities down to what one scholar has termed the “scientific subculture” in taverns and private homes.¹³⁸ After exploring where people might gather, I will turn to the process by which informal conversations were translated into the printed texts that form the basis of this study. As in England, writers wishing to put their thoughts into print faced a number of challenges from printers, booksellers, and censors, but these challenges were amplified by the Crown’s

¹³⁷ Victor Navarro Brotóns has long argued for the philosophical and natural-philosophical diversity in sixteenth and seventeenth-century Spain, especially in his studies of the Stoic physics of Juan de Muñoz, a sixteenth-century writer on comets, and Muñoz’s followers. See Navarro Brotóns, “Astronomy and cosmology in Spain in the Seventeenth century: the new practice of astronomy and the end of the Aristotelian-Scholastic cosmos”; Víctor Navarro Brotóns, *Disciplinas, saberes y prácticas: filosofía natural, matemáticas y astronomía en la sociedad española de la época moderna*, 2014. On the beginning of Cartesian thought in this period, see Ceñal Lorente, “Cartesianismo en España: notas para su historia (1650-1750).” Brief English surveys of intellectual achievements (or lack thereof) in this period can be found in Kamen, *Spain in the Later Seventeenth Century, 1665-1700*; Israel, *Radical Enlightenment: Philosophy and the Making of Modernity, 1650-1750*.

¹³⁸ José López Piñero, *La introducción de la ciencia moderna en España* (Barcelona: Ariel, 1969).

tight control over the circulation of foreign books. After examining these difficulties in more detail, I will turn to the question of whether, and how, we can speak of Spain as a part of the Republic of Letters at the end of the seventeenth century.

3.2.1.1 Universities

The universities, despite their long history as centers of learning in the Spanish world, appeared to later Enlightenment thinkers, *novatores*, as a hindrance. The evidence supported their perception of universities mired in decadence.¹³⁹ Enrollments in Spanish universities fell precipitously in the seventeenth century. When the Bourbons brought in new professors of mathematics and natural philosophy in the eighteenth century, many of them complained of the lack of infrastructure for teaching these subjects, since in many cases their chairs had sat empty for fifty years or more. With fewer names on the rolls and the overwhelming centrality of theology and philosophy, universities such as Salamanca, Alcalá, and Valladolid could not muster enough student demand to keep permanent professors of mathematics and the natural sciences on staff. Even when they did bring in someone to teach these subjects, the pool of candidates was meager, so that throughout the seventeenth century the teaching of mathematics and astronomy in the universities often fell upon those who were neither

¹³⁹ José Abellán, *Historia crítica del pensamiento español*, Vol III: Del Barocco a la Ilustración (Madrid: Epasa-Calpe, 1981), 355-56; José Pardo Tomás, "Medicine and the Spanish novator movement: ancients vs. moderns and beyond," in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 323-44.

prepared to teach nor interested in lecturing on these subjects.¹⁴⁰ The historian López-Piñero, speaking of these three universities, concludes that the three great centers of Castilian learning were “dominated by traditionalists” and acted as a main pillar of support for an “intransigent posture” that would hinder the efforts of the *novatores*.¹⁴¹

The character of university teaching remained overwhelmingly scholastic. The curriculum consisted of examinations of Aristotle’s logic, metaphysics, and physics, learned through the prism of late Thomism.¹⁴² But even within the philosophy faculty, there were variations and attempts to respond to challenges not only from the new philosophy, but from alternative conceptions of the scholastic project with origins in the thirteenth and fourteenth centuries, such as Llullism and Scotism.¹⁴³ At the time of the comet, philosophy faculties were beginning to open up. José Saenz de Aguirre, professor of philosophy at Salamanca from 1670 to 1686, issued the *Philosophia novo-antiqua*,

¹⁴⁰ Tayra Lanuza Navarro, “Astrology in Spanish Early Modern Institutions of Learning,” *Beyond Borders*, 2008, 79–98; Navarro Brotóns, *Disciplinas, saberes y prácticas: filosofía natural, matemáticas y astronomía en la sociedad española de la época moderna*; Víctor Navarro Brotóns, “La ciencia en la España del siglo XVII: el cultivo de las disciplinas físico-matemáticas,” *Arbor*, 1996.

¹⁴¹ López-Piñero, *Introducción*, 38-39. Lanuza Navarro, “Astrology in Spanish Early Modern Institutions of Learning”; Eduard Recasens Gallart, “El cultivo de las matemáticas puras en la España del siglo XVII,” in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 413–26; Mordechai Feingold, ed., *Universities and Science in the Early Modern Period* (Dordrecht: Springer, 2006).

¹⁴² Feingold, *Universities and Science in the Early Modern Period*; Luís Carolino, “Mathematics and the late Aristotelian theory of science: the *Quaestio de certitudine mathematicarum* in seventeenth-century Portuguese universities,” in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 399–411.

¹⁴³ The best source for the character of teaching in this period, and the continuing influence of Medieval Spanish traditions of Llullism, is José Abellán, *Historia crítica del pensamiento español* (Madrid: Espasa Calpe, 1988).

rationalis, physica et metaphysica.¹⁴⁴ This work unsurprisingly defended Thomism and Aristotelianism, but addressed the work of Descartes, Gassendi, and Spinoza in a way that remained open to their conclusions about physics, though without enthusiasm.¹⁴⁵ As the debates in 1680 would show, Spanish scholastic physics proved more than flexible enough to accommodate various features of the new physics—the abolishment of crystal spheres in the heavens, the corruptibility and mutability of the heavens, the possibility of corpuscular and alchemical explanation, the use of new instruments such as the telescope—without precipitating a “crisis” that demanded the abandonment of traditional authorities.¹⁴⁶

We cannot ignore the universities in our study of astronomy and astrology, since it was in a morning lecture on Sacrobosco’s *Sphere*, in the faculty of arts, that many Spanish men of letters acquired their first taste of the subject. Students studying for a medical degree undertook a study of astronomy over the course of their medical education in a university.¹⁴⁷ As medical professionals, students needed to know the

¹⁴⁴ José Saenz de Aguirre, *Philosophia Novo-antiqua, rationalis, physica et metaphysica* 3 vols (Salamanca: 1671-1675).

¹⁴⁵ Abellán, 254.

¹⁴⁶ Here and elsewhere I echo the conclusions of Craig Martin, whose studies of Renaissance meteorology show that new evidence could be easily accommodated within a physics that remained Aristotelian in its broad outlines. New evidence alone was hardly sufficient to demolish of the Aristotelian synthesis. See C Martin, *Renaissance Meteorology*, 2011; C Martin, “With Aristotelians Like These, Who Needs Anti-Aristotelians? Chymical Corpuscular Matter Theory in Niccolò Cabeo’s Meteorology,” *Early Science and Medicine*, 2006.

¹⁴⁷ Tayra Lanuza Navarro’s pioneering work on astrology in Spain has been foundational to this study. In the last decade, Lanuza Navarro has begun to use the extensive body of surviving astrological works in order to reconstruct the outlines of an astrological community and its social, political, and cultural boundaries. Lanuza Navarro, “Astrology in Spanish Early Modern Institutions of Learning”; Tayra

proper times for bleeding and administering purges and other cures. Proper timing required a thorough knowledge of astrology, which in turn relied on a grasp of the extensive mathematical techniques and books of ephemeris on which astrology relied.¹⁴⁸ The continued presence of astrology in university curricula—and astrology professors' practice of publishing vernacular pamphlets about eclipses and comets—pressed the debate over comets in very different directions than we saw in England.

3.2.1.2 Technical Schools

As in England and France, many of those who embraced the new learning did so outside the old institutions of learning. In response to the demands of maintaining an empire across three continents in the early sixteenth century, Carlos V had established a number of institutions for training pilots, navigators, and cartographers. These continued to grow throughout the sixteenth century and into the seventeenth. The largest and most influential of these was the *Casa de Contratación*, or House of Trade. At the Casa, would-be pilots and navigators took state examinations under the eye of the Chief Pilot and a board of other experienced professionals.¹⁴⁹ By the 1560s, disputes over aspects of chart-making and celestial navigation had prompted the Crown to order

Lanuza Navarro, "L'astrología como explicación científica de la historia : los pronósticos españoles del siglo XVII," *Synergia*, 2006, 303–23, 10.

¹⁴⁸ Lanuza Navarro, "Astrology in Spanish Early Modern Institutions of Learning"; María López Terrada, "Medical Pluralism in the Iberian Kingdoms: The Control of Extra-Academic Practitioners in Valencia," in *Health and Medicine in Hapsburg Spain*, ed. Harold Cook, Jon Arrizabalaga, and Teresa Huguet-Termes (London: Wellcome Trust Centre for the History of Medicine at UCL, 2013), 7–25.

¹⁴⁹ Antonio Barrera-Osorio, "Nature and experience in the new world : Spain and England in the making of the new science," in *Más allá de la leyenda negra: España y la revolución científica*, 2007, 37–42.

that cosmography, astronomy, and mathematics be taught at the Casa itself.¹⁵⁰ In 1681, just after the comet faded from the sky, a new institution for astronomy was founded in Seville, associated with the Casa. The *Colegio de San Telmo* emerged as a place for teaching astronomy, mathematics, and navigation to those who would manage the Spanish trade to the Indies.¹⁵¹

Recently, Maria Portuondo and Antonio Barrera-Osorio have shown how the practical aims of the Casa influenced the development of natural philosophy in Spain.¹⁵² Yet it is important to emphasize that the astronomy and mathematics taught at the Casa was not strictly practical in nature. The chairs in those subjects were university-trained and often found themselves in conversation with their counterparts at the Iberian universities regarding abstract natural philosophical and cosmological matters.

The Jesuit-run *Real Estudios* at the *Colegio Imperial* in Madrid employed a master of mathematics to teach “the Sphere [i.e. Sacrobosco], astrology, astronomy, astrolabes, perspective, and prognostics” in the morning.¹⁵³ Among the professors of astronomy was Jean Charles della Faille, who later served as Royal Cosmographer at the Council of the Indies in the early seventeenth century. Della Faille offered a sympathetic view of the Copernican system, but affirmed that both the Copernican and Ptolemaic systems

¹⁵⁰ Barrera Osorio, 39.

¹⁵¹ Abellán, 233.

¹⁵² Barrera Osorio, *passim*, and María M. Portuondo, *Secret Science: Spanish Cosmography and the New World* (University of Chicago Press, 2009).

¹⁵³ See Navarro Brotóns (2012), 683.

adequately modeled the phenomena.¹⁵⁴ We know little about the *Colegio Imperial* during the reign of Carlos II, but, as will become clear below, the Jesuits at this institution maintained an active interest in astronomy and shared observations, books, and correspondence with scholars around the world. They were interested in developments outside Spain and a desired to contribute to the advancement of astronomical knowledge without engaging in discussions of metaphysics. The *Colegio Imperial* was a center of intellectual inquiry and astronomical knowledge at the time of the debates over the comet, but it was not a locus for the debate itself.¹⁵⁵

3.2.1.3 Courtly Knowledge

Those who lacked university or ecclesiastical credentials could seek patronage elsewhere; the most direct route, throughout the century, was through the king himself. Those unaffiliated with established institutions—whether *novatores* or charlatans—sought patronage by dedicating their works to members of the court. Yet the late seventeenth century is clearly a time of transition and of relatively decentralized circles of virtuosi seeking patrons among the nobility, rather than a climate in which most patronage came from the crown or from an established academy.

We know little about the intellectual interests of the Spanish rulers in the seventeenth century. During the reign of Carlos' father, Felipe IV, the king displayed at

¹⁵⁴ Navarro Brotóns (2012), 684.

¹⁵⁵ On the *Colegio Imperial*, see Antonio Barrera-Osorio, *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* (Austin: University of Texas Press, 2006).

least a cursory interest in astronomy. The Belgian astronomer and cosmographer Michael Florent van Langren assisted Felipe IV in observing the moon while he was staying in Madrid between 1631 and 1634.¹⁵⁶ One better-explored aspect of scientific life in the late seventeenth century is the brief patronage of Juan de Austria. Don Juan, as he was frequently known, was the natural (i.e. illegitimate) son of Carlos II's father Felipe IV.¹⁵⁷ Don Juan made a career for himself as a military officer in Portugal and the Spanish Netherlands, where he became interested in diverse areas of learning, including astronomy and medicine. In 1675 he marched on Madrid and seized control of the government by persuading his royal half-brother to declare him *valido*, an official title for a royal favorite who carried the responsibilities and respect of a prime minister.¹⁵⁸

The sciences in Spain had been suffering for want of a patron since the death of Felipe IV in 1664. Spain's economic woes had curtailed royal expenditures, and faction politics at court during the Regency of the young Charles attracted far more attention than patronage of the arts of science.¹⁵⁹ Juan of Austria, on the other hand, immediately began to patronize thinkers upon taking control of the government.¹⁶⁰ Don Juan died of

¹⁵⁶ Navarro Brotóns (2012), 685.

¹⁵⁷ Spanish kings had often placed natural sons in leadership positions. For the circumstances surrounding Phillip IV's wishes for the succession, see Kamen, *Later Seventeenth Century*, 328, and for the biography of Don Juan, see 330-331.

¹⁵⁸ R Carrasco, *L'Espagne au temps des validos: 1598-1645*, 2009; on Don Juan in particular, see JC Contreras, *Carlos II el Hechizado: poder y melancolía en la corte del último Austria*, 2003 and Kamen, *Spain in the Later Seventeenth Century, 1665-1700*.

¹⁵⁹ Kamen (1980), 318-320.

¹⁶⁰ Kamen places more emphasis on the role of Don Juan's active patronage than Lopez Piñero does. Kamen (1980), 320-22. Cf. Lopez Piñero, *Introducción*, 35-62, in his chapter on scientific institutions, which hardly mentions patronage.

natural causes in 1679. Intellectual activity failed to coalesce under the aegis of royal institutions as it did in England or France until the last year of the century, with the establishment of the *Regia Sociedad*.¹⁶¹

The court, however, did provide a site for discussion of the comet, as we will see in the discussion of the career of Don Luis Aldrete y Soto, whose musing on the relationship between a clockmaker God and prophecy opened this chapter. The pamphlets produced in the wake of the comet also suggest the roles of nobility at court as patrons or potential patrons for astronomical or astrological work. For example, Vicente Montano was one of several soldiers who published tracts on the comet. He wrote to the Duke of Albuquerque, Captain General of the Armada, perhaps in an effort to gain a particular favor. He reported that when he had time free from his military duties, he was accustomed to apply himself to the sciences, astrology among them. The military and the aristocracy as sources of scientific patronage, however, are ripe for more study; the pamphlets in this dissertation only offer hints at a complex network.¹⁶²

¹⁶¹ There were important exceptions; for example, Marcelo Aranda has shown how Jesuits participated in the crafting of extremely high-quality mathematical instruments as royal gifts. Marcelo Aranda, *Instruments of Religion and Empire: Spanish Science in the Age of the Jesuits, 1628-1756* (PhD Diss.), 2013.

¹⁶² The sixteenth-century Spanish patronage networks are far better understood, thanks to Goodman's excellent work; David Goodman, *Power and Penury: Government, Technology and Science in Philip II's Spain* (Cambridge: Cambridge University Press, 1988). Likewise, patronage in Latin America in the 1680s has benefitted from more historiographical interest; see Anna More, *Baroque Sovereignty: Carlos de Sigüenza y Góngora and the Creole Archive of Colonial Mexico* (Philadelphia: University of Pennsylvania Press, 2013).

3.2.2 Mapping the “Scientific Subculture”

It is difficult to distinguish the loose conglomeration of scientific activity around the court from what López-Piñero has termed the “scientific subculture” of early modern Spain. Intellectual activity in Madrid centered on numerous *tertulias*, held in the private homes of Madrileños of renown.¹⁶³ Hosts included the Marquis of Mondéjar, the Count of Salvatierra, the Duke of Montellano and the Count of Montehermoso.¹⁶⁴ In the early eighteenth century, the president of the *Regia Sociedad*, Diego Mateo Zapata, recalled that gatherings in these homes included discussions of Descartes and other modern philosophers, but these topics were treated “always with indispensable attention to the purity of our faith.”¹⁶⁵ Though the meetings at the home of the Duke of Montellano, to which Zapata was referring, did not begin until 1687, it is clear from his reminiscences that such gatherings had been in place for some time.¹⁶⁶

Madrid, however, was not the only city full of willing hosts. The *Regia Sociedad* itself grew out of a gathering in Seville at the house of Juan Muñoz Peralta. The group that met at Peralta’s home consisted mainly of men with medical training who favored an experimental philosophy. They focused on questions of chemical medicine, against the Galenic philosophy taught in the universities. The extension of royal patronage to

¹⁶³ Abellán, 358.

¹⁶⁴ Abellán, 358.

¹⁶⁵ Deigo Mateo Zapata, “Censura,” in Alejandro de Avendaño, *Diálogos filosóficos en defensa del atomismo y respuesta a las impugnaciones del Rev. P. Fr. Francisco Palanco* (Madrid, 1716), quoted in Abellán, 358.

¹⁶⁶ Zapata, quoted in Abellán, 358.

this small group of innovators marked a turning point in the institutionalization of the new science in Spain—but before 1700, those interested in intellectual discussions met informally. Valencia, in the Crown of Aragón, supported several *tertulias* in the 1680s that included men who would, in the 1690s, move to the center of the *novator* movement.

Another key space for intellectual discussion on philosophical matters, especially those related to medicine, was the medical *junta*. A *junta de médicos* occurred when a physician, having encountered an unusual or difficult case, brought together other physicians in order to discuss how best to treat the patient. These gatherings proceeded according to strict protocol; the recommendations of the highest-ranking physician would be heard (and implemented) first, and others would speak in descending order of importance. These *juntas*, then, served as fora for debates about the use of chemical medicines and other medical innovations. Successful performance in a *junta*, like the publication of a well-received book, could make the career of an ambitious physician. This was especially important in the cutthroat world of physicians in Madrid, where medical men jockeyed for positions in the great noble houses, the royal palace, or the *Protomedicato*, the body of Spanish medical authorities.¹⁶⁷

Military posts also housed men interested in astronomy, astrology, and the comet. Those engaged in certain kinds of military careers received extensive training in mathematics and astronomy as part of their preparation for siegecraft, artillery fire, and

¹⁶⁷ JP Tomás and ÀM Vidal, “Las consultas y juntas de médicos como escenarios de controversia científica y práctica médica en la época de los novatores (1687-1725),” *Dynamis: Acta Hispanica ad Medicinæ* (2002): 303–25.

other mathematically-intensive military applications. These men occasionally published their astronomical observations and their reflections on natural philosophy. Vicente Mut, a military engineer and the sergeant-major of the city of Palma, on the island of Mallorca, printed his *Narració físico-matemàtica dels cometes de l'any 1665* in 1666. Mut was, in the opinion of Victor Navarro Brotóns, “the best observer in Spain in the seventeenth century.”¹⁶⁸ He corresponded with Riccioli and with Kircher, and commented on the astronomical ideas of Tycho, Kepler, Landsbergen, the Belgian astronomer Wendeln, and Cassini. In his work on comets, he provided observations of the comets of 1664-5, agreeing with Kepler, Galileo, Cysat, and Gassendi that comets could occur above the moon, and that they traveled in a great circle.¹⁶⁹ Mut exercised a deep influence on later Spanish astronomers, especially the Jesuit Josep de Saragossà, who would later join the *novatores*. After the comet of 1680, several military men joined the debate over the meaning of the comet.¹⁷⁰

The lack of clear political and intellectual parties, and of institutions like the Royal Society that supported scholarly controversy, meant that the Spanish response to the comet was highly decentralized. Basic differences in geography mandated this; the

¹⁶⁸ Navarro Brotóns (2012), 689.

¹⁶⁹ Navarro Brotóns (2012), 692.

¹⁷⁰ Andrés Dávila y Heredia, *Respuesta a la piedra de toque, en que se descubren los quilates de los Pareceres sobre el Cometa que se ha visto en el mes de Diziembre passado de 1680, Escrito por el Abad Don Iuan Brauo de Sobre-Monte*, 1681; Vicente Montano, *Discurso filosofi-astronomico* (Barcelona, 1690); Alonso Cépeda y Adrada, *Antipologia ò pathegoria contra el discurso apologetico de la piedra de toque del Abad D. Iuan Bravo de Sobremonte* (Huesca, 1681). Dávila y Heredia, in particular, seems to have been something of a professional controversialist; see Rosselló Botey, *Tradició i canvi científic en l'astronomia espanyola del segle XVII*, 103. Adrada knew Latin and translated the works of Raymund Llull; Ramon Llull, *Arbol de La Ciencia* (En Brusselas: Por Francisco Foppens Impressor y Mercador de Libros, 1664).

vast majority of writers in the English debate over the comet lived in London and Cambridge.¹⁷¹ Spain, however, supported many important urban centers, many universities, and little institutional support for new science. It was dotted instead with small, informal gatherings of men (and possibly women) with an interest in intellectual discourse. Printing could be done in several regional centers, though bringing a pamphlet to press still presented considerable difficulties.

3.2.3 Legal and Economic Limitations of the Press

In the late sixteenth century, Felipe II issued a set of restrictions forbidding the importation of books published in Protestant cities. The target of these restrictions was religious material, particularly Protestant devotional or proselytizing tracts or so-called “Judaizing” works. Unlike the Roman Inquisition, the Spanish Inquisition, which after 1559 took charge of censorship efforts, rarely sought out works of a scientific nature. Famously, the prohibition of Galileo was met with indifference by Spanish secular and ecclesiastical authorities, much to the irritation of Roman representatives in Spain.¹⁷² The significance of these import restrictions remains disputed in scholarship on early

¹⁷¹ Of course this gives a false impression of the overall interest in such matters; almanacs, for example, were increasingly printed for small regional markets and included information useful to rural and provincial readers. On the expanding market for provincial almanacs in England, see Louise Hill Curth, *English Almanacs, Astrology and Popular Medicine, 1550-1700* (Manchester University Press, 2008).

¹⁷² José Pardo Tomás, *Ciencia y censura: la inquisición española y los libros científicos en los siglos XVI y XVII* (CSIC, 1991), 183–85.

modern Spain. Contraband book traffic thrived, with smugglers and Spanish importers alike routinely bribing or evading customs officials.¹⁷³

Compared to the situation in England, Spain's popular press was sparse. Spanish printers operated under the restrictions of the Inquisition, but it remains unclear how much this restrained the activity of printers.¹⁷⁴ Natalia Maillard Álvarez and Rafael M. Pérez García, in their 2013 article, describe a Spanish printing industry that, in the sixteenth century, showed remarkable vitality. Yet they affirmed that "Spain's position was always marginal" in European publishing.¹⁷⁵ Venice declined beginning in the 1530s, making space for publishing houses in France, Germany, and the Low Countries, but these areas had advantages over Spain when it came to sustaining a printing industry on the scale of northern Europe.¹⁷⁶ In the sixteenth century, the Spanish book industry suffered from a lack of capital and of distributors abroad, as well as a lack of good paper, so that printers had to import paper at considerable cost.¹⁷⁷ This seems to have

¹⁷³ Anastasio Rojo Vega, "Ciencia y censura inquisitorial en la España del siglo XVI," in *Ciencia, medicina, y sociedad en el renacimiento castellano*, ed. Juan Riera (Valladolid: Instituto de ciencias de la educación, 1980), 43-5.

¹⁷⁴ For a discussion of the Inquisition and the popular press in Spain more generally, see Kamen, *Later Seventeenth Century*, 314-316.

¹⁷⁵ Natalia Maillard Álvarez and Rafael M. Pérez García, "Printing Presses in Antequera in the Sixteenth Century," in Costas (ed.), in Benito Rial Costas, *Print Culture and Peripheries in Early Modern Europe a Contribution to the History of Printing and the Book Trade in Small European and Spanish Cities* (Leiden, Boston: Brill, 2013): 271-302, 272.

¹⁷⁶ Andrew. Pettegree, *The Book in the Renaissance* (New Haven: Yale University Press, 2010), 66-67.

¹⁷⁷ Álvarez and Pérez García, 272.

accelerated in the seventeenth century, though far more research remains to be done.¹⁷⁸

From the mid-sixteenth century onward, Spain imported most of its books, even those printed in Spanish. During this time, the book trade centered on the great book fair at Medina del Campo, controlled by foreign merchants selling foreign books.¹⁷⁹ In 1561, the court moved to Madrid, beginning Madrid's gradual ascendancy as the most important center of printing in Spain.¹⁸⁰ Many of the printers active in Castile were of foreign origin, and concentrated in major centers of trade like Seville and Barcelona. Yet relatively few printers operated in Spain, which continued to rely on the Antwerp printing house of Plantin and Moretus for most of its complex printing needs.¹⁸¹ Despite the historical interest in the eighteenth-century explosion of the Spanish popular press, intensive study of the press in the reign of Carlos II remains to be done. However, the

¹⁷⁸ In 1677, for example, the *Diario de sucesos notables* reported a paper shortage in Mexico that drove printing to a halt. Since most of their paper was imported, it is likely this affected Spain as well. Francisco García Figueroa, *Documentos para la historia de Méjico*. (Méjico: Impr. de J.R. Navarro, 1853), 1st ser., vol 2., Antonio Robles, *Diario de sucesos notables*, December (1677).

¹⁷⁹ Álvarez and Pérez García, 273-274.

¹⁸⁰ Álvarez and Pérez García, 275; see also Anastasio Rojo Vega, "Los grandes libreros españoles del siglo XVI y America," *Cuadernos Hispanoamericanos* 500, no. Feb (1995): 116; 131, who examines the growth of Madrid as a printing center in the late sixteenth and early seventeenth centuries.

¹⁸¹ A Bruycker and D Netten, "'Zodat mijn verbanning tegelijk jouw straf is:' bloei, verval en migratie van wetenschap in de republiek en de spaanse Nederlanden," *BMGN-Low Countries Historical Review*, 2008; Werner Thomas, *Een wereld op papier : Zuid-Nederlandse boeken, prenten en kaarten in het spaanse en portugese wereldrijk (16de-18de Eeuw)* (Leuven: Acco, 2009).

printing of almanacs thrived throughout the later seventeenth century and into the eighteenth.¹⁸²

In the 1550s, the Crown enacted a number of measures to control the distribution of books. The *Index librorum prohibitorum*, which compiled earlier lists of forbidden books, was published in 1559, and a series of new statutes in 1554 ordered that books be examined before publication by a centralized body under the control of the Royal Council. In 1558, the final version of this legislation, the *Pragmática*, went into effect.¹⁸³ Booksellers lobbied unsuccessfully for loosening these measures; for example, in 1580 a group of booksellers and merchants from throughout Andalusia asked the humanist Gonzalo Argote de Molina to urge the Crown to hire a more flexible censor because of the increasing economic costs of delays—a single censor was expected to manage the load of all books printed in Spain.¹⁸⁴

But the Inquisition proved relatively ineffective at stopping book smuggling.¹⁸⁵ In the 1660s, a number of gazetteers began operating in Madrid, issuing small *relaciones*

¹⁸² For example, the anonymous almanacs *Almanach y pronóstico para el año 1661*, Valencia, Esparza, 1660 and *Almanac y Kalendario del Año del Señor de 1673 para España*, Valladolid, Valdiviriso [sic], 1672. A full list is available in Hurtado, 113.

¹⁸³ Álvarez and Pérez García, 274. Lanuza Navarro, “Astrological prognostications in seventeenth-century in Spain”; Tayra Lanuza Navarro, “Los pronósticos astrológicos de fray Leonardo Ferrer y las esperanzas de sucesión de Carlos II en torno a 1690,” *Actes de la VII Trobada d’història de la ciència i de la tècnica*, 2003, 173–79; Jesús María and Galech Amillano, “Astrología y medicina para todos los públicos : las polémicas entre Benito Feijoo , Diego de Torres y Martín Martínez y la popularización de la ciencia en la España de principios del siglo XVIII,” in *Más allá de la leyenda negra: España y la revolución científica*, 2010.

¹⁸⁴ Álvarez and Pérez García, 274–75.

¹⁸⁵ Tomás, *Ciencia y censura: la inquisición española y los libros científicos en los siglos XVI y XVII*; Henry Kamen, *The Spanish Inquisition: A Historical Revision* (Yale University Press, 1998).

de sucesos, or newsletters, which often contained relations of miraculous or supernatural happenings.¹⁸⁶ Despite the paucity of sources, authors in Spain participated in the same sorts of discourse as their counterparts in England. Laudatory, religious, and satirical poetry was common; public figures suffered ridicule in pamphlets and broadsides; and, most importantly in this study, Spanish men of letters participated in vigorous printed debates, but these were not debates over the most cutting-edge issues in European thought.¹⁸⁷

Books were not the only things whose travel fell under state scrutiny. Students, too, were prevented from acquiring potentially subversive knowledge abroad. Crown authorities curtailed study at universities beyond Iberia. However, students, like books, managed to circumvent these rules often enough to pursue a few years of study at the universities of Germany, England, or the Netherlands.¹⁸⁸ The great centers of medicine and theology at Bologna and Paris, since these were in Catholic lands, did not fall under the prohibition.¹⁸⁹ Spain was unusual, then, for the scale of the restrictions laid on its

¹⁸⁶ Patricia Manning, *Voicing Dissent in Seventeenth-Century Spain: Inquisition, Social Criticism and Theology in the Case of El Crítico* (Brill, 2009).

¹⁸⁷ Political polemics were especially common throughout the seventeenth century. H Hermant, *Guerres de plumes: publicité et cultures politiques dans l'Espagne du XVIIe siècle*, 2012; Manning, *Voicing Dissent in Seventeenth-Century Spain: Inquisition, Social Criticism and Theology in the Case of El Crítico*; Kamen, *The Spanish Inquisition: A Historical Revision*.

¹⁸⁸ Rojo Vega, 46-49. His discussion of education comes in the midst of an overview of the factors often implicated in the failure of Iberians to cultivate an outstanding scientific culture in the seventeenth century; ultimately, he blames the financial woes of the monarchy rather than the involvement of the Inquisition or of Phillip's decrees.

¹⁸⁹ On medical travel to Italy in this period, see Jon Arrizabalanca, "Spanish Medical Students' peregrinatio to Italian Universities in the Renaissance" and Mário Sérgio Farelo, "On Portuguese Masters and Medical Students Travelling Abroad: An Overview from the Early Modern Period to the

scholars, but, as we will see, Spanish writers were not unaware of developments beyond the Pyrenees.¹⁹⁰

3.2.4 Republics of Letters

It is clear that by 1680, Spaniards showed widespread resentment of the difficulties inherent in getting books from abroad, but they had established networks to overcome these difficulties. For example, in 1682-1683 the Jesuit astronomer Jean-Francois Petrey, at the *Colegio Imperial* in Madrid, corresponded with Fr. José Pérez, a teacher of astronomy at Salamanca. On July 28, 1683, Pérez wrote that he had acquired a copy a book with “rare innovations in Geometry” by one Thomas Hobbes, a “*philósopho no vulgar*.”¹⁹¹ He wished to know if Petrey knew of Hobbes, and what he thought of his works on geometry. Specifically, he wondered whether Petrey knew if “the Ephemerides” said anything of him, because “the author is noble, and these matters are most worthy of note by erudite gentlemen.”¹⁹² He acknowledged parenthetically that “the works of this author are rare, and here in Spain they are

Enlightenment,” in Andrew Cunningham, Ole Peter Grell, and Jon Arrizabalaga, *Centres of Medical Excellence?: Medical Travel and Education in Europe, 1500-1789* (Basingstoke: Ashgate Publishing, Ltd., 2010), 93-126 and 127-48, respectively.

¹⁹⁰ The “Black Legend” of Spanish intellectual decadence has a long history. For a recent introduction to the historiography in English and Spanish, see Eamon and Brotóns.

¹⁹¹ RAH MSS Col. Cortes, 12-12-4, núm. 597. Sections of this correspondence are also cited in Ceñal Lorente, “Cartesianismo en España: notas para su historia (1650-1750).” Fr. José Pérez, a Benedictine, was listed as a professor of astrology at the University of Salamanca in Enrique Esperabe de Arteaga, *Historia pragmática e interna de la universidad de Salamanca*. (Salamanca: Impr. Fr. Nuñez Izquierdo, 1917), 586.

¹⁹² RAH MSS Col. Cortes, 12-12-4, núm. 597. “Pues el autor es noble, y las mat[erias] dignísimas de la nota de varones eruditos.”

prohibited, and I use them by the special indulgence of the Sr. Inquisitor.”¹⁹³ The next March, Pérez sent Petrey two books by Hobbes, the geometry mentioned above and *De corpore*, which he termed an “*obra no vulgar y de singular estimación*.”¹⁹⁴

This exchange suggests several things. First, Pérez’s reference to the “Ephemerides” suggests that Petrey had, or at least that Pérez believed he had, access to some of the natural philosophical periodicals in circulation at the time. We know from Cassini’s testimony in his observations on the comet in 1681 that Petrey was a correspondent of Cassini, in Paris, since Cassini published Petrey’s observations of the comet and of an eclipse that occurred later that year.¹⁹⁵ Petrey would have read at least occasional issues of that journal, sent by Cassini or by other correspondents abroad. Yet the fact that Petrey had not heard of Hobbes suggests that he did not read the *Philosophical Transactions* of the Royal Society, and that his reading of the *Journal* was at best intermittent. The fact that it took a year for Pérez to send Hobbes’ works to Petrey suggests that, though Pérez was in this case better connected, it was still difficult for him acquire potentially dangerous books from abroad.

¹⁹³RAH MSS Col. Cortes, 12-12-4, núm. 597 “*Las obras deste author son raras, y acá en España prohibidas, y yo las uso por especial indulto el Sr. Inquor...*”

¹⁹⁴ RAH MSS Col. Cortes, 12-12-4, núm. 597.

¹⁹⁵ Jean-Dominique Cassini, *Observations sur la comete qui a paru au mois de decembre 1680 et en janvier 1681, presentees au roi par M. Cassini*. . . (Paris: E. Michallet, 1681), 72. Petrey’s manuscripts concerning the comet of 1680 survive, but I have not analyzed them at length because they contain observations, but nothing regarding the interpretation of the comet. See Rosselló Botey, *Tradició i canvi científic en l’astronomia espanyola del segle XVII*, 99–101, for analysis of its astronomical content.

More likely, Petrey benefitted from the vast network of informal correspondence maintained by his own order, the Jesuits.¹⁹⁶ This hints at a far more important implication, for this study, of this exchange: the importance of manuscript correspondence. French by birth, Petrey maintained contacts from his schooldays at the Jesuit institutions in France, as well as a large network of scholars throughout Spain.¹⁹⁷ A few of these letters survived, mainly from the 1690s, in the archives of the *Real Academia de Historia* in Madrid. Petrey, however, was one of the few Spanish astronomers from this period who left behind a manuscript archive; most participants in the debate over the comet of 1680 left no such record.¹⁹⁸

Petrey's correspondence shows that Spain's isolation was far from total, but it was enough to frustrate those who wished to keep abreast of developments abroad. The poor circulation of books within Spain, and the limited enthusiasm Spanish intellectuals expressed for parts of the new philosophy, exercised a profound influence on its intellectual atmosphere. But Spanish writers benefitted, too, from a common intellectual heritage. All observers of the comets of the 1680s read many of the same sources, especially classical and ecclesiastical works. They brought a shared set of assumptions to celestial objects as they tried to discern their nature and their meaning.

¹⁹⁶ For more on the Jesuit network after Kircher, see ch.5.

¹⁹⁷ Abellán, *Historia crítica del pensamiento español*, 234.

¹⁹⁸ We will see a much more detailed account of the extent and use of Jesuit networks in the wake of the comet of 1680 in ch. 5, in the letters from Eusebio Kino to the Duchess of Aveiro.

3.3 Part II: Mathematical Astronomy, Physical Astronomy, and Astrology

Spain was more isolated than England, but it did not stand still. It is important not to assume that, if only foreign books had flowed freely in the Peninsula, Spain might have embraced the new philosophy with the same fervor as France or England. Spanish authors did learn a bit about Cartesianism, and a great deal about Gassendi, Galileo, and Kepler, yet most continued to espouse Galenism or Aristotelian ideas. Authors had their reasons for not embracing the new ideas they encountered; there was a limited landscape of possible meanings to attach to phenomena in nature. The details of this landscape, and the stakes of the controversy over the comet in the 1680s, are the subject of this section.

In his 1681 treatise, *The Innocent Comet*, royal physician Andrés Gámez declared that “all of the controversy and dispute over comets can be reduced to three principles, which are: Physico-Astronomical, Astronomical, and Astrological.”¹⁹⁹ Physical astronomy, he clarified, inquired into the nature, material, and form of Comets; astronomy proper quantitatively described the movement of comets and their distance from the earth; and astrology asked how the comet affected the sublunar world.²⁰⁰ Gámez articulated a classification used not only in Spain, but throughout Europe; his division of the parts of cometography was only an especially clear articulation of divisions present in almost all

¹⁹⁹ “Toda la controversia, y disputa de los cometas se reduce a tres principales puntos, que son *fisico astronomico, astronomico, y astrológico*.” Gámez, *Cometa inocente*, 5.

²⁰⁰ Gámez, *Cometa inocente*, 5. “En el fisico astronomico se inquiere la naturaleza, material, y forma, de que constan los cometas, y de donde proceda tal material. en el astronomico, qual sea su movimiento, y en que lugar, y sitio se deban colocar su longitud, y latitud; quanta sea su distancia de la tierra.”

comet treatises produced in the seventeenth century, and provides a convenient way in which to survey the opinions on the comet of 1680 in Spain.

The discussions of mathematical astronomy and physical astronomy will be brief, providing only the background necessary to understand the debates over astrology, the primary concern here. But controversies over the physical nature of a comet helped to destabilize traditional accounts of how and why comets caused disasters, and fueled dissatisfaction with astrological methods for predicting a comet's effects.

3.3.1 Mathematical Astronomy: Describing the Comet's Motion

Gómez's first category, mathematical astronomy, has dominated discussions of comets in the history of science. In this narrative, the key question at the end of the seventeenth century was how astronomers could describe the path of a comet mathematically. The quest culminated in the answer offered by Newton's and Halley's demonstration that comets moved in elliptical orbits maintained by an attractive force emanating from one focus with a strength of the inverse square of the radius.²⁰¹ The question of mathematical descriptions of comet paths proved of little interest to Spanish observers in printed treatises. However, manuscripts showed that making precise observations of the comet's trajectory constituted one of the major roles Spain played in the broader European conversation about the comet. Father Petrey, at the

²⁰¹ See Schechner, ch. 7.

Colegio Imperial, submitted observations of the comet and of an eclipse in 1681 to Cassini in Paris, who printed these observations with praise later the same year.²⁰²

Printed documents, however, contained few precise observations. The Valencian priest (and later *novator*) Juan Bautista Corachán, for example, despite his considerable mathematical training, marked out the path of the comet in terms of its progression through the zodiac; this was true of other professors of mathematics as well, including Leonardo Ferrer.²⁰³ Even for observers who had enough mathematical and astronomical ability to make observations, it is clear that there was no expectation that these observations, with their precise measurements of right ascension and declination on each night, belonged in a vernacular treatise.

The brief discussions of mathematical astronomy do, however, reveal some interesting facts about the state of celestial mechanics in Spain in the last decades of the century. Several authors made reference to the theory that comets move in straight lines—potentially a reference to Cartesian theories, but more likely to sixteenth-century theories of straight-line paths—only to state that it was impossible to reconcile this theory with the phenomena, since no straight-line path was consistent with the

²⁰³ Cassini, 72.

²⁰³ Corachán, 4-5; Ferrer, 1-3. Corachán's facility in mathematics is demonstrated by his later publication of Juan Bautista Corachán, *Arithmetica demonstrada theoricó practica para lo mathematico y mercantil* (J. Piferrer, 1682). A complete list of his publications, most of them technical, can be found in Vicente Ximeno, *Escritores del reyno de Valencia, chronologicamente ordenados desde el año M.CC.XXXVIII. . . hasta el de M.DCC.XLVII* (En la oficina de Joseph Estevan Dolz, 1747), I:268–69.

observations.²⁰⁴ Most authors in Spain agreed that the comet's path was curved, and most claimed that it is circular, according to the theory of Aristotle.²⁰⁵ One implication of this is that no Spanish author experienced the confusion Newton felt when he tried to reconcile straight-line paths with the phenomena, causing him to believe, for most of 1681, that there were two separate comets, not a single object before and after rounding the sun.

Newton's struggles found no counterpart in Spain, where not a single author doubted that the comets of December and January were the same object before and after passing the sun. Even Vicente Montano, among the few agreeing with the idea that comets traveled in straight lines, did not raise the possibility that he had actually observed two separate comets.²⁰⁶ One author, Don Luis Aldrete y Soto, wrote:

The comet appeared in November, 1680, east of the sun in the first degrees of Scorpio. . . It moved west of the sun, shining in the first degrees of Capricorn, going through the signs, always pointed northward—its portentous tail, from Capricorn, reached almost to Ursa Minor [i.e., the comet stretched from the ecliptic to the celestial north pole, or one-half of the visible sky].²⁰⁷

²⁰⁴ See, for example, Aldrete (1681), 3; Miguel [pseud.] Yepes, *Discurso theologico y filosofico contra la astrologia y los que la profesan, y juicio del cometa que se ha visto en este orizonte de Madrid desde 23 de diziembre* (Madrid, 1681), 2. Gámez (1683), 36.

²⁰⁵ A notable exception was Vicente Montano, who argued that comets traveled in straight lines; he may have been a reader of Descartes. Montano, *Discurso filosofi-astronomico*, A3v.

²⁰⁶ Montano, *Discurso filosofi-astronomico*.

²⁰⁷ Aldrete y Soto, *Discurso del cometa del año de 1680*, 2r. "el cometa, sobre que discurrimos del año passado de 1680, se advirtió en él por el mes de noviembre del dicho año, oriental al sol en los primeros grados de escorpion, que fué en su aumento en el signo que hazia trino a su nacieme[n]to, avie[n]do, hasta ento[n]çes, desde su cuna, cominado de dia. Y por el mayor movimie[n]to, en que excedia al sol, se hizo occidental á él, manifestandose en los primeros grados de capricornio, caminando por el orden de los signos, inclinandose al norte sie[m]pre; y su porte[n]tosa cola, desde este signo, llegava casi a la vrsa menor."

Aldrete did provide some evidence for the proposition that Newton's "comets" were the same object. At first, he said, the comet was observed east of the sun, i.e. an evening object, moving through the first degrees of Scorpio. Because of its "greater movement" the comet overtook the sun, moving west of it and showing up again in the first degrees of Capricorn. It was moving west to east with the motion of the zodiac, moving from Scorpio into Capricorn faster than the sun itself. The comet became, in Aldrete's words, "*oriental*" to the sun, i.e., a morning object, which (confusingly, given the meaning of "*oriental*") occurred when the object was *west* of the sun. It moved from Scorpio to Capricorn, arising as a morning object and fading as an evening one. Throughout this journey, the comet's tail, according to Aldrete, remained pointed toward the north star in the constellation Ursa Minor, reaching almost to it from the ecliptic—a span of about 70 degrees.²⁰⁸

Aldrete's description of the comet's path was anything but mathematically precise—he failed to name even the date on which the comet was first observed, saying only that it was "in November." Aldrete's loose account of the comet's path was more characteristic of the way in which mathematical astronomy was treated in printed Spanish writings on the comet. The manuscripts of Father Petrey, with their careful quantitative observations, were not mirrored in printed Spanish texts, even those intended for circulation among professional astrologers and mathematicians at universities, who, as we will see, dominated the debate over the comet in Spain.

²⁰⁸ In this, Aldrete disagreed with almost all other observers, who noted that the tail changed direction frequently, always pointing away from the sun.

3.3.2 Physical Astronomy: Assessing the Comet's nature

Gámez's second category, physico-astronomical, concerned the nature and genesis of a comet. This was of far keener interest to most commentators than the question of the comet's path, and discussions of the physical aspects of comets took up a significant part of most treatises on the comet.

As in England, most authors in Spain addressed physical questions in terms of Aristotle's four causes. The vast majority of authors agreed upon the material and formal causes. The comet was composed of exhalations: vaporous, oily, and dry. Though Aristotle contended that comets arose from the inflammation of exhalations from deep within the earth, most Spanish authors accepted the evidence of Tycho Brahe—many cited him explicitly—that at least some comets formed above the moon. Most also agreed that the comets of 1680 and 1682 fell into this latter category. The formal cause of such supralunar comets, were the “faecal” exhalations either of the sun (these were believed to be the source of sunspots), the planets, or the stars themselves. Accepting the comet as supralunar represented a major revision of Aristotelian physics, allowing for the heavens to be corruptible, rather than moving unceasingly in circles. However, the commitment to substantial forms and teleology, rather than mechanical causes, remained in effect.

Yet a few authors proposed innovative ideas about the material composition of comets, and these novel ideas hinted at the variety of physical propositions circulating in Spain at the time. In his 1681 *Discourse on the nature, properties, causes, and effects of comets*, professor of astronomy Francisco Antonio de Artiga affirmed that comets

arose from exhalations of an oily or sulfurous material, but “with a quantity of Mercury, or Sulphur.”²⁰⁹ This hinted at Artiga’s unusual attempt to synthesize the chemical theories of Van Helmont with an account of the generation of comets. He argued that the gross material of a comet had corrupting properties, and was responsible for comets’ tendency to cause plagues and droughts. But, like all natural substances, it contained a measure of pure material. When a comet ignited, the pestilential vapors were simply burned away, reduced to their parts. The idea of reducing matter to its pure parts was a fundamental notion of spagyric, a process used in chemical medicine to rid matter of corruption through repeated distillation, filtering, or other means of analysis.²¹⁰

Luis Aldrete y Soto, cited above, proposed another unusual account of the composition of comets. As we will see, Aldrete proved to be an outlier in many respects, and his broader theory of astrology and divination will be explored below. With respect to the material cause of comets, he espoused an idiosyncratic understanding of the “lens” theory of Galileo and Kircher, and emphasized the importance of planetary conjunctions in the formation of comets and, more importantly, in their interpretation.²¹¹

²⁰⁹ Francisco Artiga, *Discurso de la naturaleza, propiedades, causas, y efectos de los cometas, y en particular del que apareció en el deziembre de 1680* (En Huesca, 1681). See Hurtado, 69. “con cantidad del Mercurio, o azogue.”

²¹⁰ Principe, *The Scientific Revolution : A Very Short Introduction*.

²¹¹ Aldrete (1680), 2. “vémos, que los rayos del sol no tienen fuerça para quemar, inmediatamente en este mundo sublunar, y aplicamosles un vidrio cristalino; y passando por èl sus rayos, se fortalezen, tomando tanta actividad, que encienden un leno. Assi llevado sus rayos á la conjuncion de los superiores, passando sus luzes por ellos, como por un cristal, se fortalezen; y los planetas superiores,

Aldrete proposed a biblical cosmology of comets, attributing them to “leakage” in the waters above the firmament described in Genesis.²¹² Comets sprang from the “Crystalline Waters,” which are above the firmament.²¹³ Assuming the firmament was the sphere of the fixed stars, he argued that the “waters” above it were either identical with or immediately contiguous to the Prime Mobile. The conjunction of Saturn and Jupiter acted as a lens, focusing the rays of the sun, which then passed through the sphere of the fixed stars, and were modified by the stars’ occult influences. These rays then struck the waters above the firmament and vaporized a massive volume of it, which, when illuminated by the sun, appeared as a comet.

One possible source for Aldrete’s incorporation of the waters above the firmament is a passage in Juan Eusebio Nieremberg’s *Curiosa filosofía*, a mid-seventeenth-century Spanish compendium of natural knowledge. In chapter 15 of book 5, entitled, “*Tres cielos solamente ay*” [“there are only three heavens”], Nieremberg described the three spheres of heaven. The third was the Empyrean, the “supreme heaven.” The second was the heaven of the “waters, which in their substance are above the stars.” The third was the “tenuous space” where the planets and fixed stars move,

como mas cercanos á las aguas cristalinas, la atraen, en forma de vapores, contiguos al firmamento; donde rebervverando la luzes del sol, actuadas, y fortalecidas de los planetas superiores, causan la estrella unas vezes comata, otras caudata [i.e., a veces tiene una cabeza luminosa y grande, y otras veces tiene una cola larga]; de la calidad, é influxo de los padres, que en su concepcion intervinieron, signo en que se engendró, y aspectos que la irradiaron; y de aí naze la falta de paralapsis, y que los antojos visorios [spyglasses] no nos la representen mayor á la vista, haziendo esto con los planetas, que están mas contiguos al orbe terrestre.”

²¹² Genesis 1:7 reads: And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so.

²¹³ Aldrete (1680), 2.

“which is not divided but continuous.” In other words, Nieremberg—and Aldrete—dismissed the idea of crystalline spheres dividing the orbit of each planet. As for the waters, “even though they are above the Stars, they are called ‘heaven,’ as Scripture also calls them.” Nieremberg cited a number of theologians who supported this position: St. John Chrysostom, St. Ambrose, St. Basil, St. Clement Romanus, “with the agreement of St. Peter the Apostle and other Fathers” who argued from scripture that there are only three heavens.²¹⁴

As for efficient causes, most authors followed the Muslim writer Abumashar, whose work, *On Great Conjunctions*, proposed that conjunctions of Saturn and Jupiter tended to cause comets.²¹⁵ Artiga, despite his chymical theory of the composition of comets, presented a traditional and representative discussion of their efficient causes. In laying out the four causes of the comet, he argued that the efficient cause is “the Great Conjunctions of Jupiter and Saturn, the Eclipses of the Sun and Moon, of which the Lords of their houses are Mars and Mercury.”²¹⁶ In 1686, an almanac writer, the “Gran

²¹⁴ Juan Eusebio Nieremberg, *Curiosa y oculta philosophia primera y segunda parte de las maravillas de la naturaleza, examinadas en varias cuestiones naturales*, ed. Imprenta Real (Madrid, 1643), 165r–165v. “Será pues el tercero, y supremo cielo el empireo. El segundo se podrá señalar el de las aguas, las quales en su sustancia estan sobre las estrellas. El primero puede ser el espacio tenue por donde andan los planetas, y luzes fixas, el qual no está dividido sino continuado, si alguno no quisiere contar las aguas por cielo; aunque estén sobre los astros, podrá llamar cielo, como tambien le llama la escritura, y los autores profanes al espacio restante desde la luna acá...con razon san Juan Crisostomo, san Ambrosio, san Basilio, san Clemente Romano, con la sentencia de san Pedro Apostol, y otros Padres coligen de la Escritura, que no ay sino tres cielos. . .Ni está mas blando Teodoreto, que dize, que los que sienten lo contrario, quieren mas arrimarse a las fabulas, posponiendo la sagrada escritura.”

²¹⁵ Abumashar was a common source for astrologers throughout Europe and the Americas, and his use in Spain is not a holdover from the days of Islamic occupation.

²¹⁶ Artiga, “las Conjunctiones Magnas de Iupiter y Saturno, los Eclipses de Sol, y Luna, quando son señores de sus Casas Marte, y Mercurio.”

Cazador,” explicitly drew out the connection between conjunctions and comets, about both of which “there is no doubt that they always signify and denote changes in matters of importance.”²¹⁷

The three conjunctions of Saturn and Jupiter in 1682 were of particular import. Known as the “fiery trigon,” they represented the completion of an astrological cycle of conjunctions that lasted about 800 years and was thought to signal tremendous changes in empires, and the appearance of a comet in 1682 added to the anticipation.²¹⁸ The future *novator* Corachán attributed the efficient cause of the comet of 1682 to the conjunctions of the moon, Mercury, the sun, Jupiter, and Saturn, that occurred that year. But he went into an unusual amount of detail regarding how, precisely, a conjunction led to the formation of comets. He referred to the comet of 1680, in which “all the planets were together,” and to conjunctions that accompanied nearly all the comets of the seventeenth and sixteenth centuries.²¹⁹ Corachán was careful to say, however, that the correlation was not absolute. Certainly there had been comets without conjunctions of the superior planets, and there had been conjunctions without

²¹⁷ Cazador [pseud.], *Discurso astronómico*, Madrid, 1686, quoted in Hurtado, 68. “constelaciones, que sobre todo causan, ó significan sobre graves, o desusados accidentes, suelen ser, o son, por la mayor parte, o los nuevos fenómenos, ó cometas, ó las conjunciones magnas de los dos superiores astros de la sexta, y septima esfera, o los eclipses del mayor, o menor luminar: todos los quales, no hay duda, que significan, y denotan siempre alteración en cosas de magnitud, y raras vezes acaedidas.”

²¹⁹ Schechner, 80-82.

²¹⁹ Corachán (1682), 5. A few years later, John Goad in England would attempt an even more detailed comparison between conjunctions and the formation of comets as part of his larger project to trace the impact of planetary aspects on meteors, including comets. J Goad, *Astro-Meteorologica, or Aphorism's [Sic] and Discourses of the Bodies Coelestial, Their Natures and Influences*. (London: printed by J. Rawlins for Obadiah Blagrove at the Black Bear in St. Pauls Church-Yard over against the little north-door, 1686).

comets—though, he pointed out sensibly, there must have been many more comets than we could see from earth, since most would be small and many would be so close to the sun their light could not be distinguished.

Moving to final causes, many Spanish authors proposed two. The first was a physical final cause, and the second, a moral one. Among physical final causes, authors invoked the comet's role in purifying the earth, the atmosphere, and the celestial spheres of noxious impurities. Artiga, for example, wrote in 1681 that the final cause was the conservation of the universe—a grand claim that stemmed from his belief that comets were essential for eliminating impurities from the earth.²²⁰ Yet Artiga, and others, also argued that comets had a moral purpose: the moral cause was for God to warn man of his impending punishment. The moral final cause related directly to the third branch of cometology, astrology.

3.3.3 Astrology: The Meaning of the Comet

Gámez offered the following definition of astrology as it relates to comets:

In Astrology, or *Iudiciario* (I do not know if with more vanity than certainty) one searches for a [comet's] presaging rains, or draughts, motions of the elements, earthquakes, wars, deaths of kings, sickness among the people, and other effects; of whose truth, or falsity, I shall speak of at length.²²¹

²²⁰ Hurtado, 70.

²²¹ Gámez, *Cometa inocente* (Naples: Salvador Castaldo, 1681), 5. Quoted in Hurtado, 73. “Y ultimamente en el Astrológico, o Iudiciario (no sé si con mas vanidad, que certeza) se busca su presagio de lluvias, o sequedades, mociones de los Elementos, terremotos, guerras, muertes de Principes, enfermedades populares, y otros efectos; de cuius verdad, o falsedad se ablará despues largamente.”

Though Gámez's interpretation of an astrologer's work was less than flattering, it did speak to the perception among physicians that astrology constituted a distinct field within medicine dedicated to ascertaining the effects of celestial phenomena on earthly ones. Furthermore, Gámez explicitly linked astrology to the interpretation of comets, so that the comet became a vehicle for the discussion of astrology more generally. This move was, as we will see, common in Spain and in Latin America, while astrologers and almanac-makers in England and New England remained far more circumspect in asserting their professional expertise on the subject of comet divination, leaving the interpretation of the comet to preachers.

In Spain, the validity of the notion that the heavens influenced earthly life was almost universally accepted, even, as we will see, by Gámez, who objected not to the idea that the stars influence human affairs, but to the notion that any human science could make concrete predictions about those influences. When it came to comets, those who wished to untangle the complex web of celestial influences had a number of distinct methods at their disposal.

In 1690, Fulgencio Astapi, professor of mathematics at the Dominican-run University of Almagro in southern Spain, summarized five systems astrologers used when categorizing comets, dividing them in the following ways:

1. By appearance
2. By their dominant astrological sign

3. By their aspects [angular relationships] with the other planets
4. By their color
5. By their “species,” or shape, i.e. single-tailed, “hairy,” globular, etc.²²²

However, as historian Antonio Hurtado points out, though astrologers were aware of these systems and invoked them in a general sense, it was rare for an astrologer to apply them in any systematic way.²²³

The distinctions among these systems of classification marked an important fault line for astrologers battling for professional authority. Some astrologers explicitly rejected simpler methods for divination by color and shape, arguing that these were useful but insufficient for predicting particular results and amounted to mere “superstition.” In this scheme, the color of the comet revealed the planet that “ruled” it, with silver for the moon, lead-colored for Saturn, red for Mars, etc. By combining shape, color, and direction, an observer could use this method, derived from Pliny, to interpret the comet without any recourse to calculation.

Most astrologers took divination by shape and color into account, but believed this was not sufficient to give an account of the effects of the comet. A fully “astrological” method of interpretation required a complex series of astrological manipulations, beginning with an assessment of the state of the sky at the moment of

²²² Hurtado, 70.

²²³ Bartolomé Valle, *Explicacion y pronostico de los dos cometas* (Granada: por Franc. Heylan y Pedro de la Cuesta, 1619). Hurtado, 71. One attempt to do so is found in the *Explicación y Pronóstico de los dos cometas* (1619) of Bartolomé del Valle. Along with prognostications, he casts mathematically and astrological sophisticated figures.

the comet's formation—which, in Aristotelian terms, was the moment at which the oily exhalations ignited and became visible. Beginning from this cometary “geniture,” or birth-chart, the astrologer would trace the comet's path through the zodiac, noting the positions of the planets as the comet moved through the sky. By comparing the comet's geniture and path to standard accounts of which planets and stars influenced particular cities and regions, the careful astrologer could pinpoint both the type of effect the comet portended and the region where its effects would be felt. The problem, from the astrologer's point of view, was that the effect of the comet would depend on the celestial influences present at the comet's genesis, which may have occurred during the day, or, if at night, would be too faint to see, since a comet grows slowly in brightness.²²⁴

This was where the conjunctionist theory of the efficient cause of comets proved useful; the birth of a comet was a difficult thing to observe, but great conjunctions were not. Corachán took aim at the astrologically dubious notion that a comet signified anything over and above the significations of the conjunction that caused it. He presented a kind of skeptical argument with regard to the special bad effects of comets. “As the final cause [of comets] I say that they signify no effects over and above those signified by the conjunction that formed them.”²²⁵ The final cause, then, was to be a sign of immanent effects. To suppose, however, that these effects were somehow distinct from the effects of the conjunction lacked physical rigor. In this case, the conjunction

²²⁴ Aldrete (1680) 3. “Para fortalecer sus luzes, para atraer la Aguas, ò vapores del Cielo Cristalino, es necesario valerse de los Planetas superiors, y sus Conjunciones.”

²²⁵ Corachán, 6.

did not signify anything disastrous, though it might appear to at first glance, because of the benevolent influence of Jupiter.²²⁶ Limiting speculation over the final cause of comets to the final cause of *conjunctions* curtailed the dire prophecy-mongering that followed from divination by shape and color, since these prognostications could be made only under the technical constraints of established astrological methods.

Yet the conjunctionist theory presented problems as well as solutions. Aldrete offered a discussion of the particular difficulty inherent in deciphering the relationship between comets and conjunctions. Because a conjunction of the superior planets must occur in order to form a comet, Aldrete located the genesis of the comet of 1680 during the last major conjunction before the comet was seen. This was a conjunction of Saturn and Mars that occurred on 30 August 1680, in the nineteenth degree of Cancer, nearly *four months* before the comet was actually observed. The moon, “conciliatrix of celestial influences,” was in Scorpio at the time, “leaving the sextile of Venus.” The sun was in Virgo, “in a quadratic aspect, or in the sign adjacent to, Saturn and Mars,” and received further influence from Saturn and Jupiter. With such a potent aspect, and so many influences, the Conjunction so strengthened and focused the sun’s rays that they moved

²²⁶ Corachán, 6. “En quanto a la causa final digo, que no significa otros efectos, mas de los que significa la conjunction de Planetas que le han ocasionado; esto parece sintió Albumasar de los Cometas 8 de coniunct. Mag. D ff I apud Iunctiorum, y assi se han de juzgar por ella. Notables han sido siempre los efectos que las conjunctions de los Planetas superiores suelen causar como dixo Messahalach *Res maximae atque mirandae accident ex coniunctione planetarum superiorum*; pero en esta no tenemos que temer, por ser su señor Iupiter, que se halla en su triplicidad con dominio en el ascendente, y junto con la cabeça del Dragon, que quitará la malicia de Saturno; aunque es corriente que las conjunctions magnas causan sequedad si suceden en signos igneos; como esta que sucede en Leon por lo qual parece la podíamos temer; pero la Venus en el ascendente mirando? de trino a Saturno, y Iupiter, y la Luna de conjunction con el Sol en Escorpion no prometen aguas saludables a sus tiempos, y. . .de quadrado de Saturno en Leon, y de Sexti de Marte, denota vientos, nublados, y truenos.”

a huge quantity of celestial vapor, many times the volume of the earth, and caused a comet.²²⁷ It was the properties of the conjunction that determined the happy outcome of the comet, but the temporal distance between efficient cause and effect created problems for the astrologer, and critics of comet interpretation attacked an interpretation's reliance on such a tenuous cause-effect relationship.

3.4 Part III: Controversies

The controversy over comets in Spain was very much a controversy over astrology, between astrologers and those who sought to discredit them. It is not surprising, then, that controversies over the comet in Spain quickly transformed into controversies over the foundations of astrology, and to the claims of astrologers and those who sought to know the future. Particular predictions made about the comet, especially about political matters, were criticized in the 1680s, including critiques of the social motivations of those who made them. Broad critiques were made of astrological claims to know the future.

3.4.1 Comets and Kings

Comets were believed to cause particular kinds of effects, but the severity of these natural effects depended on the astrological influences affecting a particular region at the time of the conjunction which caused the comet. For example, Corachán proclaimed that the position of Mars at the time of the comet of 1682 suggested

²²⁷ Aldrete (1680), 4.

sickness due to an overabundance of heat and blood.²²⁸ Yet he argued that the influence of Jupiter and Venus would mitigate the Martian pestilential heat. Thus, he concluded, even though the astrological authority Giuntini said that a comet in Leo signified worms, other agricultural pests, and the destruction of property, his fellow Valencians could rest easily.²²⁹ He assured his readers that this dire prediction applied only when a malevolent planet was the astrological lord of the comet. Since the comet of 1682 had Jupiter as its lord, his readers could expect good fortune, the health of the king, and other happy occurrences predicted “eruditely” by Leonardo Ferrer, another Valencian mathematician.²³⁰

Corachán’s invocation of the health of the king, and his assertion that a comet’s disastrous effects could be mitigated by benevolent astrological influences, was not unusual. After all, there were good political reasons to suggest that comets might have a positive influence. Since ancient times, comets had signaled the death of kings and the overthrow of monarchies.²³¹ An astrologer known simply as “Monsieur Gariter” offered

²²⁸ Juan Bautista Corachán, *Discurso sobre el cometa que aparecio este año 1682* ([s.l.], 1682).

²²⁹ Francesco Giuntini’s sixteenth-century *Speculum astrologiae* was among the most-cited astrological treatises in the latter-seventeenth century. The theory of conjunctions, originally from Abumashar, was generally known through Giuntini’s synopsis of it. Francesco Giuntini, *Speculum astrologiae*, 1573.

²³⁰ Corachán, 1682, 6. “Marte señor de la 1 y 6 del Tema celeste de la raiz de Valencia de sextil con el Sol y Luna en el Tema de la coniuncion (que en signos de larga ascension equivale al quadrado) significa enfermedades ocasionadas de abundancia de calor, y sangre, pero se mantigaran por la beneficencia de Iupiter, y Venus. Y aunque Iuntino diga hablado de un Cometa . . . pero esto se ga de engender quando algun malefico tiene el dominio, y assi Iupiter, y Venus no prometen abundancia de mantenimientos, la felicidades que esta conjunction señala a nuestro Rey (que Dios guarde) y otros efectos eruditamente tienen pronosticado el R. P. M. Fr Leonardo Ferrer en su Cielo favorable, a quien me remito.”

²³¹ Schechner, *Comets*.

a natural-philosophical justification for this phenomenon, one which appeared more frequently in Latin America, where the question of American airs and European bodies was a subject of debate.²³² Gariter attributed the sicknesses following the comet to natural causes, especially the viscosity and grossness of the air as a result of the oily material of the comet. These effects, he said, were most dangerous for “the most delicate,” including the well-born, who required a more congenial environment in which to flourish.²³³

The special vulnerability of monarchs presented a particular problem to those wishing to persuade their readers that the comet was a sign from God of immanent punishment for sin, since the first to be punished was usually the monarch, in whose good graces the author wished to stay. It was an even greater problem in late-seventeenth-century Spain, where the chronic sickness of Carlos II elicited constant gossip.²³⁴

In Spain, the primary strategy of prudent authors was to affirm that the comet would cause terrible effects, but that Spain and its empire would not suffer them. Luis Aldrete y Soto offered an extreme but illustrative version of this view. Aldrete’s *Discurso del cometa de 1680* predicted dire fallout from the comet—plagues, floods, earthquakes, the deaths of kings, the undermining of monarchies, etc. He even

²³² This idea also appeared in Giuntini; see above, n. 231.

²³³ "Monsieur de Gariter", *Discurso astrológico sobre el cometa: Que se manifiesta en nuestro horizonte este año de 1681* (Zaragoza: Imprenta de Matevat, administrada por M. Gelabert, 1681), 1v. See Hurtado, 72.

²³⁴ Mariá Mar Rey Bueno, *El Hechizado: medicina, alquimia y superstición en la corte de Carlos II (1661-1700)*, 1998; Contreras, *Carlos II el Hechizado: poder y melancolía en la corte del último Austria*.

described an earthquake which, a few months before the comet appeared, had devastated his home town of Málaga, in the south of Spain. Yet Aldrete did not dwell on the destruction this earthquake caused—and it was considerable enough to make it into pamphlets on signs of God’s fury in England.²³⁵ Nor did he explain how the earthquake and the comet might both be related to an excess of hot exhalations (whatever their source). Instead, Aldrete took the earthquake itself as another prodigy, alongside the comet. Neither, however, was a warning for Spain to repent and change its ways. He argued that both were signs of the imminent birth of a great prince to the thus-far-childless king of Spain.

He seemed to recognize that this was a difficult line to follow, because he protested that “it is not a new thing in Astrology,

that comets and new stars signify the birth of great princes; for example, in the year 1664 a Comet-Star appeared in the sign of Sagittarius, which is lord over Spain, and because of it the most learned Campanella, and other astrologers of that time, predicted the birth of His Majesty [Carlos II] from [his father] King Felipe IV the Great.”²³⁶

Thus, he defended a kind of exceptionalist view with regard to the political effects of comets in Spain. His approach was quite representative; Pedro Álvarez de Miranda has

²³⁵ Christopher Ness, in *Signs of the Times* (1681) includes the Málaga earthquake as one of his nine signs, along with three dead lions at the Tower of London, a dead whale in the Thames, and, of course, the comet.

²³⁶ Aldrete (1680) 11. “No es nuevo en la astrologia, que cometas, y estrellas nuevas, signifiquen nacimientos de monarcas grandes; pues en el año de 1664 apareció una estrella cometa en el signo de sagitario, que predomina en españa, y por ella juzgó el doctisimo campanela, y otros astrologos de aquel tiempo, el nacimiento de la Magestad del señor Rey Don Felipe Quarto el Grande.”

shown that at least six other Spanish authors on the comet of 1680 provided similar arguments for the comet as a sign of the continued health of the king.²³⁷

Aldrete argued that king-killers were merely a subspecies of comet. In order for comets to be a danger to kings, the following conditions must be met: first, the comet must have originated under conditions very similar to those at the King's own birth [*"en parte igual de su Tema Celeste"*]; second, that the comet must be "wholly of the nature of Saturn, melancholy, and ash-colored, dark";²³⁸ third, it must move against the zodiac; fourth, "that it withers in a violent star" [i.e. it fades while under the influence of a violent portion of the heavens].²³⁹

Miguel Yepes, a teacher of mathematics who provided an alternately straightforward and satirical attack on those who fear comets, claimed that he was providing a judgment of the comet of 1680 on the orders of an anonymous patron. After a long philosophical diatribe against the possibility of making accurate judgments about the future from the stars or comets, he begrudgingly offered a prophecy. "To answer your grace lest [you accuse me of] failing this judgment, taking up my Astrolabe, taking the altitude, and observing its movements, I infer that this comet could be that which

²³⁷ Pedro Álvarez de Miranda, "Las controversias sobre los cometas de 1680 y 1682 en España," *Dieciocho: Hispanic Enlightenment* 20: 1 (1997), 332.

²³⁸ ". . .de naturaleza en todo de Saturno, mela[n]colica, y cinericia, obscura. . ." Aldrete, *Discurso*, 3v.

²³⁹ ". . .que fenezca en Estrella violenta." Aldrete, *Discurso*, 3v. See Hurtado, 72.

signifies the restitution of Jerusalem to the Catholic protection of our sovereign Majesty.”²⁴⁰

As “evidence” for this, he offered a prophecy supposedly given by the emperor of the Turks “in the Persian tongue” in an unspecified year, supposedly translated into Latin by Giorgio Veneto and into Castilian by Padre Fray Angel Roca Cametino.²⁴¹ His invocation of the prophecy, which had nothing to do with a comet but described a Golden Apple that could plausibly signify Jerusalem, was probably satirical, given the many pages of denunciations of attempts to know the future that precede it. After a discourse on the astrological reasons for equating this comet with the one observed by Vespasian before the destruction of the Temple, Yepes underscored his ultimately skeptical purpose when he turned to predictions of the birth of an heir for Carlos II.

Given that the comet coincided with other portents, such as a series of extraordinary rainbows in Germany and three suns visible in the sky over Vienna, Yepes claimed that the comet did not augur doom, but good. Three suns also appeared at the birth of Christ, suggesting that the birth of a great Prince was imminent.

It can be inferred from all these signs that a Prince will be born in Spain, as el Pescador [the Fisher, an unidentified astrologer in Madrid]. . . says, making a whole nation happy. Thus have prognosticated all the astrologers that have written [on the

²⁴⁰ Yepes, 10. “No obstante par contestar a v.m. que me ha pedido este juizo, alçando mi Astrolabio, tomando la altura, y observando sus movimientos, infiero, que este Cometa puede ser que signifique la restitution de Ierusalen a la Catolica proteccion de nuestro soberano Monarca.”

²⁴¹ Angel Roca Cametino wrote extensively in the sixteenth century and there is no reason to doubt the prophecy genuinely circulated, though I have not been able to locate it in Latin or Castilian.

comet] so far, and thus speaks St. Malachi, a contemporary of St. Bernard, in his prophecies.²⁴²

After a few more examples of princes born after comets, he said, “more to the point, the most learned Campanella says a similar comet, which appeared in the year 1604, prognosticated the birth of King Felipe IV the Great.”²⁴³ He finished by saying that he had thus fulfilled the wishes of his patron, albeit with “conjectures of little certainty” drawn from astrology, “which seem to be governed more by the loyal desires of a Spanish heart, than by astronomical rules.”²⁴⁴

Fulgencio Vergel, in Zaragoza, vacillated on the issue of whether the comet of 1680 was dangerous for Carlos II. On the one hand, he offered a number of happy predictions due to the particular astrological properties of the comet. On the other, he advised that the reader place a hand on his heart and recognize that “if [the comet] is vicious, there is no comet but his vices; if it is luxurious, there is no comet but his luxury; and if it is old, there is no comet but his years.”²⁴⁵

²⁴² Yepes, 12. “Se pudiera inferir de todas estas señales nacerá a España un Principe, que como dize el Pescador, fol. 24, pagin. 2 alegrará a todo un Pueblo. Assi lo han pronosticado todos los Astrologos que han escrito hasta aora: assi lo dixo en sus profecias San Malaquias, contemporaneo de San Bernardo.”

²⁴³ Yepes, 12.

²⁴⁴ Yepes, 13. “Esto es lo que por obedecer a v. merced he podido inferir del Cometa que hemos visto en nuestro Orizonte, mas con tan leve congetura por la poca certeza que se le deve a la Astrologia, que mas parecen regulados estos argumentos, por los leales deseos que produce un pecho Español, q[ue] por reglas Astronomicas.”

²⁴⁵ Fulgencio Vergel, *Discurso verdadero, y iuizio del admirable cometa, que se ha aparecido en este orizonte de Madrid, desde 23. de diziembre del año passado de 1680: Perseverando toda via en el mismo orizonte, hasta este presente año de 1681* (Lucas Antonio de Bedmar, 1681). Quoted in Hurtado, 72. “Cada uno meta mano en el pecho, y vea de que pie coxea, y si es vicioso, no ay mas Cometa que sus vicios; si es luxurioso, no ay mas Cometa que su luxuria; y si es Viejo, no ay mas Cometa que sus años.”

What stood out in the Spanish case, compared to the English one, is the striking degree of agreement among political prophecies, and their relatively low importance in a given pamphlet compared to astrological and religious issues. In England, Patrick Curry and William Burns have explored the fierce ideological battles that played out in late seventeenth-century prophetic works, including comet pamphlets, between Whigs and Tories. In most English comet pamphlets, political sentiments were the author's primary, or even sole, motivation for writing on the comet. Curry and Burns' emphasis on political uses for prophecy draws on Keith Thomas' arguments about the growing distance between vulgar and learned cultures, a theme that Daston, Park, and Cameron draw out at length. In Spain, the condemnation of vulgar astrology or vulgar prophecy was present, but far more muted.

3.4.2 Knowing the Future

Only a few Spanish examples of the condemnation of astrology for its vulgarity survive. In his *Discurso filosofi-astronómico*, Captain Vicente Montano complained to his dedicatee, the Duke of Albuquerque (who then served as Captain-General of the army), that many of the vulgar at court were "reading with horror the book of the hidden marvels of heaven, the most ominous announcements of great ruin, it seeming to them that the comet is not a chance occurrence, but rather a presage of these things."²⁴⁶

Montano expressed skepticism toward the traditional apparatus of astrology and the

²⁴⁶ Montano, *Discurso filosofi-astronómico*, A2. "En esta Corte están los ojos del Vulgo leyendo con horror en el libro de las ocultas maravillas del Cielo, funestisimos anuncios de grandes ruynas, pareciendoles que el Cometa no es un acaso, sino un presagio de desdichas. . ."

body of historical evidence for comets having bad effects. He addressed himself to his patron as a student of astrology, but he specified that by astrology he did not mean the vanity of judiciary astrology or the calculation of horoscopes, either for individuals or for entire nations. Rather, distancing himself from astrology, he professed to follow “astronomy” as founded on the more certain rules of mathematics.²⁴⁷

Montano’s treatise proceeded according the usual formula, addressing the comet’s form, material, its motion, and its effects, but he expressed some disdain for the literary history—the Greek and Latin poets—brought into discussions of comets. Meteorologists, he wrote, went about “defining each one, or better to say metaphorizing about them, giving them names like hairy, bearded, tailed, and others.”²⁴⁸ His dissatisfaction with this “metaphorizing” fit with his disdain for astrology, his embrace of the “more certain” foundations of astronomy, and his admiration of Gassendi as “the most celebrated astronomer and philosophers of our times.”²⁴⁹ Montano, again, believed comets traveled in rectilinear paths, since no comet had been seen to traverse 180 degrees.²⁵⁰ Comets, then, did not dissolve when they disappeared,

²⁴⁷ Montano, *Discurso filosofi-astronomico*, A2v.

²⁴⁸ Montano, *Discurso filosofi-astronomico*, A2v. “. . .Definiendo a cada uno, o por mejor dezir, metaforizando sobre ellos, dandoles nombre de crinitos, barbados, caudatos, y otros. . .”

²⁴⁹ Montano, *Discurso filosofi-astronomico*, A3.

²⁵⁰ Montano, *Discurso filosofi-astronomico*, A3.

but rather "went off into the distance among the stars, from whose height, to my estimation, they had come."²⁵¹

Nothing, however, moved Montano to fear comets because nothing either preceding or following their appearance gave him reason to do so. He, too, brought up the comet of 1618, which, on account of the disasters that accompanied the outbreak of the Thirty Years War, proponents of malefactivism upheld as a key piece of evidence. However, he affirmed that positing the comet as a cause for these effects was "certainly ridiculous," and that the deaths of King Felipe III and the Emperor Matthias happened months or years after the comet and could have nothing to do with it. He pointed out that the death of the English king Charles I came *before* the comet of 1652, not afterward, and that the wake of the comet brought a general peace to England, albeit under the "tyrant" Cromwell.²⁵² He did admit that Felipe IV died after a comet, but argued that this relationship could not be causal since many great men died without comets, and many lived when comets occurred.

As for the current comet, ironically, it was the skeptic Montano who gave one of the most detailed accounts of the disasters Spain had suffered shortly before the comet: a "notable mortality among the people, caused primarily by hunger, after the plague. . .and some cities destroyed in the earthquake."²⁵³ And yet, notwithstanding the

²⁵¹ Montano, *Discurso filosofi-astronomico*, A3v. ". . .no como otros dizen, resolviendose su materia, sino remotandose entre las estrellas, y en aquella altura, de done, a mi parecer, avia baxado."

²⁵² Montano, *Discurso filosofi-astronomico*, A4.

²⁵³ Montano, *Discurso filosofi-astronomico*, A4v. "Y no estamos viendo que a este mismo cometa han precedido tantos males, como ha padecido la España en la Andalucia, con notable mortandad de

appearance of the comet, Spain found itself in full recovery from these disasters rather than seeing more. He assured his patron that he could rest knowing that these apparitions were celestial and that they moved without regard for the terrestrial effects which the vulgar ascribed to them. Montano, perhaps gesturing to the rhetorical strategies of the astrologers who had published pamphlets on the comet, wrote that though it was a pity they could not take the comet as a favorable sign, nonetheless it was some consolation that they could read nothing ominous in it, either.²⁵⁴ He ended by commending himself to Seneca, who affirmed that sciences perfect themselves through the discourse of time, and that someday astronomy would have “reason [enough] to forecast and to know apparitions of comets, like what happened with eclipses of the moon and sun.”²⁵⁵

Another condemnation of “vulgar belief” appeared in the work of Juan Bravo de Sobremonte, in a pamphlet called *Piedra de toque* (“Touchstone”). There, Bravo complained that the appearance of the comet had “given the ignorant vulgar a reason to discuss fatal predictions, which don’t make sense, nor do they have any foundation other than the impression [the astrologers] give them.”²⁵⁶ In Spain, criticism of comet divination, and of astrology, relied less on its political implications than on a dismantling of the idea that man has sufficient knowledge to discern the will of God.

gente, causad primero de la hambre, y despues de la peste, y por remate, destruidas algunas ciudades principales con el temblor de tierra?”

²⁵⁴ Montano, *Discurso filosofi-astronomico*, A4v.

²⁵⁵ Montano, *Discurso filosofi-astronomico*.A4v.

²⁵⁶ Juan Bravo de Sobremonte, *Piedra de toque* (1681), 1.

Astrologers themselves were often the first to condemn overzealous claims for astrology's ability to penetrate the secrets of the future, denying that they preached or assumed determinism. Yet however astrologers sought to purge their craft of superstition, astrological methods for comet interpretation remained subject to the vicious criticism that authors aimed against astrology in general. Bravo railed against "the theologians with their foundations in Holy Scripture,

the Astrologers, with their vain science, the philosophers, with the uncertainty of their metaphysical principles, and the Astronomers, because of the agreement which their doctrines have with Philosophy. All of them discuss disasters, horrors, fatalities, deaths of Kings, subversions of monarchies, and other portents.²⁵⁷

Bravo announced that he would go on to disprove the presumptions of those who said the comet would cause disasters on theological, astrological, philosophical, and astronomical grounds. In his condemnation of astrology, he invoked the usual criticism that accused astrologers of denying the freedom of the will, along with other arguments against it that had been current since Pico della Mirandola's fifteenth-century diatribe against astrology. The key issue, for Bravo and most critics of comet-divination in Spain, was astrologers' claim to know the future.

In addition to his satirical attack on the political motivations for comet predictions, Miguel Yepes proffered philosophical arguments against the foundations of

²⁵⁷ Juan Bravo de Sobremonte, *Piedra de toque* (1681), 1. "Ha dado motivo a que el Vulgo ignorante discurra predicciones fatales, que no entiende, ni tienen otro fundamento, que la impresion que les haze, que los Theologos con fundamentos de la Sagrada Escritura; los Astrologos, con los de su Ciencia vana; los Filosofos; con la incertidumbre de sus principios metafisicos; y los Astronomos, con la aderencia que sus doctrinas tiene con la Filsosfia; unos, y otros discurren amenazas, horroes, fatalidades, muertes de Reyes, subersiones de Monarquias, y otros portentos."

astrology, relying explicitly on Aristotle's epistemology. In order for astrologers to be able to divine the future in the stars, he began, we must accept the premise that "in the heavens are written all particular things, in the same manner they exist in the divine understanding, and that in the stars one finds the particular virtues of all particular causes. . .even those which proceed from free will."²⁵⁸ He cautioned that such a premise was not only wholly false, but heretical—but that, even supposing such a thing were true, reading this celestial book of causes remained morally impossible. Aristotle, he said, showed that a being deprived of a certain sense from birth had no knowledge of those things pertaining to that sense. For example, those born blind had no knowledge of colors. A knower in such a position might observe accidents, but his knowledge of the object could only be imperfect and confused.

Humans, he argued, understood the accidents of the stars, such as their size, movement, and the figures they make in the sky, but the heavens remained beyond humankind's sense experience except through vision. Since no human had heard the stars, or touched them, humans only had access to a few general accidental properties of the celestial bodies, and so knowledge of them was "a general knowledge, and confused."²⁵⁹ If, Yepes finished, humans still lacked a complete understanding of animals and plants that they could touch and explore with all senses, and to which the greatest philosophers had dedicated their lives, how could anyone expect to have any real knowledge of the stars, which were so distant? Counting himself among "we

²⁵⁸ Yepes, 6.

²⁵⁹ Yepes, 7.

astrologers,” he ended sarcastically: “O Great Wisdom of ours, which reaches that which Aristotle, Plato, and others could not know!”²⁶⁰

Yepes concentrated primarily on disparaging astrology, but when he turned to his “interpretation” of the comet, he asserted that offering predictions about the effects of the comet would invite the same errors that astrologers commit, namely, supposing to know the future, which is known only to God. Citing St. Augustine, Yepes argued that astrologers make false claims about the future at the behest of demons, who were themselves ignorant of the future, but who, as angels, had a better understanding of the nature of the world and so could make accurate conjectures about the future. Importantly, he argued, demons did not derive their accurate predictions by watching the stars, but only “conjectures” drawn from their “perfect natural Science.”²⁶¹

Furthermore, Yepes invoked the knowledge of the blessed in heaven, which “in the common opinion of theologians” was more perfect than the knowledge of the living. Those in heaven, in his view, benefitted from the vision of God and saw in the divine essence the order of the world, and so understood the natural causes of things in the world. Yet even they could not know the future except that which was divinely revealed. Thus the astrologers, who pretended to know the future from the stars alone, wished “to have more science than the angels and the blessed.”²⁶²

²⁶⁰ Yepes, 7.

²⁶¹ Yepes, 5-6.

²⁶² Yepes, 6.

3.4.3 Aldrete and the Defense of Astrology

Yepes' *Discourse* attracted the ire of one of the most prolific writers on astrology in seventeenth-century Spain, the courtier Luis Aldrete y Soto, who responded at great length in his *Defense of Astrology* (1681), a work which offers unparalleled insight into astrological thought in Spain on the eve of the eighteenth century. Few details of the life of Don Luis Aldrete y Soto survive, except those he provided in his own writings. We do not know the date of his birth. No record survives of the granting of the two titles he claims in his pamphlets: *regidor perpetuo* of the city of Málaga and *aguacil mayor* of the Inquisition.²⁶³ Both of these were likely honorary titles, without responsibilities but with considerable social standing, and they allowed him to circulate freely at court.²⁶⁴ Aldrete himself claimed he traveled throughout Italy and consulted with unnamed experts in iatrochemistry. Whether or not this was the case, he was reasonably well-read in the chemical tradition—though not, tellingly, as well-read as some of his Galenist adversaries.

His defense of astrology was, primarily, meant as a defense of his *medicine*, which he believed to be founded on astrology. Aldrete articulated his history of astrological medicine most clearly in one of the tracts he composed in response to the comet of 1680. His physics emphasized the primacy, though not the physical centrality, of the sun. He wrote that “the essence of God is an immense light. He created the sun in his image.” This was not merely a theological point, but a physical one, because Aldrete

²⁶³ He claimed these titles in his *Discurso del cometa del año de 1680* (Madrid [1681]) and all subsequent works.

saw light as the origin of the four primary qualities, “the pillars which sustain this macrocosm.” When light, which was the image and the virtue of God, passed through the firmament, sun, and planets, it was divided into “branches” which formed the four primary qualities. Thus, knowledge of the stars, planets, and light and their influence on the microcosm—that is, astrology—was the *foundation* of all philosophy.

Adam knew all of this, according to Aldrete, citing a well-known story from Josephus:

God gave the secret [of the relation of macrocosm to microcosm] to Adam, so that he might know the virtues of all creation; he gave it to Seth, his holy and virtuous descendant, who reduced this knowledge to rules, and knowing from Adam that the world was in danger from water and fire, in order that the world would not lose such an important science, he wrote the foundations of this knowledge on two columns, one in brick, which can survive fire, and one in marble, which can survive water, and Josephus says that these columns survived on the earth until his own time, in Syria.²⁶⁵

We have here an origin for astrology, which, again, Aldrete believed to be the most fundamental science. He put forward this account in a *Defense of Astrology*, published in 1681, but even within that pamphlet he discussed medicine, and most importantly, explained how the sciences became corrupt. This story originated in the work of Josephus, who also wrote of the twin columns, and it formed a standard part of

²⁶⁵ Aldrete, *Defensa de la Astrología* (1683), 1. “. . .para que por ella conociese las Virtudes de todo lo criado: él a Seth, su Hijo, Santo, y Iusto, que la reduxo a Reglas; y aviendo sabido de Adam, que el mUndo avia de peligrar por Agua, y Fuego, para que no pereciesse Ciencia tan importante, en dos Colunas, una de Ladrillo, y otra de Marmol, escribió sus fundamentos; aquella contra el Fuego; y la de Marmol, contra las Aguas, que permanencia en Tierra de Syria hasta el tiempo de Iosepho, que assi lo refiere en el lib. 1, cap. 2., de Antiquitatibus.”

defenses of astrology across Europe and the Americas.²⁶⁶ However, Josephus merely recounted that Adam received knowledge of the stars; the account of how the perfect science of astrology came to be corrupted was Aldrete's own.

Man already possessed perfect knowledge in the Garden. Yet the devil, understanding that astrology was the noblest and most divine human knowledge, immediately sought to corrupt it in order to bring man into sin. So he taught Cain diabolical magic and taught him to call this astrology. The devil also taught Cain to pervert the other sciences. He laced theology with heresies. He allowed philosophy to be corrupted by gentiles, stoics, and peripatetics. Cain, Aldrete continued, was actually Zoroaster, "King of the Brahmas." In Asia, where he reigned, he founded schools of this diabolical art, whose students included Plato, Pythagoras, and Apollonius of Tyana. Mosaic law fell into the hands of King Minos of Crete, who corrupted it with idolatries.

Aldrete thus agreed with many—both astrologers and critics—that certain interpretations of astrology were rife with superstitious falsehoods.²⁶⁷ Specifically, he

²⁶⁶ Examples of it can be found in John Butler, *Hagiastrologia, Or, The Most Sacred and Divine Science of Astrology* (London: Printed for the author and are to be sold by William Bromwich, 1680); John Brinley, *A Discovery of the Impostures of Witches and Astrologers by John Brinley* (London: Printed for John Wright and sold by Edward Milward). In Mexico, Martin de la Torre's *Manifiesto christiano*, now lost, also included a version of this history (see ch. 5). Skeptics of astrology often attacked this claim to ancient knowledge; see Gassendi, *The Vanity of Judiciary Astrology, Or, Divination by the Stars*; Geminiano Montanari, *L'astrologia convinta di falso: col mezzo di nuove esperienze e ragioni fisico-astronomiche: o' sia La caccia del frugnavolo* (Venetia: Per F. Nicolini, 1685); *Antikairoi: Or, An Answer to That Late Bundle of Malice, Stuffed with Envy, Error, and Ignorance: And Sent into the World with the Title of Observations upon the Strange and Wonderful Prophecies of John Gadbury*; Carlos de Sigüenza y Góngora, *Libra astronómica, y philosophica en que D. Carlos de Sigüenza y Góngora. . . examina no solo lo que à su Manifiesto Filosófico contra los Cometas opuso el R.P. Eusebio Francisco Kino de la Compañia de Jesus, sino lo que el mismo R.P. opinò* (Mexico City: por los herederos de la viuda de Bernardo Calderon, 1690); Pierre Bayle, *Miscellaneous Reflections, Occasion'd by the Comet Which Appear'd in December 1680 Chiefly Tending to Explode Popular Superstitions. Written to a Doctor of the Sorbon, by Mr. Bayle. Translated from the French. To Which Is Added, the Author's Life. In Two* (London: printed for J. Morphew near Stationers-Hall, 1708).

went on to say, the works of the Arab astrologers further corrupted the pure science of the stars. The trope of astrology corrupted served him well as he tried to answer Augustinian criticism of astrology, which Yepes raised in his pamphlet. To answer those who argued that Isaiah 47 prohibited all astrology, he responded that the astrologers to whom the passage referred were taught in the schools of Cain.²⁶⁸ He also referred to Jeremiah 10, which, in his view, did not speak of astrology, but only of idolatry.²⁶⁹

He went to great lengths in order to defend astrology because it occupied a vital place in his cosmology as the science of the *imago dei*:

Astrology is all images, and thus it is God's own language, as far as it indicates the ideas of his Immense Providence. He rolled out this Parchment of the Firmament, full of images of different figures, which shined with the light of sun and the stars. We see in the Sacred Writings, that God explains his will to Prophets, and even those who are not prophets, with images. . . Even in a literal sense, in the Apocalypse, the visions are all images: of the sun, stars, moon, angels, animals, beasts—and this is an infallible prognostication of the seven days of that mysterious week of Genesis, and the seven ages of the World, whose enigmas can be unraveled in the immense sea of the Science of God, and whose allegories can be understood with Theology, the Scriptures of the

²⁶⁷ Most famously, Gassendi and Bayle articulated this view, but it was near universal for those wishing to defend astrology to decry those who tarnished the good name of the art by associating it with improper attempts to divine the future. In the early 1680s alone, in Spain, Andrés Dávila y Heredia did this, as well as Aldrete; in Latin America, Martín de la Torre provided a very similar history to the one seen in Aldrete's; in England, Gadbury and Lilly both customarily opened their almanacs with dismissals of those who used astrology for illicit purposes, while John Butler examined licit and illicit astrology at length.

²⁶⁸ Isaiah 47: 13-14 reads, "Thou art wearied in the multitude of thy counsels. Let now the astrologers, the stargazers, the monthly prognosticators, stand up, and save thee from these things that shall come upon thee. Behold, they shall be as stubble; the fire shall burn them; they shall not deliver themselves from the power of the flame: there shall not be a coal to warm at, nor fire to sit before it."

²⁶⁹ Aldrete, *Defensa*, 6.

New and Old Testaments, philosophy, chemistry, astrology, mathematics, arithmetic, and geometry.²⁷⁰

Aldrete believed, then, that not only could astrology discern the effects of the comet, how severe they would be, and what cities they might harm, but he argued that astrology held the key to understanding scripture itself.

In light of this extraordinarily optimistic account of human knowledge through astrology, it is telling that Aldrete condemned the attempts of unscrupulous astrologers to make overly zealous claims about the future. Yepes argued that astrology had, as its object, the knowledge of the future, which was reserved to God alone, and so astrologers were striving to become like God. Aldrete conceded that knowledge of future contingents was reserved for God alone. However,

Because only God, as Author and Maker of all things, who created the celestial bodies, and who will suspend their influence or give them more force, can know this. Conjecturally, this is denied. Because, being a science [*ciencia*] taught by God, like philosophy and the other sciences for the governing of this world; well can one conjecture when it will rain, which is a future [event]; when there will be eclipses; if a man will be choleric; if phlegmatic, conjecturally. Even to take the mathematics of eclipses . . . and by their demonstrations they can reach, without erring even a little,

²⁷⁰ Aldrete, *Defensa*, 6. "La Astrologia es toda Imagenes, y propio Idioma de Dios, por donde indica las Ideas de su Inmensa Sabiduria. Extendió esse Pergamino del Firmamento, lleno de Imagenes de diferentes figuras, que bordó con la Luzes del Sol, participada a los Astros. Veamos en las Sagradas Letras, si Dios por Imagenes se explicava con sus Profetas, y aun con los que no lo eran. Las de Daniel, en el cap. 7, fueron quarto Bestias, y quarto Vientos, que peleavan en un Mar grande." He continues offering a number of images by which God communicated with men in the Bible. "Del Apocalypsi, en lo literal, las Visiones son todas Imagenes de Sol, Etrellas, Luna, Angeles, Animales, Brutos, y Fieras: y es un pronóstico infallible de los siete Dias de aquella mysteriosa Semana del Genesis, y de las siete Edades del Mundo: cuyos Enigmas se forjaron en el Mar Inmenso de la Ciencia de Dios, y se defatan? sus alegorias por la Teologia, Escrituras del Nuevo, y Viejo Testamento, por la Filosofia, por la Chymica, por la Astrologia, por la Matematica, y por la Arismetica, y Geometria, que irémos refiriendo, para por fin desvanecer el Pronostico de la Conquista de la Casa Santa del Catedratico de Cien-Pocuelos."

even until the end of the world, as can be seen in ephemerides. Is that, then, to be like God?²⁷¹

He thus denied that making conjectures, even true ones, was to commit idolatry. “The consequence is denied, as timid and unsound. The prophets, who predicted so many truths, and drew out such certainties—no Catholic will say that they are like gods.”²⁷² In other words, Aldrete accused those who agreed that the philosopher should be modest about claims to understand natural causes of excessive timidity, and of failing to use the sciences given to them by God.

This view, as we have seen, had come under attack in late seventeenth-century Spain, as authors grew to see sign-mongering as misguided, if not superstitious. Though some authors, like Bravo, defended Aristotle’s account of comets, they argued that God’s intervention into nature was supernatural and exceedingly rare. Spanish authors objected not only to seeing unusual phenomena as signs from God, but also to the astrological methods brought to bear on the problem of comet divination. The assault on astrological methods, combined with a growing willingness to see positive outcomes from traditionally terrible comets, contributed to a debate over more general aspects of man’s ability to see God in nature by the mid-1680s.

²⁷¹ Aldrete, *Defensa*, 4. “porque solo Dios realmente, como Autor, y Hazedor de todas las cosas, y que crió esso Astros, y podrá suspender sus influxos, o darles mas Fuerca, la podrá conocer. Conjecturalmente, se niega; porque siendo Ciencia, que enseñó Dios, como la Filosofia, y demás Ciencias, para el Gobierno deste Mundo; bien se puede conjeturar, quando ha de llover, que son Futuros; quando avrá Eclipses; si uno será colerico; si flematico, conjecturalmente: Aunque por tocar a la Matematica los Eclipses, son evidentes, y por sus demostraciones [sic] se podrán sacar, sin errar un apice, hasta la fin del Mundo, como se vé por las Efemerides. Luego será como Dios?”

²⁷² Aldrete, *Defensa*, 4. “La consecuencia se niega, como temeraria, y mal sonante. Los Profetas, que tantas Verdades predixeron, y salieron ciertas, ningun Catolico dirá que son como Dioses.”

3.5 Conclusion

The perceived philosophical, historical, and technical inadequacies of comet prognostication helped to make it unappealing to the Spanish elite on the eve of the eighteenth century. This, then, marks an alternative path toward skepticism about belief in comets when we compare it to the English case: such a belief was not dismissed as vulgar or dangerous in Spain, but as philosophically absurd and potentially theologically illicit.

Of course, particular philosophical arguments against fear of comets had circulated for centuries—in some cases, millennia—by 1680. Most of the arguments presented were, at their core, modifications of those proposed by Pico della Mirandola in the fifteenth century, Augustine in late antiquity, Seneca in Roman times, or even mysterious “Chaldean” keepers of wisdom. What gave these arguments “teeth” at the end of the seventeenth century? The fact that many authors began to cite the same kinds of old arguments, at the same time, when they were not doing so before, suggests this is a period in which Spaniards were changing their ideas about astrology, superstition, and the role of God in Nature. It is important to take seriously the beliefs that motivated them to write and print their treatises, often at considerable inconvenience and expense. The purpose of this chapter has been to clarify what was at stake in the *content* of the debate over comets, rather than reducing the flurry of pamphlets to concerns over patronage, politics, and payment.

Philosophical and theological arguments over the foundations of astrology and commitments to different ideas about the limits of human knowledge shaped the

debate over comets and other wonders in late-seventeenth-century Spain. Comet-belief, in other words, was drawn into debates over the limits of human knowledge and the validity of ancient philosophies as they played out in natural philosophy and in medicine. These debates were not straightforward battles between champions of European new philosophy and scholasticism or Galenism. Men who would become prominent *novatores* issued fairly standard comet tracts complete with divinations; philosophical demolitions of comet divination came from writers who argued from Aristotelian final causes. It was not clear, by 1683, that opposition to comet divination was a marker for any particular philosophical position, whether scholastic, Galenist, or *novator*. Only gradually would the philosophical muddiness resolve into clear “traditionalist” and “*novator*” camps, which became institutionalized at the end of the century.

CHAPTER 4:
WORMWOOD: THE COMET OVER NORTH AMERICA

And the third angel sounded, and there fell a great star from heaven, burning as it were a lamp, and it fell upon the third part of the rivers, and upon the fountains of waters;

and the name of the star is called Wormwood: and the third part of the waters became wormwood; and many men died of the waters, because they were made bitter.

Revelation 8:10-11

4.1 Introduction

AT HIS THURSDAY LECTURE at Harvard College on 20 January 1681, Increase Mather preached on God's "Alarm to the World"—a comet, stretching by Mather's own measurement sixty degrees across the sky.²⁷³ The sermon urged the members of the Cambridge congregation to heed God's warning and recommit themselves to Jesus Christ. When he printed his sermon, Mather made no effort to hide the apocalyptic overtones of his subject, including the text of Rev 8:10-11 on the title page. These passages told the story of the third angel of the Apocalypse causing a great star,

²⁷³ Increase Mather, "Heaven's Alarm to the World," 157. Page numbers are from the more widely available second edition, published as an addendum to Mather's *Kometographia*, 1683. Abbreviated hereafter as IMK.

Wormwood, to fall from the sky and poison the waters of the earth. Above this biblical passage, Mather's long subtitle exclaimed in large print that the sermon aimed to prove "that fearful Sights and Signs in Heaven, are the Presages of great Calamities at hand," against those "who would have the World believe, there is no cause of dread when such Ensigns amidst the Heavenly Host, are held up in the sight of all the Earth."²⁷⁴

Mather did not name his adversaries, but by 1681 those who would have the world believe there was no cause to fear comets, or that they happen by chance, had become numerous and vocal. Mather himself exercised *de facto* control of the press in New England, so skeptical views did not often make it to print, but Mather and others made it clear they faced a range of skeptical arguments against prodigies. Mather's words also suggested he meant to address the concerns of members of his congregation; manuscript notes in New England almanacs showed that many people took notice of the comet, and speculation over its meaning or lack thereof would have been the talk of the taverns in Boston and the subject of student musings at nearby Harvard College.

The discussion of the comet in New England appears, compared to the other regions we have seen, sparse and remarkably homogenous. Despite the flourishing culture of almanac-making in British North America, astrological debates there proved anemic, shying away from the fierce philosophical arguments in Latin America and Spain or the astro-religious polemic of Old England. Those who spoke of the comet in New

²⁷⁴ IMK, Mather's preface, 7.

England overwhelmingly made their living preaching the gospel, and their concerns rarely stray from a defense of the view that the comet had been sent as a sign from God and a warning of his punishment.

In the following pages I outline the responses to the comet in British North America. After discussing the circulation of information in North America and the particular challenges of working there, I examine the almanacs emerging from Boston and Cambridge and the precedent they set for discussions of celestial anomalies. I then turn to the works of New England preachers, the most numerous commentators on the comet. Preachers addressed the sign in the sky in sermons given throughout Massachusetts.

The third part of this chapter will focus on New England's most prominent contribution to the wider conversation over the comet, Increase Mather's *Kometographia*. In this work, Mather attempted to prove the effect of comets on the world through historical inquiry and "empirical" investigation. This project attracted attention and ridicule on both sides of the Atlantic, and received mixed assessments even from Increase Mather's own son, Cotton Mather, early in the eighteenth century. The words of the preachers, including Mather, offered a testament to beliefs about God's intervention in Nature as they were articulated near the end of the century in one corner of the growing English colonial empire. Above all, they showed that New Englanders possessed a sophisticated theological vocabulary to explore and explain the role of signs and prophecy in religious life.

4.2 Circulating Knowledge

In 1662, a teenaged boy, taken perhaps by a fit of moral rectitude, wrote out his confessions. Among them, he included “beating Arthur Storer.”²⁷⁵ Storer, the beatee, made no mention of the incident, but his forgiveness of his boyhood assailant showed in the many letters exchanged, even across an ocean, in their later years.

The recalcitrant teen, Isaac Newton, lived with the Storer family for a time and attended school with Arthur and his brothers (among Newton’s other confessions we find “stealing cherry cobs from Eduard Storer” immediately followed by “denying that I did so”).²⁷⁶ William Stukeley, who interviewed members of the Storer family after Newton’s death, provided some evidence that, in his youth, Isaac took a fancy to Arthur’s sister, Katherine, who lived with the family. Newton certainly extended kindness to Katherine throughout his life, even instructing his agent to buy a house because “his old acquaintance Mrs Vincent [*nee* Katherine Storer] livd in the place.”²⁷⁷ But the evidence remained circumstantial. However, Newton remained close to the Storer family, even when Arthur and some other members of the family moved to “Mary-Land” in the 1670s.²⁷⁸

²⁷⁵ These confessions come from Newton’s “Fitzwilliam Notebook,” MS, Fitzwilliam Museum (Cambridge), 3v.

²⁷⁶ Newton, Fitzwilliam Notebook, 3r.

²⁷⁷ William Stukeley, *Memoirs of Sir Isaac Newton’s Life*, (London: Taylor and Francis, 1936), 19. A key source for the relationship between the Storer family and Newton, and on the astronomical career of Arthur Storer, is Peter Broughton, “Arthur Storer of Maryland: His Astronomical Work and His Family Ties with Newton,” *Journal for the History of Astronomy* 19 (1988): 77–96.

²⁷⁸ Stukeley, 19.

Arthur Storer (1645-1686) is one of the better-documented observers of the comet of 1680 thanks to his connection with Newton. Storer emigrated from England to Maryland sometime before 1673. He lived on the Patuxant River, “near Mr-Kinders neare Hunting Creek.”²⁷⁹ He left no record of his reasons for moving to Maryland, though it seems likely he was following another of his sisters and her husband, who moved there earlier.

Most of what we know about Storer himself comes from letters to his family, especially his uncle at Trinity College, and from administrative documents such as wills. The contents of these letters range from details on various members of the family to more complex astronomical writings. In 1678, for example, when Storer had already moved to Maryland but was briefly back in England, he sent Newton a set of astronomical tables in which he had calculated the azimuth of Polaris from the north using a method previously unknown to him. He calculated them for the latitude of Cambridge on the thought that Newton, having the correct values already, could give his opinion on this new method—although, as Storer’s biographer Peter Broughton notes, “perhaps he was really only trying to let Newton know what his old school chum was up to.”²⁸⁰ Over the course of this visit to England, which lasted from August (at the latest) to late September 1678, Storer exchanged quite a few letters with Newton. He wrote on 4

²⁷⁹ Storer to Humprey Babington (April 16, 1681), *Newton Correspondence II*, 269.

²⁸⁰ For a detailed examination of the mathematical process Storer may have used, see Broughton, 83.

September and 19 September, and received a less than encouraging reply from Newton about his astronomical tables on 11 September.

In a letter of 18 April 1681, Storer (now back in Maryland) wrote to his Uncle Humphrey Babington about the comet he had been watching since the previous autumn, asking him to have Newton take a look at them. Newton's reply, if he did reply, has not survived. But there is no doubt that Babington passed the tables to Newton. In Book III of the *Principia*, Newton recorded that

Mr. Storer, (by letters which have come into my hands) writes, that in the month of Dec. when the tail appear'd of the greatest bulk and splendor, the head was but small, and far less than that which was seen in the month of November before Sun-rising; and conjecturing at the cause of the appearance, he judg'd it to proceed from there being a greater quantity of matter in the head at first, which was afterwards gradually spent.²⁸¹

Having access to observations from the far corners of the world allowed Newton to make striking juxtapositions of data in order to determine the precise position of the comet at a given hour and minute, London time. Making use for Arthur Storer's observations for one morning, Newton wrote:

The same day Mr. Arthur Storer at the river Patuxent near Hunting Creek in Maryland in the confines of Virginia in lat. $38\frac{1}{2}$ ° at 5 in the morning (that is at 10h at London) saw the Comet above Spica [in Virgo], and very nearly join'd with it.²⁸²

²⁸¹ Isaac Newton, *The Mathematical Principles of Natural Philosophy*. By Sir Isaac Newton. Translated into English by Andrew Motte. (London: Printed for Benjamin Motte, 1729), vols. 2, Book III, 372–323.

²⁸² *Principia*, vol. 2, Book III, 354.

Storer's observations wrote of a tail of 30 degrees by mid-December just after sunset.

Newton was relying primarily on Flamsteed's observations, of course, though he made his own "extending to 9 March" and used "observations of Kirch, commencing 4 November."²⁸³

4.3 "These American Desarts"

It is clear that Storer was dreadfully sick when the comet appeared in the sky. A letter to his uncle, Humphrey Babington (also a friend of Newton's) at Trinity College, dated 18 April 1681, recorded that:

I have been Ill almost this 12 Months but Especialy from Octo 2 on which day I got a fall from horse back by wch I got as I suppose some Inward Bruise that I have bene in a very weake condition ever since so yt I have not been above 2 miles from home never since October ye 2: sometimes I am in some hopes of Recovery & sometimes to the Contrary much fearing a Consumption.²⁸⁴

Storer's difficulty drew out the often debilitating physical limitations observers of the comet faced. Making astronomical observations in 1680 required non-trivial physical exertion. For all the observers quoted in this dissertation except Andres de la Rocha in Lima, the comet appeared in the depths of winter. Measuring precise angles in the chill of a January pre-dawn with cold or even numb fingers required considerable tenacity,

²⁸³ Newton, *Principia* (1687), 485.

²⁸⁴ Storer to Humphrey Babington (18 April 1681), MS Add. 3978/5 (Cambridge University Library, Cambridge, UK), 1r. Printed as Storer to Babington (April 18, 1681), *Newton Correspondence II*, 269-72. On this letter and Humphrey Babington's circumstances at the time of its writing, see Broughton, 82.

especially for observers in the cold climates of Boston or more provincial towns in Massachusetts.

Lieve Verschuier's painting of the comet of 1680 over Rotterdam, perhaps the most famous depiction of the Great Comet other than Newton's own, showed the crowd observing the comet while standing on snowy ground, the men, women, and children bundled up in layers of coats and winter cloaks, struggling to balance their astronomers' staves.²⁸⁵ For those lucky enough to observe through a telescope, the crystal-clear, dry atmospheric conditions often present in winter (one of Verschuier's observers might have mentioned dry exhalations) may have been canceled out by frosted-over lenses from the astronomer's breath. Though Storer may well have exaggerated his physical weakness in order to impress Newton with his dedication (his later letters indicate that he very much wanted to impress his now-famous friend), his description of his own condition reflected the physicality of astronomical observation. It also highlighted the very personal circumstances in which those in 1680 made their observations—circumstances almost always expunged from printed records.

But physical limitations did not only affect the bodies of observers; the physicality of one's place in geographic space bound individuals and groups of observers in important ways. The Atlantic, of course, was seen as both a bridge and a barrier—those in the Americas benefitted, and benefitted from, trans-Atlantic networks, but they also recognized the challenges that their physical location forced them to face.

²⁸⁵ Lieve Verschuier, "The Great Comet of 1680 over Rotterdam," Collection Museum Rotterdam, inv. no. 11028.

Storer suffered not only on account of the cold, his consumption, and the pain of his “inward bruse,” but also from a chronic lack of suitable instruments. He wrote to Newton that he was making use of a “pocket pece,” apparently of his own making, to perform his observations. He apologized to Newton, saying,

as for the instrument by wch I Observed, it was but a pocket pece
& therefore cannot be so Exact as those of far Larger Sizes
therefore mine may sometimes faile about one degree in the
Right Ascension & $\frac{1}{2}$ a deg in the Declination wch is in some places
is but one forth part of a days Motion.²⁸⁶

The Boston printer and almanac maker John Foster, in his 1681 almanac, noted that, “by the help of a good Telescope,” the comet, which had disappeared to the naked-eye observer “may be for some time yet discerned” after that date. Yet evidently he could find no telescope at hand to use. Nevertheless, he was able to make careful observations of the comet for much of its time in the sky.

It was not just the quality of the instruments themselves but the particularities of the colonial climate that troubled Arthur Storer. In 1683, he wrote to Newton that he was working with a quadrant of only 12 inches, also of his own making. However, he found that it was unsuitable because it was made “of wood which is heare more apt to warpe & shrink then in England.”²⁸⁷ The hot, humid summers of Maryland affected the quality of his observations even when they were taken at midwinter, and presented

²⁸⁶ Storer to Humphrey Babington (18 April 1681), MS Add. 3978/5 (Cambridge University Library, Cambridge, UK), 1r. For a detailed mathematical and astronomical analysis of this letter, see Broughton, 86.

²⁸⁷ Storer to Newton (26 April 1683), MS Add. 3978/6 (Cambridge University Library, Cambridge, UK), 1r. See also Broughton, 92.

challenges to the colonial astronomer that his counterparts in the metropole did not have to face.

Storer did not record having help to make his observations, or to craft his instruments, but the difficulty of the weather and the extent of his own sickness suggest that he enlisted the help of his sister or another family member to carry equipment, hold the candle, or take notes as he called out measurements. This leads us to consider another aspect of observation that will not feature prominently in the discussions of comet tracts in later chapters: the presence of “invisible technicians,” including domestic servants, family members, and slaves.²⁸⁸ Those whose work required careful, detailed observations almost certainly relied on others to assist in gathering data. Even those preachers whose work did not rely on painstaking observations, however, relied on servants or amanuenses to assist them in making astrological calculations, or, when none were made, in bringing their sermons to press.

The assistance given by these unseen participants, many of them women or possibly slaves, must be kept in mind as we examine the manuscripts and final printed texts that discuss the comet. Unlike, say, the slides of a microscope, a comet was a democratic phenomenon, accessible to anyone with good eyes and clear skies. Despite the large number of pamphlets and essays that made it into print, the surviving record shows only a tiny fraction of the perspectives likely circulating in the late-seventeenth-

²⁸⁸ Stephen Shapin and Simon Schaffer address the problem of invisible technicians in *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton University Press, 1985).

century Atlantic, and even many of those represented in the printed record left no trace *except* their writings on the comet.

4.4 Almanacs in New England

The first New England almanac was printed in Cambridge, Massachusetts Bay Colony, in 1639, and from that time onward a “Cambridge dynasty” of Harvard College students, alumni, and masters controlled the production of almanacs in the English-speaking New World. John Foster’s 1681 almanac, printed—unusually—in Boston rather than Cambridge, included an unpaginated treatise called “Of Comets, Their Motion, Distance, & Magnitude.”²⁸⁹ In this small treatise, he presented a range of conclusions relating to comets in general and to the path of the comet of 1680 in particular. As to the possible effects of the comet, however, Foster said little. Perhaps he felt that he lacked the authority to speak on such matters, because he chose not to close with an admonishment, but with an advertisement:

But of these things we have lately heard in Publick, by a Reverend Divine among us, in a Sermon occasioned by this Ominous Appearance, shewing that prodigious Sights and Signs in heaven are many times Presages of great Calamities coming upon the World; which at the desire of many is forthwith to be made publick, to which we may refer our selves for the knowledge of what concerns us being under such heavenly Warnings.²⁹⁰

²⁸⁹ John Foster, *An Almanack of Coelestial Motions for the Year of Christian Epocha, 1681. : Calculated for the Meridian of Boston in New-England, Where the Artick Pole Is Elevated 42 Degrees & 30 Minutes*. (Boston: Printed by J.F. [i.e. John Foster] for Samuel Phillips, in the west end of the Exchange, 1681).

²⁹⁰ Foster, unpaginated “Treatise on Comets” in *Almanack* (1681).

Foster, a good friend of Increase Mather, was not merely doing his friend a favor by advertising his upcoming pamphlet. He also publicly ceded his authority, as an almanac-maker and someone trained in natural philosophy, to interpret comets. Though he acknowledged the comet's status as a "heavenly warning," he referred the reader to Mather, who at that time had little astronomical training but a great deal of respect as a "learned divine," for an interpretation of the heavenly sign.

The majority of New Englanders, like their compatriots across the Atlantic, would have encountered astrology in almanacs such as Foster's. Despite the relative newness of the colony compared to New Spain or Peru—Boston had been founded just fifty years earlier—Massachusetts hosted a number of competing presses and a regular stream of almanacs poured from the pens of the mathematically-trained graduates of Harvard College in nearby Cambridge. When the comets of 1680 and 1682 came, almanac-makers produced varying accounts of it.

The descriptions of comets found in almanacs in New England were just that—descriptions. They attempted to describe the path of the comet through the zodiac and offer insights into its physical nature. They leave the question of astrology aside. Foster's professional deference to Mather on the question of the comet's meaning was representative of Foster's personal respect for Mather. As we will see, it is difficult to speak of broad trends in New England, since almost all writers on the comets of the 1680s are acquaintances, friends, or enemies of Mather. Foster's hesitance also reflected the perception in New England that comets, as wonders and signs, could only be interpreted by those with the proper theological training.

John Foster, who identified himself as an “astrophil,” composed almanacs before he established himself as a printer. Dissatisfied with printer Samuel Green’s edition of his regular almanac in 1675, Foster set up his own press in Boston in 1675. The establishment of Foster’s Boston press brought an end to the dominance of the so-called “Cambridge dynasty” of almanac-makers.²⁹¹ The almost complete dominance of college men in the almanac trade produced a body of almanacs distinct in character from those in England—the writers catered to learned audiences as well as the barely literate and the rustic. Historian Michael Hall points out that this distinction played out in the quality of the humor present in New England almanacs: “in one rare example of New England wit it was the ignorant countrymen, not the upper classes, who were ridiculed.”²⁹²

Foster himself mainly garnered notice as a friend of the Mather family and as the engraver of the first picture of the Copernican system in New England, which appeared in his 1675 almanac and was reprinted in his almanac for 1681. He enjoyed, however, considerable acclaim as an astronomer and an astrologer in New England. Throughout the winter of 1680-81, Foster collaborated with Thomas Brattle, a newly-minted M.A. at Harvard, using the college telescope to observe the comet nightly. Both he and Brattle demonstrated familiarity not only with Copernican theories of the universe, but also

²⁹¹ SE Morison, “The Harvard School of Astronomy in the Seventeenth Century,” *The New England Quarterly* 7 (1934): 21; Marion Barber Stowell, *Early American Almanacs: The Colonial Weekday Bible* (New York: B. Franklin, 1977), 53–54.

²⁹² MG Hall, *The Last American Puritan: The Life of Increase Mather, 1639-1723* (Middletown, CT: Wesleyan University Press, 1988), 160.

with the Cartesianism popular in England at the time.²⁹³ Brattle himself earned thanks for his observations on the comet of 1680 in the *Principia*, where Newton acknowledged the contributions of an unnamed gentleman from Boston.²⁹⁴

Foster had a better command of the astronomy of comets than almost anyone else in New England—only Brattle would have bested him—but he wrote openly on the limits of his technical knowledge. His opinion of the possibility of precise prognostication echoed that of many other commentators in England, Spain, and Latin America, emphasizing the difficulty of acquiring certain knowledge of something so far from our sensory experience. “Nothing,” Foster wrote, “comes to the understanding but what hath first passed the senses, then it will follow that such things as are far removed from our senses, will also be remote from our understandings.”²⁹⁵ Foster thus encouraged skepticism regarding precise prognostications about the comet. Like Miguel Yepes, Juan Bravo de Sobremonte, and Carlos Sigüenza y Góngora, Foster emphasized the difficulty of coming to certain knowledge of the true causes of a phenomenon as distant from our senses as a comet.

It would be incorrect, however, to call Foster a pessimist with respect to knowledge of heavenly bodies in general. He demonstrated a familiarity with many of the discoveries of modern astronomy and held them in high esteem, explicitly invoking

²⁹³ John T. Kelly, “Practical Astronomy during the Seventeenth Century: Almanac-Makers in America and England” (Harvard University, 1991).

²⁹⁴ Newton, *Principia* (1687), 495. The observer was first identified as Thomas Brattle by Samuel Morison, *Harvard College in the Seventeenth Century*, (Cambridge Mass.: Harvard University Press, 1936), 220–1.

²⁹⁵ John Foster, *Almanack* (1681), unpaginated treatise, “Of Comets.”

the ways in which contemporary astronomers and astrologers benefitted from knowledge not available to the ancients:

And though it must be confessed that the age wherein we live hath made many rare discoveries of such things in the heavens whereof the Ancients were wholly ignorant . . . as may serve to subvert the old fabric of their fancies . . . but yet notwithstanding these discoveries, we are still ignorant what they are.²⁹⁶

Foster thus expressed enthusiasm for modern discoveries, but it did not allay his skepticism about the astrologer's ability to know what a comet means, given that he only had access to phenomenological aspects of the comet such as its size, shape, and color.

On the subject of *meaning*, then, Foster remained less precise than one might expect given his astrological expertise. The bulk of Foster's treatise concerned the motion of the comet, as observed from Cambridge with Brattle's help, with precise measurements of the comet's position until its disappearance on February 10. Only at the close of the treatise did he turn to its potential effects. After narrating his observations of the fading comet, he wrote,

And thus is this prodigious Spectacle removed, leaving the world in a fearful expectation of what may follow: sure it is that these things are not sent for nothing, though man cannot say particularly for what: they are by most thought to be Fore-runners of evil coming upon the World, (though some think otherwise) as was long since observed by Cicero.²⁹⁷

²⁹⁶ Foster, unpaginated treatise, "On comets."

²⁹⁷ Foster, unpaginated treatise, "On comets."

Here we see again the argument that comets could not be sent in vain. This was the same argument put forward by John Edwards in England, Luis Aldrete y Soto in Spain, and Eusebio Kino in Mexico. Compared to what we will see of the other predictions from New England, Foster seemed exceptionally circumspect in his interpretation. The comet must mean *something* in Foster's eyes, but other than this general foreboding of future evils somewhere on earth, he could not say what that meaning must be.

Two years later, when the second comet came—Increase Mather would call it “the latter sign”—another almanac-maker offered his opinion on it, which proved even more guarded than Foster's. Nathaniel Mather was one of several members of that family who took an interest in astronomy generally and in the comet in particular. In 1682, his end-of-almanac exhortation to the reader cited Schiller's *Coelum Stellatum Christianum* as a model for understanding the Christian nature of the heavens, but he said it was not necessary to go so far as to rename all the constellations with Christian symbolism, as Schiller did.²⁹⁸

At the end of his *Boston Ephemeris* for 1682, he compared the most recent comet (Halley's Comet) with that of 1680, and then proceeded to offer a description of the comet's path, including latitudes and longitudes. Yet this Mather did not go so far as to offer an astrological interpretation. He suggested that the comet arose from the Great Conjunction that occurred earlier in 1682, but, as to “whether some celebrated

²⁹⁸Julius Schiller, *Coelum Stellatum Christianum* (Augsburg: Praelo Andreae Apergeri, 1627).

conjunctions of the Superior Planets will not issue in more aethereal blazes, we must wait to Time to discover.”²⁹⁹

In private, Nathaniel expressed his disagreement with his brother’s providentialist interpretation of comets. In a letter dated between 1676 and 1687, Nathaniel Mather confessed, “for I am perswaded Comets doe no more portend than eclipses, and Eclipses no more than the constant conjunctions of the sun & moon, that is, just nothing at all . . . ”³⁰⁰ But in public, Nathaniel Mather, like John Foster, dutifully yielded to the opinion of the preeminent Increase Mather on the subject.

Nathaniel, too, ended his short discussion of the comet with an advertisement for his brother’s sermons and discourse. “In the mean time,” he wrote, “we acquaint the Reader, that there is now in the Press, A Discourse of the Nature and Events of Comets, with Two Sermons occasioned by the two late Blazing Stars: The Elaborate Composure of the Reverend Mr. Increase Mather.”³⁰¹ Nathaniel’s disagreement with his brother’s providentialist assessment of the comet showed that private sentiments differed from those expressed in preaching and pamphlets. However, the character of public discourse on the comet in New England overwhelmingly supported Increase Mather’s providentialist view.

²⁹⁹ Nathaniel Mather, *Boston Ephemeris* (1682), “Description of the late comet,” 1v. “We observed that the *Head* or *Star*, in this Celestial appearance was much bigger then [sic] in the last of that kind, and of a dim colour, that the *Coma*, or *Blaze* of it was much smaller; not ever extended above 15 degrees in length.”

³⁰⁰ Michael Hall, 383, n. 69. From *Mather Papers*, 1-68, 49.

³⁰¹ Nathaniel Mather, “Description,” 1v.

4.5 Water and Fire: The Comet in Preaching and Poetry

Increase Mather, however, was not the only New England divine to preach on the comet. Samuel Willard, pastor at Boston's Old South Church, preached a sermon on the punishment of sin on 15 February 1681, in Charlestown in Boston. The sermon, which he printed in 1682 as *The Fiery Tryal no strange thing . . . Being a Day of Humiliation*, called for a day of fasting and prayer and targeted those who neglected to heed God's warnings and who tried to "silence his messengers." Willard himself had long earned respect as a careful theologian as well as a preacher. His approach was representative of the tactic Massachusetts preachers more generally used in order to persuade their flocks to pay attention to God's signs and repent their sins.

The comet entered Samuel Willard's discourse only at the end. After the fiery climax of the sermon and its close, the reader turned the page to discover an epilogue. Willard begged the reader to

be not offended at the remaining Page, as if its service were unseasonable, and out of place, whenas it relates (as well as it can) to what the Gazetts report concerning the terrible INUNDATION that the Low-Countryes lately smarted under; and which was looked upon as one awful consequent of the late formidable Blazing Star.³⁰²

He linked the fire of the comet to the water of a massive flood in the Netherlands. This continued his theme from the sermon, which took as its text 1 Peter 4:12-13:

Beloved, think it not strange concerning the fiery trial which is to try you, as though some strange thing happened unto you: but rejoice, inasmuch as ye are partakers of Christ's sufferings; that,

³⁰² Samuel Willard, *The Fiery Trial No Strange Thing* (Boston, 1682), 20.

when his glory shall be revealed, ye may be glad also with exceeding joy.

He made the connection clear at the beginning of his epilogue, instructing the reader that “the desolating Judgements by *Water* and *Fire*, with which God hath, and intends to cleanse the World; are in Scripture brought together, and made to illustrate each other.”³⁰³ The instances in scripture in which fire and water appeared alongside one another justified, in Willard’s eyes, a link between the comet and the flood. He might have found some justification in meteorological or cometographical texts that linked comets, or the fiery exhalations that formed them, to floods.³⁰⁴

But Willard left natural philosophy aside, making room for his pastoral purpose. In lieu of a description of the blazing star like that offered by Foster or Nathaniel Mather, he filled the final page of his pamphlet with a harrowing description of the flood. “In some Churches,” he related, “the Water was above eight foot high and Corps were taken out of their Graves . . . Yea 'tis generally said; that near twenty thousand perished by this overflowing Scourge.”³⁰⁵ The comet was merely a pretext to describe the horrors that awaited man as the end times approached, and to exhort his audience to seek refuge in God.

Outside the bustle of Boston and Cambridge, Ichabod Wiswall, the minister of the church at Duxbury in the colony of Plymouth, a half-day’s ride from Boston, took

³⁰³ Willard, 20.

³⁰⁴ Eusebio Kino linked an excess of rain to the action of the comet in one of his letters to the Duchess of Aveiro in 1681. See below, ch. 5.

³⁰⁵ Willard, 20.

notice of the comet and its appearance at a time of crisis for the world. He did not publish his observations until 1683, just before the appearance of Mather's *Kometographia*. In the 1680s, Wiswall would become Increase Mather's *bête noir* in the battle for control of the Plymouth Colony; Mather referred to him several times, punning Wiswall's name as "the little weasel" or "the old weasel."³⁰⁶

Wiswall's work did not follow the conventions of a normal comet tract; its purpose was pastoral and prophetic. According to his account, the comet appeared on 18 November and lingered until 10 February. His observations were recorded in verse, along with ample discussions of the Aristotelian cosmos and the likely signification of the comet. He touched on some of the practical aspects surrounding the interpretation of the comet, but his approach could not by any means be called astrological. After discussing how clouds obscured much of the comet's path, and thus interfered with its proper interpretation, Wiswall expressed his hope that the collection and comparison of observations might allow those in Duxbury to gain a fuller understanding of what God had in store for them.

Yet those who are remov'd to th' East,
Unto the North, to th' South, and West,
May by their interwoven light,
Discover what to us is night.
And when their Observations all
Compared are, one general
System may be delineate thence,

³⁰⁶ This seems to have been a common mistake—Wiswall's name appears in the archives as "Wisewelle," "Wissell," and "Wizzle," and "Wiswall's Point," later the site of the United States Coast Survey, has been known for centuries as "Weasel Point. Henry O. Thayer, "Ministry on the Kennebec," Read before the Maine Historical Society, March 1896, *Collections & Proceedings of the Maine Historical Society* 2nd series, Vol IX (Portland: Published by the Society, 1898), 121-122.

Which will apparent make to sense
What is contriv'd and ratifi'd
Against all that have God deni'd³⁰⁷

In this hope that broad comparison of observations might yield some new insight, Wiswall acknowledged the importance of precise observations in understanding the full implications of the prodigy.

Nonetheless, Wiswall did not shy away from offering a whole litany of predictions pertaining to the comet—but his predictions were emblematic rather than astrological. He forecast trouble for sailors, for example, because the comet passed through the constellation Delphinus, the dolphin:

It touch'd the Dolphin , that's the Fish
Which swims with greatest pace: I wish
Poor Seamen might a Licence have
Themselves to keep from Neptune's Grave.³⁰⁸

No astrological integrity underpinned these predictions; rather, the symbolic resonance between dolphins and the sea was sufficient for Wiswall to warn that God's judgment would fall especially on sailors. He provided similar emblematic prognostications for each constellation on the comet's path, each one offering a poetic account of the trials waiting for a particular group of sinners. After going through each constellation, Wiswall turned to prophecy itself, with more reference to scripture than to the comet but leaving no doubt as to the connection between the comet and the prophesied effects.

³⁰⁷ Wiswall, lines 88-96.

³⁰⁸ Wiswall, 140-143.

The prophecy was, without exception, dire, and Wiswall closed the poem with a concise summary of the earthly sources of the evils that the comet heralded:

If any ask how this can be?
Let him anatomize these three:
I mean the Pope, the Turk, the Devil ,
Grand Architects of all that's evil.³⁰⁹

In these final verses, Wiswall echoed the anti-Catholicism of England and the anti-Ottoman feeling pervasive in Spain. Yet the character of Wiswall's poem, focused as it was on prophecy rather than on the nature of comets and the question of whether they portended evil, contrasted with the most important comet treatise penned by a New England churchman. In the work of Increase Mather, we see an attempt not merely to prophesy from the appearance of the comet in order to scare the sin out of a wayward flock, but rather a different kind of treatise aimed at a similar, but distinct, audience: the skeptic.

4.6 Increase Mather and the *Kometographia*

The most extensive New England commentaries on the comet came from the pen and pulpit of Increase Mather, one of the most powerful men in Cambridge or Boston. Mather began his investigations into comets when he preached *Heaven's Alarum to the World*, the sermon mentioned at the outset of this chapter. Three years after Mather's original sermon, and a few months after the appearance of the comet of 1682, Mather's worries about skeptical disdain for divine signs and prodigies remained

³⁰⁹ Wiswall, 405-408.

strong. They had become so strong, in fact, that he felt the need to publish a treatise of several hundred pages detailing the dire effects of comets throughout history, in which he also included his two sermons from 1680. Mather himself admitted to spending “the spare hours of a few Weeks” in writing his treatise, at the behest of “Worthy Persons” who wished him to “write the History of Comets.”³¹⁰

This book, the *Kometographia*, would find audiences on both sides of the Atlantic in the mid-1680s. The *Kometographia* emerged as an outgrowth of Mather’s interest, drawn explicitly from Matthew Poole’s mid-century project in Cambridge, England, to assemble prodigies together with information about the witnesses who observed them in order to make a systematic study of the works of God on earth. Mather re-started this project in New Cambridge, and in addition to the *Kometographia* produced another work, the *Rules for the Interpretation of Illustrious Providences*, addressing the providence of God in New England.

Like Sigüenza y Góngora (considered in chapter 5), Mather took pride in his book being the first effort of its kind to appear in the Americas. Unlike Sigüenza, however, who simply spoke of “the Americas,” Mather couched his approbation in terms of the English reader. “I may hope that my labour herein, will not be altogether unacceptable to the English Reader, since there never was yet (so far as I understand) an attempt of this kind, by an English hand.”³¹¹

³¹⁰ IMK, Author’s preface, 6.

³¹¹ IMK, Author’s preface, 7.

Bringing such a book to print in the Americas was not without its challenges. Mather, like Arthur Storer in distant Maryland, acknowledged the difficulties of acquiring suitable materials. He complained that, although “Rockenbachius is many times cited, I could not obtain the perusal of his Book (it not being in this American Wilderness) only I take his Observations upon trust from Hevelius.”³¹² Mather cited Lubienietzki, as well as the *Philosophical Transactions* for 1668. He admitted that he could read only the reviews for some of his sources in the *Philosophical Transactions*, without having the text at hand. John Sherman, who wrote the preface to the work, emphasized the difficulty of extending knowledge into the “American Desarts” and praised Mather’s intentions:

to promote this, the best and most blessed end and use, of such tremendous and threatning Aspects of the highest and most Dreadful Majesty, is the pious design of the Reverend and Learned Author, in compiling & publishing this Treatise, & it’s a thousand pities it should not be attended to and attained by a People so circumstanced as we, English transplanted into, or procreated in these American Desarts, be.³¹³

On the first page of his preface to the *Kometographia*, Sherman echoed Arthur Storer by lamenting his inability to get books which he “very much wished for a sight of” because he “could not at this distance from Europe, suddenly obtain them.”³¹⁴

What he lacked in books, Mather made up for in observation, working with Brattle night after night while each comet was in the sky and dedicating himself to the

³¹² IMK, Author’s preface, 7.

³¹³ IMK, John Sherman’s preface.

³¹⁴ IMK, Author’s preface, 6.

study of the relevant mathematics. However, this observational skill did not make it into his treatise. Even the specific details of the comet's path, color, and shape did not come into play in Mather's analysis. He addressed such information but did not attempt to use it to perform a Plinian or astrological interpretation of any kind. Rather, very briefly, in the historical sections of the book, Mather attempted to connect the comet of 1680 to a *particular* historical comet, which occurred in the relatively unremarkable year of 729. Yet the only detail of relevance Mather drew upon is the fact that the comet was seen first in the morning, and then in the evening—a property demonstrated by many comets, due in modern terms to their rounding of the sun. “The learned and judicious Hospinian . . . writes that Anno 729 there was a comet seen first in the East, in the Morning, and after in the West in the Evening (just as with our present Blazing Star).”³¹⁵ Mather's emphasis on this point is puzzling. However, he couched this observation in strictly providential terms, asserting that the New Englanders “have cause to fear that this Comet so appearing doth presage and portend great Calamities both to the East and the West, i.e., to the World in General.”³¹⁶ Such calamities, he believed, would not spare the people of New England despite the righteousness of their religious cause.

In his preface, Sherman made it clear that Mather wanted to exclude any favorable interpretation of the comet. “If it be said,” Sherman wrote, “that some of those Periwigged Heralds have appeared on the aethereal stage upon a more benign

³¹⁵ IMK, 158.

³¹⁶ IMK, 158.

account: it may be rationally replied, that the number of such is very small.”³¹⁷ Mather himself made this even more explicit in his own preface. He was aware that, given the surfeit of comets in recent years, there were “some who would have the World believe, there is no cause of dread when such Ensigns amidst the Heavenly Host, are held up in the sight of all the Earth.”³¹⁸ These, he believed, were mistaken, and mistaken in a way that imperiled their own souls and the public function of a Christian community.

Mather opposed not only those, such as Gassendi, who argued that comets could be neither signs nor causes of effects on earth, but also those who believed that the comet might have a benign influence. “As for their notion,” Mather began,

who think that Comets are signs that the light of the Gospel shall be further dispersed in the world, or that they portend mercy to the Church, and Judgement to others only; it is to be wished that there were a solid foundation for such a concept: But alas! Divisions amongst the Lord’s professing People themselves, and great Persecutions have oftentimes been the fatal consequents of such portentous signs.³¹⁹

To be subject to the comet’s woes, Mather believed, is part and parcel of the condition of a Christian in the postlapsarian world. Thus, they could not under any account be understood as benign. “If publick calamities come upon the world,” he said in 1680,

it is not to be expected but that the Lord’s People, whilst they are mixed amongst others (and too much partaking with them in their sins) living in an evil world, will have their share therein. It hath

³¹⁷ IMK, Sherman’s preface, 4.

³¹⁸ IMK, Mather’s preface, 7.

³¹⁹ IMK, 157.

ever been so, and is ever like to be so, until the sign of the Son of Man appear.³²⁰

Mather believed comets must signify evil because the world itself was evil, and because the natural world was merely God's instrument for turning men toward salvation. He believed that this proposition could be proven empirically, by looking at the history of comets since creation.

Mather accepted that some historical comets failed to bring on noticeable disasters, and he had to fall back on the argument that the exception proved the rule. He addressed the theory that comets might not augur ill effects in the printed preface to his January sermon. "Some," he wrote,

object that after the blazing star, anno 1097, a very fertile prosperous year followed, but they forget that the next year a direful Plague raged in the World. Others object that Wickliffs and Luthers Reformations had Comets to procede [sic] them. But (to say nothing of the Warrs and fatal changes which in those days hapned [sic] in diverse parts of the World) two or three exceptions do not invalidate the truth of a general Assertion. If such signs are commonly Presages of sore Calamityes, that's enough to awaken men out of their Lethargyes, though now and then, once in an hundred times it should happen to be other ways, which yet remains to be demonstrated.³²¹

Mather's addition of "which yet remains to be demonstrated" foreshadowed attempts by skeptics of the malefactive view to do just that. In this way, he became vulnerable to those who would seek to prove that the exception was, in fact, no exception. This would be the strategy of the most successful cometary skeptics after 1680, most notably Carlos

³²⁰ IMK, 157.

³²¹ IMK, 156. I have altered the punctuation slightly to aid in reading.

Sigüenza y Góngora. But Mather, by placing the history of all the comets from the beginning of the world together in one text, sought to provide a bulwark against this kind of historical skepticism.

History provided the foundation for Mather's proof. The testimony of the ancient writers held a special weight in his discourse, and especially in his argument that comets must be heralds of bad tidings. "Such stars . . . have ever been accounted Ominous Presages of great mutations and miseries coming upon the world. So did the wise men amongst the Gentile of old their Orators, Poets, Philosophers ever esteem of them."³²² He quoted Cicero, Virgil, and Claudian, among many others.

The more modern history of comets also played a role in Mather's treatise. Like authors in England, and, as we will see, in Spain, Mather placed special emphasis on the comet's distinctiveness from previous seventeenth-century comets. The appearance of 1680 "was a terrible sight indeed, especially about the middle of December last, the stream of such a stupendous magnitude, as that few men now living ever beheld the like."³²³ But the recent spate of spectacular comets did play a role in Mather's attempt to cast this comet in an apocalyptic light:

I see little reason to conclude, that it is an Omen of happy days to the world until God hath made way for mercy by great Judgements. Especially considering, that we are fallen into the dregs of time, wherein the days must and shall be perilous. It was long since conjectured . . . that in the Ages more immediately

³²² IMK, 156.

³²³ IMK, 157.

preceding the day of Judgement, Comets and other fearful sights should be more frequent than formerly.³²⁴

He drew out the implications of this passage: the century, with so many sights in heaven, might be drawing closer to the appearance of the first apocalyptic heralds.³²⁵

Mather was a partisan of global interpretations of the comet, rather than simply local ones. He could, and did, point to plenty of sins among the citizens of Boston and the students and faculty of the young Harvard that might deserve divine retribution. But a comet, he thought, was a portent of far more momentous changes in the world. Though a comet might occur—he did admit that comets were of natural causes, and he was in general well informed of natural-philosophical theories—without ill effects, he believed that spectacular comets like that in 1680 act as markers in biblical, Christian history.

In the *Kometographia*, Mather aimed to collect the histories all the known comets from the creation of the earth and prove, inductively, that they augured terrible trials for mankind. By connecting comets with the disasters they presaged, Mather hoped to demonstrate that God did indeed remain active in the world.³²⁶ He aimed “to evidence and evince that Comets

³²⁴ IMK, 158.

³²⁵ IMK, 158.

³²⁶ He was not the first to attempt such a project. After the comet of 1664, Polish astronomer Jan Lubienietski (or Lubienecsky) wrote a *Cometographia*, from which Mather took his title, though Mather was unable to obtain a copy. If he had, his book might have been very different, since, as Carlos Sigüenza y Góngora’s use of that text showed, Lubienietski criticized the historical validity of many of the stories Mather took as proof of his thesis.

are ordinarily the forerunners of disastrous Calamities, Mischiefs, & Miseries, hastning to follow and fall down on the heads of senseless & secure Sinners. For the clearing up and making out of which, by way of induction, a great multitude of particular Instances and Examples are out of sundry Authors of approved ability and faithfulness alledged; who have left upon Record their accurate observations of time, place, and other circumstances of several Comets in divers ages, with the dreadful Revolutions, dismal Commotions, and Confusions which followed them at the heels.³²⁷

His project, however, brought repetitive, and comparatively minor, local disasters into tension with his broader thesis, namely that the comet of 1680 was the biblical Wormwood, the star that would fall from heaven and poison the waters of the world, and that the end times had come at last. Mather's predicament—how empirically to argue that this comet signaled the apocalypse by showing how previous comets had presaged comparatively trivial events—was familiar to many of those who interpreted the “great comets” of 1680 and 1682.

4.7 Collecting Prodigies

The *Kometographia* represented just one part of a larger project that occupied much of Mather's time before 1684, a project that emerged directly out of the prodigious excesses of the English Civil Wars in the 1650s. In the 1650s and 1660s, Matthew Poole (1624-79) undertook an effort to collect and catalogue recent prodigies that had occurred in England. His efforts came to the attention of Samuel Hartlib, one of the great “intelligencers” of mid-century Europe, and a central figure in Puritan

³²⁷ IMK, Sherman's preface, 4.

intellectual networks before and after the Restoration. It was through Hartlib that Mather learned about Poole, since some of Poole's manuscripts ended up in a collection of Hartlib's papers, or copies thereof, that Mather obtained after Hartlib's death.

Poole's project foundered for lack of time and money to pay a scribe or couriers. In William Burns' estimation, "the Restoration meant that many of the clergy Poole tried to recruit to his plan were deprived of their churches or were preoccupied with more urgent concerns of survival."³²⁸ But Poole's dream of an inductive record of God's providence experienced a significant afterlife. The Anglican divine William Turner claimed Poole's project as an inspiration for his own 1697 work, the *Compleat History of the Most Remarkable Providences*, and Increase Mather was explicit in crediting the Poole manuscripts for inspiring his own work.

Mather's desire to undertake an inductive examination of prodigies resulted in two works: the *Kometographia* and the *Essay for the Recording of Illustrious Providences*. The latter, printed in 1684, expanded the project of the *Kometographia* to include other "Illustrious Providences." His definition of this category was expansive:

Such divine judgements, tempests, floods, earth-quakes, thunders as are unusual, strange apparitions, or what ever else shall happen that is Prodigious, Witchcrafts, Diabolical Possessions, Remarkable Judgements upon noted Sinners: eminent Deliverances, and Answers of Prayer, are to be reckoned among Illustrious Providences.³²⁹

³²⁸ Burns, 19.

³²⁹ Increase Mather, *Essay for the Recording of Illustrious Providences* (Boston, 1684), 13.

The work began with an autobiographical preface telling how Mather came to acquire the manuscripts from Hartlib, and about his admiration for Dr. Poole. He then went on to enumerate some rules he had used in order to collect and judge these providences. Among these were the guidelines for choosing a kind of prodigy-hunter, who was tasked with tracking down stories of remarkable occurrences in New England, interviewing the witnesses, assessing their character, and evaluating the legitimacy of the stories. Naturally Mather himself found himself appointed to this position; yet he believed it fitting for all ministers to inquire into the stories of remarkable occurrences in their towns, since they had particular “advantages” in this task.³³⁰ This arose partially because understanding the identity and the character of the witnesses was of primary importance for Mather. He hung the stories he presented on the witnesses’ testimony, writing, “as to the substance of each passage, I am well assured it is according to Truth.”³³¹

Mather, then, saw his investigation into comets as part of a wider project to provide the philosophical foundations for a robust belief in prodigies and for their sensible and careful use in a Puritan society under siege. He quite consciously adapted Poole’s dream of a Baconian natural history of prodigies, and deliberately invoked the language of the New Science, with its focus on the importance of eyewitnesses, the character of such witnesses, and explicit rules guiding the collection and evaluation of information. Mather saw his project as a bulwark against ignorant superstition on the

³³⁰ Increase Mather, *Essay*, 13.

³³¹ Increase Mather, *Essay*, 14.

one hand and atheism on the other, since, he believed, it was largely from the abuse of ignorant superstition that atheists were able to draw their criticism of prodigies. A true science of prodigies based on the principles of empiricism and careful historical criticism would reveal, he hoped, the true extent of God's action in the world. Such a science would both require expert scriptural interpretation and assist in that interpretation. Most importantly, however, it would provide a genuine way for Puritan leaders to assess God's relationship with their community, and offer guidance for the reform of a godly society that waited anxiously for the end of days.

4.8 Cotton Mather and the Later History of Prodigies

In 1717, Cotton Mather, Increase Mather's son, wrote a short treatise on the appearance of the aurora borealis above New England.³³² He reflected that,

it is remarkable to see, how much we are left in the Dark, and how much our Philosophy is at a loss, about the Lights, that are ever now and then enkindled in the Heavens that are so near unto us. We may talk some fine Things, about the Sulphur and the Nitre, and the *Je ne scay quoy*, in the composition of them, and make ourselves be admired for our Learned Jargon, among them that have not learned the Language.³³³

³³² Cotton Mather, *The Christian Philosopher: A Collection of the Best Discoveries in Nature, with Religious Improvements*, 2006. On the scientific aspects of Cotton Mather's thought, see Solberg's article, "Science and Religion in Early America: Cotton Mather's 'Christian Philosopher'," *Church History* 56 (1987): 73-92. Sara Schechner Genuth discusses the opinions of Cotton in addition to Increase on comets in her article, "From Heaven's Alarm to Public Appeal: Comets and the Rise of Astronomy at Harvard," in *Science at Harvard University: Historical Perspectives* (Lehigh University Press, 1992), ed. Clark A. Elliott and Margaret W. Rossiter, 28-54.

³³³ Cotton Mather, *A Voice from Heaven: An Account of a Late Uncommon Appearance in the Heavens* (Boston: Printed for Samuel Kneeland, at his shop in King-Street, 1719), 5.

Clearly, Cotton Mather saw how much of nature remained unexplained, and felt a bit cynical about the dubious use of “learned jargon.” Yet by this point in the eighteenth century, Cotton felt far more assured of his knowledge of the universe than his father had when writing about the comet over thirty years before. He was deeply familiar with modern astronomy and mechanistic theories of matter, and disparaged those who would substitute supernatural causes for material ones.³³⁴

Cotton Mather’s subtle and judicious beliefs regarding the supernatural in the world are revealed in his brief account of the notion that the planets and stars are moved by particular angels, rather than any kind of natural force. He attributed this belief to Islam and to “fanatics,” and believed it unseemly for a learned New Englander. “Tis true, there can be nothing so ridiculous, as the Mahometan Philosophy, which . . . makes those Meteors which we call Falling Stars, to be the Firebrands with which the Good Angels chase away the Bad, when they come too near the Heavens, to Eves-drop the Secrets there.”³³⁵

Nevertheless, he was careful not to throw the theological baby out with the superstitious bathwater. The apparent ridiculousness, in his eyes, of the theory of angelic intelligences governing the planets should not convince the pious Christian to abandon the belief in angels at all.³³⁶ Not only did angels and demons exist, but they were active in New England, as the testimonies such as those of Increase Mather’s

³³⁵ Cotton Mather, 7.

³³⁵ Cotton Mather, 7.

³³⁶ Cotton Mather, 7.

prodigy stories proved. It was not even out of the question for Cotton to believe in a connection between angels and certain atmospheric and celestial phenomena. Indeed, Cotton reminded his readers, “our Sacred Scripture [does] sufficiently assure us, that the angels both Good and Bad, are sometimes particularly concerned about the Meteors in this Atmosphere.”³³⁷

In this, Cotton’s opinion did not seem so distant from his father’s. He even deliberately echoed the title of one of his father’s most famous works—*Wonders of the Invisible World* (1693)—in his assessment of the association between angelic spirits and earthly phenomena. For Cotton it was apparent that “the Heavens do Rule, and the Invisible World, has an astonishing share in the Government of Ours.”³³⁸ Like his father, also, Cotton assented to these views on the grounds of reason and empirical investigation rather than simple fideism, speculating that “the further our Improvements in Philosophy are carried on, the less will it be found Unreasonable.”³³⁹

Thus, the younger Mather sought to trace a middle way with regard to the existence and the discernment of prodigies in the phenomena of the earth and the heavens. On the one hand, it went too far to dismiss the presence of angels and demons in the world or to exclude their action from the sphere of legitimate natural philosophy. On the other, such invocations of the “invisible world” must follow from good

³³⁷ Cotton Mather, 7.

³³⁸ Cotton Mather, 7.

³³⁹ Cotton Mather, 7.

philosophy and good theology and not from “ridiculous” vulgar superstition, “Mohametan” or otherwise.

Cotton Mather traced out this middle way more explicitly in his discussion of atmospheric prodigies such as the aurora. He placed such prodigies within the sphere of the natural-but-uncommon, the prodigious. As prodigies, they had a role to play in instructing Christians as to the progress of the end times, and could be recognized from scripture. “The Uncommon Occurrences in the Heavenly Places of our Atmosphere, have doubtless their Natural Causes,” he wrote, yet “this we do know, that there shall be fearful Sights, and Great Signs from Heaven . . . among the Forerunners of a Day that all Sober Men do look for.”³⁴⁰ Prodigies, in Mather’s mind, were real, meaningful, and identifiable.

Yet admitting prodigies into the realm of natural philosophy brought with it the danger of inappropriately giving intellectual credence to baseless superstition, or inducing unnecessary fear among the vulgar. “Indeed,” he attested, “it is a Weakness, to be too Apprehensive of Prodigies, in all Uncommon Occurrences. Yea, some things may be thought Prodigies, which may really be Kindnesses to the World; among which things we may particularly reckon Exploded Meteors.”³⁴¹ Not only might such prodigies be counted as blessings rather than bad omens, but anything uncommon ran the risk of inciting fear among the credulous. One could “be sure, People are never more fanciful

³⁴⁰ Cotton Mather, 8.

³⁴¹ Cotton Mather, 8.

and whimsical, their Imaginations are never more fertile, than when they have Uncommon Occurrences in the Clouds to work upon.”³⁴²

Such fear did not belong in a Christian community. At the same time, Cotton Mather emphasized the need to investigate prodigies and search for their meaning. Though “it becomes not Serious Christians to be Dismayed at the Signs of Heaven, as the Heathen are dismayed at them . . . nevertheless, a total contempt of all Prodigies is an Extreme on the other hand, which is to be avoided by them that would walk wisely.”³⁴³ Unwarranted or extreme fear of prodigies, or fear of their physical effects alone without due consideration of their moral sense and their divine meaning, led the Christian into a kind of heathenism or idolatry. The solution, however, was not to ignore them, but to “walk wisely” under the safe guidance of prudence, experience, and scripture.

4.9 Conclusion

Cotton, like his father, reached back into the middle of the seventeenth century in England, the great age of prodigy debates, in order to complete his own examination of the subject. He recounted a story that sheds light on this chapter’s investigation into Increase Mather’s work on prodigies in the 1680s. In his book on the aurora, Cotton wrote of his father’s visit to John Spencer, who was still living in Cambridge in 1689 when Increase made a voyage across the Atlantic. We examined Spencer’s work against prodigies in Chapter Two, on England. Cotton’s story suggests that Spencer had

³⁴² Cotton Mather, 8.

³⁴³ Cotton Mather, 9.

apparently softened his fiercely anti-providential view of unusual occurrences late in his life, and is worth recounting in full:

The Learned and Famous Dr. John Spencer, Entertained the World, with a Treatise full of Erudition, or a Design to sink the Opinion of Prodigies. But the Venerable Dr. Increase Mather, visiting of him, on 27d. IVm 1689 at Bennet-College in Cambridge, took the Opportunity to Enquire of him, whether he still continued of the same Opinion concerning Prodigies? To which he made a modest Answer: 'That he was a very Young Man, when he wrote his Book on that Subject; and had not since much considered it; But that he believed the Daemons had prenotions of many things, and might give strange premonitions of them in the way of Prodigies. And that he did not know, whether he might not err in something of an Extreme, on one side, as others did on the other.'³⁴⁴

Clearly, Spencer's softening of his skeptical position flies in the face of straightforward narratives about the abandonment of belief in prodigies as the century drew to a close. Of course Increase Mather might not have told the truth about Spencer, but the fact that Cotton could look back approvingly, from the eighteenth century, on a skeptic moderating his position for religious reasons, indicates the complexity of beliefs about natural and supernatural that gets lost in broad narratives about the disenchantment of the world.

Cotton, for his part, explicitly invoked the case of comets to discuss the substitution of natural causes for supernatural ones, explaining how Halley had fulfilled Seneca's ancient prediction that, one day, humans would find a way to predict the

³⁴⁴ Cotton Mather, 9.

appearance of comets and so rob them of their power to provoke fear.³⁴⁵ Yet Cotton Mather finally argued that fear of comets and other prodigies in the sky were a distraction from the real dangers, the strife and sin in the Christian community:

But were so many Comets all seen Blazing at once, I must freely say, That tho'such Worlds in a state of Punishment, would be a very awful Spectacle, yet I should not be apprehensive of such horrid Presages in them, unto a Baptized Nation, as I should, if I saw, in such a nation, a Kingdom Divided; or an Epidemical corruption of Manners in Instances, hardly known among Infidels; or the Institutions of our SAVIOUR prostituted unto very unrighteous purposes; or Impious attempts to degrade the Infinite & Eternal Son of God, into the Class of Creatures, & render Him in all things Different from, & Inferiour to His Glorious Father; and the highest Professors of the Christian Religion fall into such a Laodecean Temper, as to be shy of appearing to assert the most Vital point in the Faith of Christianity.³⁴⁶

Thus, even within a generation of the debate over the comet of 1680, writers and observers of later celestial marvels had already begun to distance themselves from astrology, prodigies, astronomy, and “superstition,” by emphasizing that practical matters, not strange things in the sky, should occupy a Christian’s attention. The champions of what would be called superstition were eager to use the practices of new inductive natural history, in their own way, to read the history of the future of man. The history of prodigies and divine signs shows how New Englanders sought to use the emerging methods of the Royal Society in order to provide empirical evidence for the

³⁴⁵ Cotton Mather, 9-10.

³⁴⁶ Cotton Mather, 11.

providential activity of God on earth, and empirically verifiable guidance for conducting a godly society into an uncertain, but biblically assured, future.

CHAPTER 5:

PATRONAGE, AUTHORITY, EXPERIENCE: THE COMET OVER SPANISH AMERICA

5.1 Introduction

In Mexico, on 15 November 1680, according to the *Diario de sucesos notables*, “a comet was seen in the east.”³⁴⁷ The timing was fortuitous: the new viceroy, the Marquis of Lagunas, had recently disembarked in Veracruz and begun his journey to the New Spanish capital with his wife to take up his viceregal duties.

If the Viceroy had done his reading, he would have been well aware of the prominent place of comets in Mexico’s history. Among the most iconic images in the sixteenth-century Codex Durán, a manuscript history of the Indies written in consultation with indigenous people by a Nahuatl-speaking friar, is one depicting the emperor Moctezuma standing on a roof, looking out over the Valley of Mexico toward the mountains beyond, his eyes fixed on the sky.³⁴⁸ A huge comet with a curling, cloud-like tail and a head shaped like a stylized star arched above the emperor, who had an arm cast out in a gesture of confusion, or horror, or lament. The text explained that a

³⁴⁷ Francisco García Figueroa, *Documentos para la historia de Méjico*. (Méjico: Impr. de J.R. Navarro, 1853), 1st ser., vol 2, Antonio Robles, *Diario de sucesos notables*, 15 November, 1680.

³⁴⁸ Diego Durán, *The History of the Indies of New Spain* (Norman: University of Oklahoma Press, 1994).

farm boy had spotted the comet and come to Moctezuma—meanwhile, the court “astrologers” had failed to see or to explain the omen. Lacking faith in his astrological advisors, the emperor sought the help of his ally in Texcoco, who advised him that the omen would bring great sadness upon both their houses. Knowing this comet foretold his doom, he executed his astrologers and offered sacrifices to the Gods. But less than ten years later, Cortés arrived and he was executed.

The viceroy would have never seen this image, but accounts of the comet and the emperor’s confrontation with his astrologers circulated in the chronicles of the Indies that were so popular in Spain, and he may have encountered the story there. Most likely, he would have seen that comet—as so many of his fellow Spaniards did—as a sign that God favored the Spanish conquest and conversion of Mexico to the true faith.³⁴⁹ But in 1680, as the comet grew in brightness over the next few weeks, becoming visible to the naked eye by the time the new viceroy entered Mexico City on 30 November, those observing it whispered of bad omens.³⁵⁰ After all, it was well known that comets foretold the deaths of great men. Within the month, news reached the capital of an indigenous revolt in the Puebla region of northern Mexico. It was a bad time to take office in the colony, and the comet overhead proved an unwelcome guest.

³⁴⁹ For example, see Juan Solórzano Pereira, *Disputationum de indiarum iure, sive de iusta indiarum occidentalium gubernatione: tomus alter quinque libris distinctus, in quibus omnia, quæ ad servitia personalia, tributa, decimas & commendas* (Madrid: Ex typographia Francisci Martinez, 1639), II.2.

³⁵⁰ Sigüenza y Góngora complained of the vulgar at court speculating about disasters following the comet in his *Manifiesto filosófico*. See below.

At the time of the comet, Carlos Sigüenza y Góngora, professor of mathematics and astrology at the Real Universidad in Mexico City, was employed designing a ceremonial archway to celebrate the history of Mexico and the arrival of the new viceregal couple.³⁵¹ Sigüenza already enjoyed widespread fame for his learning and his cantankerous personality. When the comet appeared, Sigüenza, mindful of the awkward position in which it put his new patrons, wrote a short treatise on the subject: *The Philosophical Manifesto against Comets*. He dedicated his *Manifiesto* to the Vicereine herself, indicating that part of his motivation for writing it was to quell any speculation that the comet might be a bad sign for his new patrons. Sigüenza's tone stayed relentlessly skeptical, providing extended arguments against foundations for belief in comets such as the universal opinion of historians, the opinion of the ancients, and the testimony of the moderns.

Sigüenza's early intervention steered the debate in Latin America toward the question of whether comets could be signs at all, rather than what their specific effects might be or what limits might be placed on their interpretation. Writers addressed this question from particular positions within a web of complex professional and patronage relationships. Rhetorical, historical, mathematical, observational, and even poetical skills were brought to bear as authors sought to impress their patrons. However, we cannot reduce the content of the debate to social relationships or treat the writings themselves as mere tokens in a social exchange. Dismissing comets as meaningless required the

³⁵¹ More, *Baroque Sovereignty: Carlos de Sigüenza y Góngora and the Creole Archive of Colonial Mexico*; Ross, *The Baroque Narrative of Carlos de Sigüenza y Góngora: A New World Paradise*.

rejection of (literally) millennia of data supporting the conclusion that comets signify or cause disasters. Participants in the debate in Mexico considered the status of this body of authority and evidence more carefully and self-consciously than observers in any other region, often using their personal experience to offer criticism of it.

Latin America provides perhaps the best site for an analysis of the political as well as intellectual issues at stake in the debate over the comet of 1680. In England, an abundance of sources by unknown authors clearly showed how the comet was appropriated as a political and religious judgment. In Spain, an equal dearth of information about the authors of comet treatises and geographical decentralization allowed for a deep investigation into the epistemological questions about the limits of human reason, but provided almost no insight into their personal context. In New England, the dominance of Increase Mather revealed the preoccupations of this influential man but stifled the preservation of any conflicting opinions. In New Spain and Peru, however, we have a true debate, in which most of the authors left behind enough biographical information to at least begin to situate them in a local, professional context, and in which almost all the participants responded to one another. In other words, it provides an ideal historical context for a thorough analysis of the treatises' content and context side by side.

In this chapter, I will explore each of the contributions to the debate in turn, examining each author's relationship to authority, to evidence, and to the networks of patronage and exchange that crisscrossed Latin America. The first contribution, the treatise of Don Diego de la Rocha in Peru, was the relative outlier, since it alone did

not respond to Sigüenza's *Manifiesto*. Rocha attached his comet treatise to another book he had written about the origin of the indigenous peoples of the Americas. These twin interests gesture toward a long tradition in Latin America, and in Peru especially, of discussing astrology as a potential factor explaining the differences between the Americas and Europe, and the Americans and Europeans, which matured into a strand of "patriotic astrology" in the early seventeenth century. Rocha, despite writing in both these areas, did not uphold astrology as a key to ethnography; rather, his comet treatise addressed primarily local concerns about the comet's meaning. Though rooted in European authorities and traditional comet interpretation, Rocha critiqued these traditions in light of his privileged position within Latin American social networks. These acquaintances gave him access to many sources of information in real time, providing a basis for skepticism concerning the received ideas about the meaning of a comet.

Two contributors to the debate in New Spain have received little scholarly attention. The first, José Escobar de Salmerón y Castro, approached the comet not only as an astrologer, but also as a teacher of medicine. Escobar, more than other writers on the comet of 1680, attempted to engage with the skeptical position of the *Manifiesto* not by demonstrating mastery of a rhetorical tradition and a body of authority, but by providing plausible natural-philosophical explanations for positions these authorities upheld. However, despite his attempt to underpin these "observations" with reason, he was candid about the limitations of conjectural reasoning when it came to explaining complex phenomena such as a comet's effect on the earth. He ultimately upheld traditional malefactivism on the strength of the observations these authorities provided,

and decided it would be foolish to discard centuries of wise men's assertions about the correlation between comets and disasters simply because no cause could be determined with certainty.

Another short treatise, now lost and known only in excerpts, came from the pen of Flemish-Mexican astrologer Martín de la Torre. De la Torre responded primarily not to assertions about comets' alleged meaninglessness, but to Sigüenza's brief insult to astrology in the *Manifiesto*. De la Torre, like Luis Aldrete y Soto in Spain, argued that astrology's antiquity and Edenic origin made it legitimate, and that the epistemic limitations of prediction were instituted by God for theological reasons. Like Escobar, he acknowledged that predictions about astrology and comets were merely conjectural and the precise causes could not be known, but the aphorisms passed down from the ancients were based on long observation and ultimately founded on knowledge offered by God to Adam. This appeal to antiquity and to authority is one of two to which Sigüenza would respond in the *Libra*, which was, as a result, largely dedicated to a close examination of the historical and bibliographical evidence for astrology and for comet interpretation by extension.

The direct cause for the publication of the *Libra* was the *Exposición Astronómica* by the Jesuit Eusebio Kino, who printed it shortly after he arrived in Mexico in the summer of 1681. His letters to his patroness throughout this period survive and offer insight into the personal struggles that motivated the publication of the *Exposición*, as well as his decision to respond to Sigüenza's treatise through arguments from authority. Kino wished to demonstrate his mastery of European letters, especially works on

astronomy, but he lacked training in astrology or familiarity with the long tradition of skeptical works on comets, putting him on unsound footing when it came to challenging Sigüenza directly.

The content and context of these pamphlets help to explain the publication of the *Libra astronómica*, one of the longest treatises on the comet of 1680. In this book, Sigüenza explicitly aimed to defend himself against Kino's book, which he had seen as a violation of the rules of friendship, the conventions of learned exchange in the Republic of Letters, and an insult to Creole scholars from an arrogant European interloper. As a result, Sigüenza used his access to European books and his deep understanding of European history, natural philosophy, and rhetoric in order to show that his learning, as an American, not only matched but exceeded the Jesuit missionary's. However, he brought his knowledge of authorities to the service of skepticism, especially through a detailed historical critique of the precise chronology of comets and their supposed effects.

Each of these works contributed to a debate over the status of scientific authority, and the epistemic status of evidence, more sophisticated than in any other region discussed in this dissertation. Though ostensibly about comets, it challenged assumptions in astrology, medicine, and history as well, and allowed defenders of authority to articulate the reasons for their deference. Those reasons were varied, but they did not come down to mere stubbornness; the question at stake was the value of aphorisms and rules allegedly drawn from diligent observation in the distant past. In the case of comets, it was the increasing availability of *historical* information that allowed a

thorough critique of these “observations” and the conclusions drawn from them. But for all these authors, skeptical or not, patronage, authority, and observation formed central concerns as they sought to understand what the comet meant.

5.2 Diego de la Rocha and the Comet in Peru

In 1681, Diego de la Rocha, a member of the judicial council (*audiencia*) in Lima, wrote a letter to his natural son, a general in Cochabamba, in modern-day Bolivia. This treatise was printed for unknown reasons together with Rocha’s more famous treatise on the origin of the Indians.³⁵² Rocha’s twin interests in the comet of 1680 and in the origin of the indigenous people of Peru tapped into a long-standing discourse about strange phenomena in the new world.

Those observing the comet from America faced challenges particular to their environment. The tradition of interpreting wonders had a distinct character in Latin America, where authors had, since its discovery, sought to incorporate the oddities they saw into existing intellectual frameworks. From alligators to hurricanes to tobacco, the New World presented those who encountered it with wonders, and forced them to assign natural, preternatural, or supernatural explanations to them.

Prodigies such as the comet described in the manuscript also played a key role in defending the providential character of the Spanish conquest of the Americas. In his compendium of law in the Indies, Juan de Solórzano set aside a special section for

³⁵² Diego Rocha, *Tratado vnico, y singlar del origen de los indios occidentales de Piru, Mexico, Santa Fè, y Chile* (Lima: Impr. de M. de los Olivos por I. de Contreras, 1681).

prodigies, both in Spain and in the Indies, which marked the divinely-ordained character of the Spanish colonial project. Among these, he noted several comets that occurred before significant battles or major expansions of Spanish rule.³⁵³ Most of the scholarship about wonders in the New World has focused on the novel and the uniquely American nature of many of these wonders. Comets fit uneasily into historiographical conversations that emphasize the distinctiveness of American astrological and meteorological wonders.

In the sixteenth century, Peruvian scholar José de Acosta had attempted to provide a comprehensive account of American nature in the *Historia natural y moral de Indias*, in which he laid out his case for seeing the Americas as ruled by just and predictable laws of God. As Jorge Cañizares-Esguerra has pointed out, Acosta has mainly come to the attention of historians as an early ethnographer, a keen observer of Indian customs and beliefs. Yet these were not the questions that captivated Acosta or his early modern readers. Acosta set out to understand “why the Torrid zone of Peru instead of scorching heat enjoys temperate climate year round; why seasons of rain and drought follow exactly opposite patterns in Europe and Peru . . . and so on.”³⁵⁴ In short, while Acosta’s interest in the people of the new world—the moral history—is

³⁵³ Juan Solorzano Pereira, *Disputationum de Indiarum Iure, Sive de Iusta Indiarum Occidentalium Gubernatione : Tomus Alter Quinque Libris Distinctus, in Quibus Omnia, Quæ Ad Servitia Personalia, Tributa, Decimas & Commendas* (Matriti: Ex typographia Francisci Martinez, 1639), lib II, ch. 2.

³⁵⁴ Jorge Cañizares-Esguerra, “Iberian Science in the Renaissance: Ignored How Much Longer?,” *Perspectives on Science* 12, no. 1 (2004): 86–124, 97.

undeniable, “three out of five pages in Acosta’s *Historia* are devoted to accounting for the seemingly puzzling behavior of the cosmos in the Indies.”³⁵⁵

The study of the cosmos and the study of man were deeply intertwined, and questions about the American climate’s ability to shape bodies preoccupied the Spaniards who moved there. One of the major achievements of the recent historiography of colonial science is to show the extent to which an understanding of man, and, more specifically, of indigenous bodies, conditioned and was conditioned by ideas about American nature. Claudia Brosseder and Cañizares-Esguerra have investigated the Latin American case, while Joyce Chaplin has written extensively about the relationship between frontier natural philosophy, study of the climate, and developing ideas about Indian bodies in North America.³⁵⁶ Scholars have not traced the subsequent history of this question in the late seventeenth century, but Anthony Pagden and others have shown that it attracted a great deal of attention down to the eighteenth century.³⁵⁷ The connection between American nature and American (especially Indian and Creole) bodies was front and center in the mind of Diego de la Rocha when he composed his treatise on the comet of 1680, as he had just finished his treatise on Indian origins.

³⁵⁵ Cañizares-Esguerra, (2004), 97.

³⁵⁶ Jorge Cañizares-Esguerra, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford: Stanford University Press, 2006); Claudia Brosseder, “Astrology in Seventeenth-Century Peru,” *Studies in History and Philosophy of Biological and Biomedical Sciences* 41, no. 2 (June 2010): 146–57; Joyce Chaplin, *Subject Matter Technology, the Body, and Science on the Anglo-American Frontier, 1500-1676* (Cambridge, Mass.: Harvard University Press, 2001).

³⁵⁷ Anthony Pagden, *The Fall of Natural Man*, part III, *passim*.

One of the fundamental questions for natural philosophers discussing American nature, including Rocha, was why the indigenous were so different from Europeans. How this question was framed differed from author to author. Some, like Bartolomé de las Casas, asked how it was that the Indians were so peaceful, so healthy, so Edenic. Others asked why they were so lazy, or why they died by the thousands in their native land while the immigrant Spaniards thrived. Yet, however they framed the question, the answers they provided were nearly always founded on explanations about natural conditions in America.

For a moment in the early seventeenth century, the discussion about how nature affected the body took a particularly astrological turn. Whether authors viewed the Americas as Edenic or as corrupted, they had to address a paradox. If the torrid climate of the Americas exercised a corruptive influence, as many in Europe argued, then authors had a ready-made excuse for why the Indians required benevolent Christian rulership, but they also had to address the question of what happened to Creoles who were born and resided under these malicious skies. Would Creoles eventually turn into Indians? As more and more Spaniards moved to the New World, this became a matter of urgency; as Creoles increasingly pressed for greater access to high colonial offices in the seventeenth century, the question of their fitness to rule, which might be seriously degraded by environmental influences, offered their peninsular opponents reasons to exclude them from government.

Yet if, as many Creoles maintained, the Americas were a kind of lost Eden (or even *the* lost Eden), under beneficent stars and blanketed by mild, salubrious airs, then

the native inhabitants of such a land must be more perfect than those who had lived a thousand generations in Europe's harsh climate. Creole writers attempted to defend the healthful effects of American stars and American climates while simultaneously providing an explanation for why the Indians failed to benefit from these influences. Otherwise, they put the European mandate to rule at risk. Cañizares has argued that "the second quarter of the seventeenth century witnessed the maturation of a genre of patriotic astrology in which the heavenly influences on America were consistently cast as having soothing and beneficial effects, revealing God's providential design for Spanish America."³⁵⁸

By the 1680s, however, the problem of Indians' different bodies had become more removed from astrology as the discussion shifted toward climate. The most influential treatise on this topic, de la Rocha's *El origen de los Indios*, passed over astrological concerns quite quickly—surprising, considering that, at the time of the treatise's composition, he was involved in writing a separate letter interpreting the comet of 1680. De la Rocha addressed the question of how Indians, whom he believed to be the descendants of ancient Jews living in Spain and a few Carthaginians who made their way over by ship, came to be so different from modern Africans and Spaniards.³⁵⁹

"The second doubt," he wrote,

"Because of which the Indians cannot be descendants of primitive Spaniards. . .is that [Spaniards] are white in color and have not

³⁵⁸Cañizares-Esguerra (2006), 50.

³⁵⁹ This theory sounds far less outlandish, given the assumptions and historical data at his disposal, than this short summary makes it seem.

lost this color or degenerated into a dirty or dun-color. . .as have all Americans. To this I respond, first, that the variation in regions, climates, airs, and ways of life, caused this shift in colors, sizes, habits, and faces among these Americans, without conserving that color of the first Spaniards that came to these Indies. . .because their first ancestors had grown up under a different sky than that of Europe and Asia, different air, different sorts of earth, different water, different food. . .”³⁶⁰

The changes in skin color and body size, however, did not arise from the mere exchange of one sky for another. These changes did not begin to occur until, in order to avoid starving to death, the first proto-Indian migrants cultivated “fruits and other kinds of foods,

and this caused the variety in people and in colors according to the doctrine of Plato, in the dialogue *de Natura*, where he says, “Some men are different than others because they breathe contrary airs or drink different water, or because they do not use the same way of living. And this difference does not occur only in the face and body, but also in the inclinations of the soul.”³⁶¹

He also quoted Galen to the same effect and noted that the Spanish who have gone out into the American wilderness and eaten American foods have become “toasted” (*tostados*) like the Indians.³⁶²

³⁶⁰ Rocha, 107-108.

³⁶¹ Rocha, 107-108.

³⁶² Rocha, 107-108. “La segunda duda para que no puedan descender los indios de los primitivos españoles ni de las tribus, es que unos y otros son blancos y no había de perderse este color y degenerar en un color subfusco y pardo, de color de tierra encendida ó de membrillo cacho, como el que tienen todos los americanos. Respóndese lo primero que la variación de regiones, climas, aires y mantenimientos, ocasionó esta mudanza de colores, talles, gestos y rostros entre estos americanos, sin conservar aquel color de los primeros españoles que vinieron á estas Indias, ni de las tribus que después de muchos años entraron en ellas, porque sus primeros progenitores y ellos han gozado de diferente cielo del de Europa y Asia, diferente aire, diferente temple de tierra, diferentes aguas, diferentes manjares, que en el principia fueron de muy poca substancia, y fué mucho no muriesen de hambre hasta que fueron culti- vando frutos y otros modos de comidas, y esto causó variedad en las personas y en los colores

The skies proved to be a small factor in Rocha's analysis, compared to climate, air, and food. In his treatise on comets, he drew no explicit relation between climate and celestial influence. He may have believed that the heavens acted as primary causes for differences in climate, waters, airs, etc. Yet despite the fact that he was, at the time of writing, pondering the astrological themes in his comet treatise, he did not make this connection explicit, which suggests that he did not consider it relevant to his inquiry. Tracing the differences in climate back to the stars was hardly necessary for his purposes. We observe the same focus on climate, without reference to stars, in late-seventeenth-century New England.³⁶³

Rocha's comet treatise, rather than emphasizing the difficulties in applying astrological theories to the new world, passed over this issue all together and instead functioned to show Rocha's mastery of the European cometographical tradition. His was not a patriotic attempt to transform the comet into a sign of good fortune for the Americas, but rather a mostly standard inquiry into the nature of the comet, Plinian classification, and prognostications flowing from this classificatory tradition.

What makes Rocha's treatise especially interesting, however, is that he went beyond summaries of authoritative texts into critical evaluations of them. Rocha reused material from the genre of comet literature while also adding his own evaluations of

según doctrina de Platón, en el Diálogo de Natura, donde dice: «Unos hombres son diferentes de otros por ventilarse con aires contrarios ó por beber diferentes aguas, ó por no usar de unos mismos mantenimientos, y esta diferencia no solo se halla en el rostro y cuerpo, sino también en el ingenio del alma.» Galeno, en el lib. 2, De Temperam[entis], atribuye los colores, aún de los cabellos al diverso temperamento y aquí hemos visto hombres muy blancos venidos de España, que retirados á la sierra y comiendo mote y las demás chucherías de que usan los indios, vuelven tostados que parecen indios.”

³⁶³ Chaplin, ch. 4 and 5, *passim*.

these texts drawn from his privileged access to Latin American networks of potential informers.

Rocha was, above all, concerned with divination and thus his inquiry centered almost entirely upon the shape and color of the comet. He professed admiration for Tycho, “a notable Dane, who, being so singular in Mathematics, so rich for the making of such instruments and telescopes . . . put this in mathematical discourses in such a way that there is not yet anyone who has argued with his measurements.” Yet Rocha made little to no use of modern astronomical measurement, and it is doubtful, from the content of his letter, that he possessed the skill to make detailed astronomical observations of his own.

Not being an astrologer himself, Rocha relied upon the opinions of authorities. Like many other readers in 1680, however, he took the broad disagreement between those authorities as an argument for skepticism.³⁶⁴ Since, he said, astrologers had such a faint understanding of the effects of the fixed stars and of the planets we know so well, how much less could they understand comets, which appeared so rarely and for such a short time?³⁶⁵ Likewise, he drew upon some knowledge of the theology of future

³⁶⁴ Yepes in Spain was of this opinion, as were many critics of astrology more generally who did not focus on the comet, including Gassendi, Sigüenza, Bayle, the Italian critic of astrology Geminiano Montanari, and the English critic of astrology Henry More. Montanari, *L'astrologia convinta di falso: col mezzo di nuove esperienze e ragioni fisico-astronomiche: o' sia La caccia del frugnavolo*.

³⁶⁵ Rocha, 1r. “Probable, dicen los mas Catholicos Astrologos, es el discurrir que estos cometas amenasan mal, I dano al mundo, I a los mortales, pero que males sean los que amenasan, I a que REgiones, I Pueblos, parece es pasar mas alla, de lo que puede comprehender la capacidad humana, I si hasta oi no a podido la Astrologia alcansar con perfeccion las fuerças, I influxos, de los Astros, I Estrellas fixas, I errantes, que desde el principio del mundo las an tenido a la vista, quanto mas falencia tendran en lo indiuidual de estos cometas, que aparecen por poco tiempo.

contingents. He agreed with the opinion of many Catholic theologians and astrologers that comets augured ill for the world—however, he respected the boundaries of human knowledge, admitting that the nature of that bad fortune, where it may strike, and how bad it will be, lay beyond the human capacity for understanding.

He feigned some reluctance, but agreed to discuss to which class of comet the current one belonged in Pliny's system. Speaking according to the principles of the "greatest mathematicians," he wrote about what could be discussed "without giving [these things] more credit than philosophical reason would give them."³⁶⁶ He then offered a step-by-step guide to Plinian classification. First, astrologers must determine the color of the comet, and this told them which planet's influence the comet fell under. The present comet, he explained, fell under the influence of Venus, since it appeared very dense and bore the color of the moon. Second, the astrologer must take into account the astrological sign in which the comet originated.

This, Rocha complained, he could not do, because his informants failed to let him know the date on which the comet was first seen or the sign, "because in those parts the only astrology they have is metallurgical, and that has little to do with meteors."³⁶⁷ Rocha, writing in the form of a letter, spoke far more candidly about the practical limitations of his network of informants and the epistemological difficulties their incompetence posed for a proper interpretation of the comet. He chastised his son for

³⁶⁶ Rocha, 2v. ". . .sin darles mas credito que el que tuviere la razon filosofica."

³⁶⁷ Rocha, 3r. He was probably referring to astrological and meteorological theories useful in alchemy, which were used at the mercury and silver mines of the Bolivian Andes.

failing to learn the techniques of observation: “and neither did you tell me those things, because you aren’t versed in this either, but I’m convinced that the comet began at the beginning of December.”³⁶⁸ Rocha is one of the few authors explicitly to discuss any reliance on contemporary observations other than his own. It is clear from the content of his letters that he eagerly sought out news of the comet from people and places far distant from Lima, not for the purposes of astronomical calculation, but in order to ascertain the basic facts regarding the comet’s shape, color, and orientation. However, the letter showed that Rocha found in this additional information not a general consensus, but a plethora of opinions that reinforced his skeptical reading of his texts.

The third step in Plinian analysis called for astrologers to ascertain the principal effects of the comet and which parts of the world would feel these effects most—but this, too, proved impossible according to the data he had, since neither his authorities nor his observations provided a conclusive answer. Rocha advocated doing this by looking at the direction of the tail, according to the method put forward in the extensive sixteenth-century compendium *Speculum astrologiae* by Francesco Giuntini.³⁶⁹ He moved to Giuntini’s articulation of the method of divination by shape, saying that this comet is *Miles*, shaped like a soldier, and is of the same type that was in the sky when

³⁶⁸ Rocha, 3r. “Los dos primeros requisitos no he podido ajustar, ni de las provincias de arriba, se avisa cuándo comenzó á verse, ni en qué signo, porque por alia no hay más astrologías que las de los metales y se trata poco de meteoros, ni tú me lo avisas, porque tampoco estás versado en esto, pero bien me persuado d que comenzaría por los principios de Diciembre. . .”

³⁶⁹ Giuntini, *Speculum astrologiae*.

Xerxes entered Greece with a million soldiers. However, he noted that Gemma Frisius wrote that Xerxes' comet was shaped like a horn.³⁷⁰

Here we see Rocha, who benefitted from the large library at the university in Lima, wrestling with conflicting authorities. Despite his skepticism with regard to differences among astrologers, however, Rocha saw the conflict between Gemma and Giuntini not as a sign of incoherence or skepticism, but of distinct interpretations by two highly-trained scholars. Since, Rocha reasoned, there could be no contradiction between two "excellent authors," one must assume that the horn referred to some instrument of force. Thus a comet appearing in the shape of any kind of military paraphernalia—a lance, an arrow, or a horn—must refer to Giuntini's *Miles*. Indeed, he says, the horn is used as a symbol of great force in the Bible.

He chastised his son again, saying that if the son questioned his reasoning that the comet was the shape of *Miles*, or at the very least if he did not understand it, he would not be surprised, because his son had never spent time studying the stars, so it would be necessary to feed it to him in a very weak and watered-down way.³⁷¹ Apparently his son was neglectful of his duties in reporting the comet, because Rocha sent yet another barb in the next paragraph, saying that he could not be sure about the comet's path because the upper provinces had not reported it properly and

³⁷⁰ Rocha, 3v.

³⁷¹ Rocha, 3v-4r. "Dirásme que aún no está probado que el presente cometa sea el que llaman los latinos Miles, o por lo menos que tu no lo comprendes. No me espanto, porque como nunca te has paseado por ese ámbito de los cielos, que los griegos llaman Peripheria ó Vranoon, es menester dártelo á beber muy líquido y desleído."

Huancavelica, close to Cochabamba where his son lived, had seen it months before Lima had.³⁷²

But the real difficulty came as a result of those observations he *did* receive. His network proved extensive; he discussed the latest letters from Spain, including a judgment printed by the almanac-maker Fulgencios Vergel, professor of mathematics in Spain.³⁷³ In response to Vergel's description of the comet's color and shape, Rocha responded:

Much is necessary to set yourself against a professor of mathematics, but . . . it seems as though the same comet appeared in one form, color, and size in this America, and of another in Spain. Here it appeared as a whip, a broom, . . . as a fox's tail . . . In Cartagena, in a letter I got from Captain Alonso Ximenez de Lara from the 7th of January, he says that a month ago it appeared and that from the neck down it looked roan-colored . . . from San Lucas Don Fernando de Herra has a letter written on January 21 by the Licentiate Francisco Mexia . . . in which he says . . . the color was silvery and of the form of a branch from Palm Sunday. And so I don't know how this agrees with what the Master of Mathematics says . . . And one might confess, not being sure of its form, how can we be sure of its effects?³⁷⁴

³⁷² Rocha, 4r.

³⁷³ Vergel, *Discurso verdadero, y iuizio del admirable cometa, que se ha aparecido en este horizonte de Madrid, desde 23. de diziembre del año passado de 1680: Perseverando toda via en el mismo horizonte, hasta este presente año de 1681* [s.l., 1681].

³⁷⁴ Rocha, 8r. "Mucho es menester para oponerse a un Cathedratico de Mathematicas, per en los discursos no lo parece, sino es que un mismo Cometa apareciese de una forma, color, l tamaño, en esta America, l de otra en Europa. Aqui aparescio como azote, escoba, soldado vestido de malla de pies a cuello, como cola de Zorra, mui abierta por la extremidad, a forma de Ramales, l barras. En Cartagena por carta, que tubo el Captian Alonso Ximenez de Lara, de 7 enero, se dice, que avia un mes, que se aparescia, l que del cuello abaxo parescio como una pieza de ruano, tendida a lo largo. De San Lucar tiene carta D. Fernando de Herra, escrita en 21 de Enero de este año, por el Lic. Francisco Mexia Presbytero, en que dice que la cabeza del cometa nasce de Estrella, l corre de Poniente, a LEvante, l que el color es plateado, l la forma de una Palma de Domingo de Ramos, y asi no sé, como se ajusta lo que dice el Maestro de

Rocha's extensive network provided direct evidence that an "authority" in Spain could not be trusted even with regard to the simplest details about the visual appearance of the comet. By naming his more local correspondents directly, he could invoke their expertise as gentlemen likely to speak the truth with regard to the appearance of the comet, but even these gentlemen could not agree on the most basic matters. How then, given that the ancients were in agreement as to the importance of shape and color (though even they could not agree) for interpretation, could anyone hope to reach a useful conclusion?

He closed the treatise with a generic, though ultimately skeptical, reminder that the comet ought to be respected as a work of God and a call to live in fear of judgment. Rather than making any positive assertions as to the special meaning of the comet for the southern hemisphere or for the New World, he used an array of real-time observations from around that New World in order to show that no consensus was possible. He also used these observations to call into question authorities from the Old World, living and dead. However, as the disagreement over Xerxes' comet showed, he did not advocate abjuring all arguments for authority, and believed that competent observers could be made to agree if they had demonstrated sufficient expertise. Given this, along with his admonitions to his son, Rocha showed a keen awareness of the

Mathematica, de que era a forma de Espada ancha, l de color de Saturno, que avia de ser negro, segun dexe arriba: solo le quadra la forma de Espada, porque es Cometa guerrero, l el color fue cenicierrto, l quando iba poniendose ...[illeg.]... era de color de Luna. Fue parto de Venus, segun dixe, l los que son dados a ella, le pueden temer, por el azote, que esta prevenido contra ellos, l reparo en la variacion, que a avido en conoscer la efigie de este Cometa, que a hecho espectaculo a todo el Orbe, l confixeza, no se acierta su forma, pues que sera de sus efetos?"

necessity for competent, trustworthy observers. However, when he found them, he ultimately found that they, too, could not agree.

5.3 The Comet in New Spain

In New Spain, the appearance of the comet famously sparked a debate between the recently-arrived Austrian Jesuit, Eusebio Kino, and Carlos Sigüenza y Góngora, professor of mathematics and astrology at the Real Universidad. The debate culminated in Sigüenza's publication of the *Libra astronómica*, ten years after the comet appeared. The title, *Libra astronómica*, deliberately invoked Horatio Grassi's attack on Galileo over the comet of 1618, which shared that title. Sigüenza explicitly desired to imitate Grassi's polemical style. Rather than a natural-philosophical treatise, the *Libra* was a tirade against superstition, credulity, and European arrogance that stretched on for some 150 pages. In it, Sigüenza included some of the fiercest defenses of Creole learning in his long career, and it has been rightly celebrated as one of the most important astronomical works created in the New World.

Mexican historian Elías Trabulse compared Sigüenza's work on the comet to Pierre Bayle's *Lettre sur le comète*, published in Amsterdam after the same comet in 1680.³⁷⁵ Like Sigüenza's, Bayle's work derided the superstitious belief that comets were signs from God of imminent disasters, a belief that had circulated in Europe since

³⁷⁵ Elías Trabulse, "La obra científica de don Carlos de Sigüenza y Góngora (1667-1700)," in *Carlos de Sigüenza y Góngora: homenaje, 1700-2000*, ed. Alicia Mayer (Mexico City: Universidad Nacional Autónoma de México, Instituto de Investigaciones Históricas, 2000).

antiquity. Trabulse saw the debate between Kino and Sigüenza as a Kuhnian conflict between paradigms of pre-modernity and of true modernity.

But more recent scholarship has moved on to questions other than the relative modernity or non-modernity of Sigüenza's work. Scholars such as Anna More, Ralph Bauer, and Marcelo Aranda have placed more emphasis on the *Libra astronómica* as a celebration of Creole natural philosophy, a defense of the intellectual abilities of scholars far from the imperial metropole.³⁷⁶ Rather than casting Sigüenza as a figure of proto-Enlightenment, these works emphasize his embeddedness in a wider world of imperial politics, patronage, and *patria*, and recognize his attempt to inject a Creole voice into European natural philosophy. Aranda explores how Sigüenza established his credibility as a scientist and a mathematician in the late seventeenth century. In a fruitful departure from previous scholarship, he frames Sigüenza's scientific activity within a global, especially a Jesuit, Republic of Letters.³⁷⁷

I follow Aranda in attempting to situate Sigüenza within a larger community, and within a more complex constellation of beliefs about prodigies and comets than that conveyed by notions of modern and pre-modern. But, departing from his research into Sigüenza's correspondence networks and participation in Jesuit traditions of sociability, I

³⁷⁶ Anna More, "Cosmopolitanism and Scientific Reason in New Spain: Carlos Sigüenza y Góngora and the Dispute over the 1680 Comet," in *Science in the Spanish and Portuguese Empires, 1500-1800* (Pasadena: Stanford University Press, 2009), 115–31; More, *Baroque Sovereignty: Carlos de Sigüenza y Góngora and the Creole Archive of Colonial Mexico*; Bauer, "Los grandes cometas de 1680/1681 y la política del saber criollo en la Nueva España y la Nueva Inglaterra"; Aranda, *Instruments of Religion and Empire: Spanish Science in the Age of the Jesuits, 1628-1756* (PhD Diss.).

³⁷⁷ Aranda, "Instruments of Religion and Empire: Spanish Science in the Age of the Jesuits, 1628-1756," 141.

attempt to place Sigüenza back into the history of a genre. He used his social networks and his mastery of genre conventions in order to promote his local agenda. This chapter complements this scholarship by addressing a feature of the *Libra astronómica* that is usually left out of scholarship—the subject.

Whatever else it may be, the *Libra* is a book about a comet. It is one of hundreds of books about comets written during the seventeenth century—many of which expressed skepticism toward the belief that comets were signs from God. Many of Sigüenza’s arguments against superstition—actually, most of them—had been articulated in some form since the great anti-astrological treatises of the fifteenth and sixteenth centuries; many were taken from Seneca, Cicero, or other ancient writers. The debate over comets resembled many other Baroque debates: it was, at its heart, a conversation over the interpretation of texts within a genre.

The *Libra* and other works on the comet belong to the centuries-old genre of the comet book. Reading the *Libra* as a contribution to a genre, rather than a lone polemical book, allows for a more nuanced appreciation for the originality of Sigüenza’s rhetorical and historical work. The *history* of the genre is integral to the claims in the text. By placing Sigüenza’s *Libra* next to other works written at the same time, both in Mexico and in the other regions discussed in this dissertation, we can see more clearly how Sigüenza uses his mastery of the genre in order to subvert “superstitious” claims that comets were signs from God. First, however, I will examine two works in this genre that appeared in response to Sigüenza’s own work: the *Discurso cometológico* of José Escobar Salmerón y Castro and the *Manifiesto christiano* of Martín de la Torre.

5.4 José Escobar Salmerón y Castro

José Escobar de Salmerón y Castro's *Discurso cometológico* has been all but ignored in the scholarly literature. Escobar had, a decade before the comet appeared, challenged Sigüenza for the chair in mathematics and astrology and lost—decisively—despite possessing a degree when Sigüenza did not.³⁷⁸ Given this history, Escobar proved remarkably charitable in his own response to Sigüenza's work, but the charity was not mutual. Sigüenza mentioned his old rival's short work on the comet, but dismissed it as not worth rebuttal given his preposterous theory that the comet was composed of human sweat.³⁷⁹ This is not an entirely inaccurate characterization of Escobar's work, but it is unfair. Escobar attempted to take traditional comet lore and place it on sound medical and natural-philosophical footing. His essential task was to understand why comets occurred alongside the effects that historians had recorded, and he did that using his considerable expertise in medicine as well as observational skill.

Escobar, like Sigüenza, worked as an astrologer alongside his regular job teaching medicine. He printed a *Diario y pronóstico de temporales* for the year 1679, which he mentioned in the 1681 text, saying that on the verso of the third folio he had predicted the appearance of a comet or another celestial apparition.³⁸⁰ On Tuesday, 19 November 1680, he observed the comet himself, and continued to do so for weeks afterward,

³⁷⁸ Comparatively little is known of Escobar's life. For Escobar's complete history with Sigüenza, see José Quintana, *La astrología en la nueva España en el siglo xvii : de Enrico Martínez a Sigüenza y Góngora* (México: [publisher not identified], 1969), 51.

³⁷⁹ SGLA 289-90.

³⁸⁰ Escobar, 4r.

offering detailed descriptions of the comet's length and position within each constellation, including degree measurements. He availed himself of the best techniques of observation, which had been expounded by "many authors."³⁸¹ However, his observations did not lead him to the conclusion that the comet lay above the moon. Instead, and with few references to modern understandings of superlunary comets, he pronounced his agreement with the traditional position that the comet was sublunary and composed of terrestrial exhalations.

Escobar's project of rehabilitating traditional comet lore extended to justifying questionable interpretive practices such as divination by color. In a highly unusual move, he actually attempted to give a natural-philosophical explanation for divination by color. Here, he waxed a bit hermetic, comparing the circulation and changes in planetary exhalations to the changes in color and form of the blood in a human body.³⁸²

Escobar's treatise proceeded, like many of those printed in Spain and elsewhere, according to the four Aristotelian causes; it was his account of the material cause that distinguished him most from his fellow Latin American writers on the comet. His assignment of the material cause proved expansive: "it was in this case all that is

³⁸¹ Escobar, 4r.

³⁸² Escobar, 16v. "A lo qual se satisface para el mundo grande, lo que en el pequeño, y el hombre sucede, que de solo un humor sanguineo, y de color rubio se nutren tantas, y tan diversas partes del cuerpo, que segun el temperamento de la que le atrae, o el color que le pertenece: assi se haze, y recibe el color al llegar a la parte que le atruxo, aunque del higado salió con el color rubio, y sanguinolento, mudando el color, al color que se llega, como en el hueso, blanco y duro. . .; pues de la misma suerte sucede en el Cometa, respecto de las exalaciones de la tierra, que aunque salgan de ella de una naturaleza, qualidad, y color, llegando al termino hasta donde pudo su atraccion, segun la calidad, temperamento, y naturaleza de los Planetas, que tuvieron mas dignidades, y promissores, esto es, estuvieron mas fuertes para elevar los vapores, y materia exalable; se vistió el cometa, el color de los mas pintados en fuerzas a su produccion, y gozando de la misma naturaleza, que de sus Padres recibio. . ."

evaporable, and exhalable which there is in this inferior machine, like water, earth, all living bodies, plants, and even dead bodies entombed in the earth.”³⁸³

To make the latter proposition more plausible, he invoked the words of Hippocrates, who, in *Airs, Waters, and Places*, argued that rainwater was composed of the aqueous vapors of all things, including human sweat, drawn up by the sun. If human sweat could be the material cause of rain, why could vapors from dead bodies not be the cause of a comet? Since man was the creature most subject to corruption, being more delicate than other animals by virtue of his more delicate food, the first kinds of corrupted exhalations to be drawn up into the sky would be the “exhalations” of man.³⁸⁴

He asserted that his proposition was “experimental,” and thus not demonstrable by reason alone, but that his fellow learned doctors could verify it by the recent experience of a plague in Mexico.³⁸⁵ Escobar argued that an epidemic of tercian fevers and other “malignant accidents that gave a fair bit of worry” the past year was the result

³⁸³ Escobar, 7v. “En los que toca a la causa Material, fue en este caso todo quanto evaporable, y exalable ay en esta machine inferior, como agua, tierra, todo cuerpo viviente, plantas, y aun los mismos cuerpos muertos sepultados en la tierra. . .”

³⁸⁴ Escobar, 8v.

³⁸⁵ Escobar, 8r-8v. “Sea proposicion experimental, en esta causa, lo que han experimentado, y están experimentando mis compañeros, y doctos medicos, en esta populosa republica (y lo mismo aora [habrá] sucedido en muchas partes del mu[n]do) digo, pues, que han observado tres años hay una epidemia de granos, postulas, o ronchas, tan molestas, y tan sin falta de veneno, y malignidad, que sin ceder a medicamentos de qualidades manifiestas, no han perdonado, ni por la piedad al Viejo, ni al niño por su inocencia. Y assimismo el año passado de 80 se experimentó una epidemia de tercianas, y demás intermitentes, con otros accidentes malignos, que dieron bastante cuydado; de cuya consitucion, si me preguntaran la causa, me afirmara entonces, y ahora me afirmo a dezir, que fue la materia del cometa, que como se iba congregando, y uniendo para llegar a su incendio era necessario el que los Astros, que causaron esta atraccion de ella, fuessen exalando, y como chupando de los mismos cuerpos humanos todo aquello que era exalable, y vaporable; y como lo mas sutil está mas prompto a qualquiera atraccion, y entre los humores, el mas sutil sea la colera; esta se extravassó haziendo a vezes tercianas, y otras inflamaciones diversas, pustulas, ronchas, buboes, y otros accidentes desta prosapia, y linage.”

of the same noxious vapors that composed the comet. In his natural-philosophical view, the (terrestrial) vapors that made up the comet were attracted upward by the stars in order to ignite. This same celestial attraction “suck[ed] from human bodies everything that was exhalable and volatile.”³⁸⁶ Since the most subtle fluid would be the most subject to this attractive force, and choler was the most subtle of the humors, the comet's composition included a substantial portion of human choler. This could be observed, Escobar argued, by the choleric character of the inflammations, pustules, buboes, and fevers that had occurred recently in Mexico.

Escobar also emphasized the natural, secondary causes that explained comets' effects and articulated what these causes might be using his medical expertise. Comets caused the deaths of great men, he wrote, but for purely natural reasons.³⁸⁷ As confirmation of this he offered an example of four “rustic men, and one delicate.” In a “fatal time” when the air is poisoned and “infested by the respiration of all living

³⁸⁶ Escobar, 7v.

³⁸⁷ Escobar, 19r. “. . . Naturalmene el cometa, amenaza muertes de principes, potentados, y señores, para los qual se hallan muchas razones naturales; en cuya confirmacion pondré por exemplo quarto hombres rusticos, y uno delicado, en un tiempo fatal, en que el ayre está inficionado de prava qualidad, e infestando por la respiracion a todo viviente; los quatro rusticos en este tiempo les consideramos, com assi es, engendrados desde el vientre de sus madres de principios robustos, sanos, y fuertes. Al delicado todo les sucede a la contra por la mayor parte; aquellos usando alimentos Fuertes dificiles a la corrupcion: este debiles, y faciles de corromperse, con promptitud a obstrucciones muchas; aquellos sin cuydados agenos mas de los pocos propios; este con los de la Republica entera, y Gobierno de Reynos, pesando meritos, midiendo justicia, disimulando ofensas, castigando delictos; en ocupaciones, y cumplimientos foraneos, y de a dentro, o domesticos, que atrae siempre el puesto, pertubandose en acciones su naturaleza; y finalmente hecho de todo un cuidado; de que naturalmente se siguen molestissias vigiliass, que resuelven espiritus, consumen humores, y secan todo un cuerpo humano; lo qual se acrecienta con las tristezas, que no suelen faltar de diversas noticias calamitosas, que acontecen considerable, de cuyos accidentes estan muy lejos los demas hombres, no solo los rusticos, sino los Republicanos, y plebeyos: Luego si de los cinco hombres propuestos, el uno solo es el mas expuesto a qualquiera leve calamidad en contra de la salud, y este es un principe, un grande, un governador, un regente, un prelado, y finalmente qualquiera cabeça que gobierna?”

things," the four rustics had an advantage. From their mother's wombs they would be made according to "robust principles, healthy, and strong." The delicate man would enjoy no such benefits; in fact, his refined foods would make him weak and subject to corruption and blockages.

Furthermore, a great man's occupation itself caused what modern readers might call stress. These delicate men, tasked with the running of the republic, the governing of kingdoms, chasing after rewards, dispensing justice, dealing with domestic affairs, have their nature "perturbed" by cares. Their worries consumed their humors and dried out their bodies. The burden of their leadership distinguishes these "delicados" not only from rustics, but from townspeople and "plebeians." It could be no surprise, then, that when a comet came, heads of government seemed particularly vulnerable.

Escobar, like Rocha, had read Giuntini's sixteenth-century work on comets and astrology, and it was Giuntini's work from which he likely took his account of delicate men and humors drying up (though similar ideas were present throughout the medical literature as well). However, Escobar's lack of originality did not negate the fact that he, alone of all the commentators in New Spain, responded to the *Manifiesto's* philosophical objections of malefactivism with a philosophical explanation. The other two known commentators, Kino and Martín de la Torre, both focused their responses on appeals to authority rather than reason or to their own observation. Escobar also appealed to many authorities throughout his text, but he placed far more weight on justifying the accounts of authorities based on either reason or (recent, documented) experience.

Unlike most of his fellow commentators on the comet, Escobar cultivated an explicit interest in epistemology, and provided a lengthy argument for the necessity of experience in the matter of the comet and its effects. He conceded that he could only provide a conjectural cause in his exhalation theory, but argued that this ought to be sufficient in a subject that did not easily yield certain knowledge. He discussed the role of conjectural reasoning and experimental knowledge in astrology:

For example, take the radical signs of the cities of the world. There is no one who gave the a priori reason why they should be so, that is, which sign [should go with a particular city], and shows tables and celestial charts for when God created the world to show which sign was ascending above the horizon of that city at the moment of creation. And thus it is a posteriori, or because of what has been observed over such a long time, that we have come to know that a sign belongs to this or that city.³⁸⁸

Astrology, then, was founded on solid principles, but not the principles of *reason*, understood as deductive logic, but rather those of *experience*. Astrologers, like physicians, never claimed to be producing *scientia*, but rather a body of inductive knowledge *informed* by theory. Escobar was certainly a fierce Galenist and Aristotelian, but he upheld these views on the strength of the evidence for them. He briefly considered the opinion that celestial lights had no effect on the earth, but dismissed it by invoking his medical expertise, pointing out the “indubitable” effects that eclipses

³⁸⁸ Escobar, 17v. “Pongo por exemplo, en los signos radicales (assi les nombran todos) de las ciudades del mundo. no ay ninguno que dé la razon a priori del porque lo son, esto es, que señale, y muestre las tablas, y themas celestes al criar dios el mundo, para que conste, que signo ascendia por el horizonte de cada ciudad en aquel punto de la creacion. y assi a posteriori, o por lo que se ha observado en tantos tiempos: se a venido en conocimiento de ser signos radicales, de tal, o tal ciudad, aquellos en quienes si suceden eclipses, conjunciones magnas, o otras appariciones celestes, imprimen con estraña particularidad sus efectos...”

were observed to have on the elderly and on fever patients.³⁸⁹ However, founding a science on observation, especially ancient observation, opened astrology (and comet lore by extension) to criticism. Critiquing the *evidentiary* sources on which astrological conclusions rested occupied 80 pages of Sigüenza's 180-page treatise. Sigüenza's primary target were two treatises which concentrated on arguments from authority, one by Kino and one by Martín de la Torre.

5.5 Martín de la Torre

Not much is known about de la Torre other than that which Sigüenza himself provided. He seems to have been an astrologer of Flemish background living in the pirate-scoured port of Campeche, in the Yucatán. His home in Campeche suggests that he may have come to a knowledge of astrology through study of navigation, but this is purely conjectural. Sigüenza seems to have known of him before the exchange over the comet, indicating that he may, like Sigüenza and Escobar, have published an almanac or *lunario*, but these do not survive.

Not even his treatise on the comet survives; we would not know of it except for Sigüenza's habit of excerpting his opponent's texts (as well as his own) in the *Libra Astronómica*, where Sigüenza quoted eight paragraphs of de la Torre's *Manifiesto*

³⁸⁹ Escobar, 7v. "...está obligado a conceder la opinion, que neiga eficacia a las luzes superiors en la tierra; pues, si se le pregu[n]ta; porque es prohibido el dia de un Eclipse? Responderá, y bien, que por la contrariedad de las luzes, que sucede en los dos Luminares: de que se siguen tan sensibles efectos en los mismos cuerpos humanos, acrecentando Dolores en Galicos, ansias, e iniquitudes en los febricantes."

christiano, an obvious and direct response to the *Manifiesto filosófico*.³⁹⁰ Aside from this brief excerpt, we can gain some insight into the probable contents of the *Manifiesto christiano* from a letter that de la Torre wrote to an unknown person, which was preserved in the archives of the Universidad Autónoma de México. Sigüenza issued a separate response to the *Manifiesto christiano*, called the *Mathematical Bellerophon against the Astrological Chimera* (*Belerofonte matemático contra la quimera astrológica*) This treatise also does not survive, but Sigüenza dedicated a long section of the *Libra* to countering de la Torre's defense of astrology, and this section likely paraphrases much of the *Belerofonte*.

De la Torre, like many astrologers, believed that perfect knowledge of astrology had been granted by God to Adam in the days before the Fall. He took this story from Josephus, who had included knowledge of the stars as one of the gifts to Adam in his history of the ancient Jews.³⁹¹ Based on the excerpts Sigüenza provided, sheer antiquity seemed to be de la Torre's chief argument for the legitimacy of comet divination and of astrology. It was astrology that he sought to defend, since he made his living in that profession; we know from his surviving letter that his prognostications about the comet relied less on color and shape (though he did take these into account) and more on the constellations through which the comet passed. Thus the authority of his account of the

³⁹⁰ Excerpted SGLA S. 320-328. Sigüenza responds S. 329-380.

³⁹¹ SGLA S. 321. See also above, n. 266.

comet depended on successfully defending the principles of astrology against Sigüenza's accusations of having weak foundations.³⁹²

Like all astrologers who insisted on the Edenic origins of astrology, it fell to de la Torre to account for why astrologers in his own day failed to provide consistently good prognostications, and to consider how a supposedly God-given astrology did not trespass on religious sanctions against determinism. He conceded that it was true that the effects predicted by astrologers failed to materialize, but he put this down not to a failure in the art itself but to the plethora of celestial influences at any given moment and the complexity of the necessary calculations. True and precise knowledge of the influence of each of the fixed stars remained for him among "the arcane secrets of God," with astrologers forced to reckon using only knowledge of the influences of the planets and the houses of the zodiac.³⁹³

If humans had such perfect knowledge of the stars, de la Torre argued, astrologers would be able to prognosticate with "certain evidence" on particular types of future occurrences, such as famines, years of plenty, sicknesses, but this would be against God's will. One of the great miracles of God, he continued, was providing in astrology "a proportional mean between total ignorance and perfect intelligence . . . not

³⁹² SGLA S. 20. ". . . a los segundos [los autoridades astrolólogos] no tengo otra cosa que decirles, sino el que yo también soy astrólogo y que sé muy bien cuál es el pie de que la astrología cojea y cuáles los fundamentos debilísimos sobre que levantaron su fábrica."

³⁹³ SGLA S. 326. "Verdad es que muchas vezes no corresponden los efectos que indicant los pronosticos, pero no ay para que buscar tanta precision en lo natural pues aun no son harto conocidas las virtudes de los astros, porque segun los Arabes cada momento decienden mil influencias celestes, cuyo conocimiento se reputa entre los arcanos secretos de Dios."

denying to man sufficient comprehension for his governing, nor conceding him everything.”³⁹⁴

De la Torre’s argument, then, remained an argument from authority even as he sought selectively to undermine that authority. He did not deny, for example, that the ancients erred in certain respects, requiring the Church to justly step in and prohibit superstitions that trespassed on human free will and on knowledge of the future reserved to God.³⁹⁵ Nonetheless, he argued, in the vast majority of cases when dealing with licit astrology the axioms and methods of the ancients could be followed, as they were based on sound experience as well as on traditions stretching back to Adam.³⁹⁶ Thus the aphorisms concerning the influence of particular planets and constellations and aspects all remained legitimate, based as they were on knowledge passed from the most ancient origins of mankind.

It was to this argument from authority that Sigüenza objected most, and to which he responded at length in the *Libra*, as well as in the lost *Bellerophón*; if the Creole professor objected to de la Torre’s mathematical ability, he did not record it. De la Torre’s argument from authority earned a careful, if excessive, rebuke in the *Libra*,

³⁹⁴ SGLA S. 326. “Maravillas todas de la singular providencia de Dios pues un medio propocional entre la total ignorancia, y la perfecta inteligencia de esta ciencia Astrologica, no denegando al hombre la bastante comprehension para su gobierno, ni concediendola entera.” God also prevented perfect knowledge of the stars because he knew of man’s inclination to fall into superstition and worship celestial objects.

³⁹⁵ SGLA S. 327.

³⁹⁶ SGLA S. 327.

where it complemented Sigüenza's much longer response to the treatise of Father Eusebio Kino.

5.6 The Jesuit Missionary

In Cádiz, Spain, the point of departure for all trade with the Americas, the Jesuit Eusebio Kino was preparing to embark on a mission to the furthest reaches of the New World. He would spend the rest of his life there, preaching to the *indigenous peoples* and securing Spanish advances into the north of the continent. Before he left he was to stop over in Mexico City in the summer of 1681. During that summer, he printed a brief treatise arguing that the comet was a sign from God of trials to come. Kino, having barely set foot in the New World, chose as the frontispiece to his treatise an image that would have been familiar to Creoles who had never left it: Our Lady of Guadalupe watching over the zodiac from the constellation Virgo, with the comet passing beneath her.³⁹⁷

We know an extraordinary amount about Kino's life and thought during this brief period thanks to a series of letters he penned to the prominent supporter of the Jesuit missions, the Duchess of Aveiro in Madrid. The Duchess maintained a wide network of correspondence with Jesuits around the world, which deserves full study in its own right.³⁹⁸ Kino was far from the only Jesuit seeking her assistance, or even the only one

³⁹⁷ Kino, *Exposición Astronomica*, frontispiece.

³⁹⁸ The content of the letters, which were written in Latin, Italian, and Spanish, were translated by Burrus in the 1960s. For ease of access I will also refer to this edition. Kino, *Kino Writes to the Duchess: Letters of Eusebio Francisco Kino, S.J., to the Duchess of Aveiro : An Annotated English Translation, and the*

sending her reports of prodigies—in 1695, for example, Father François Noël sent her notice of a comet and an earthquake from Macao.³⁹⁹ Yet Kino is perhaps her best-known correspondent, thanks to his debate with Sigüenza and his fame as an early explorer of California and what is now New Mexico.

These letters, preserved at the Huntington Library, show Kino's primary purposes in writing to the Duchess were financial and personal. Throughout the letters he informed her of needs among his fellow missionaries and urged her to continue or augment her support for ailing Jesuit missions abroad. More personally, in the early correspondence, he sought her help in changing his assignment from New Spain to the Marianas, an Asian mission seen as a stepping-stone to a coveted place in China. Kino often wrote his name “Chinus” in Latin, perhaps a sideways hint that he considered that region as God's providential destination for him. Mostly, however, his passion for the Asian mission seems to have stemmed from its prestige, from the enormous ramifications that would follow if it succeeded and from his desire to pursue higher learning rather than the day-to-day survival of a frontier mission. He told the Duchess that he had pursued mathematical scholarship specifically to make him more useful to the fathers at the Chinese mission, who relied on their mathematical and astronomical knowledge in order to impress the Emperor and his court.

Text of the Non-Spanish Documents. Burrus compiled a list of known letters from and to her and a short biographical sketch, but to my knowledge no one has yet undertaken a complete analysis of her correspondence networks.

³⁹⁹Eusebio Kino, *Kino Writes to the Duchess: Letters of Eusebio Francisco Kino, S.J., to the Duchess of Aveiro : An Annotated English Translation, and the Text of the Non-Spanish Documents*, ed. John Burrus (St. Louis: Jesuit Historical Institute; St. Louis University, 1965), 51. Excerpts in *Bibliotheca Asiastica* II, p. 54, no. 1267.

Kino's vow of obedience prevented him (so he wrote) from petitioning directly for a change of assignment, but it did not bar him from zealously supporting a superior's recommendation on his behalf. Another Jesuit had recommended he be transferred to the Marianas and Kino's first letters to the Duchess asked after the fate of that letter to Rome, and requested her intercession and further recommendation. He wrote on 15 September 1680, that if the letters this Father Theófilo wrote before leaving Europe should reach Rome, asking that Kino might accompany him on his voyage to Asia, it would be one of the greatest comforts he had ever known in his life.⁴⁰⁰

The superiors, however, had another use in mind for Kino's mathematical expertise: surveying unknown lands. Brother José Gregorio, writing to the Duchess in October 1681, to inform her that Kino had been assigned to the California frontier and would be departing Mexico City that week, wrote that Kino “by reason of his knowledge of mathematics is a very capable and appropriate missionary for that country since he will be able to survey it.”⁴⁰¹ He had good reason to give up on his desire for a transfer well before that, before he even left Spain, but it is clear from his correspondence that he continued to hope for a reassignment throughout his time in Mexico as he wrote on the comet.

He first mentioned the comet in a letter to the Duchess written in Cádiz while waiting, as he had been for over a year, for his departure to the New World. On 28 December 1680, he noted its course, size, and daily motion. It is clear from his letters

⁴⁰⁰ Huntington Library MSS HM9980, Kino to the Duchess of Aveiro, 15 September, 1680.

⁴⁰¹ José Gregorio to the Duchess of Aveiro, 9 October 1681, trans. Burrus 114.

that he attempted to make some precise observations, which he would later include in the *Exposición astronómica*. As for the comet's effects, he wrote only that he would note which regions would experience disasters in an upcoming letter.⁴⁰² His letter of 8 January to a fellow Jesuit, Father Espinosa in Seville, revealed that Espinosa had inquired as to Kino's thoughts about the motion and especially the effects of the comet. This exchange suggests that Kino had earned something of a reputation for mathematical and astronomical expertise, a reputation to which he referred and clearly tried to enhance in his writing and his later action regarding the comet. Kino responded, "as to what you ask and bid me to tell you,

I say that all is subject to God; but, naturally speaking, it seems to me that so huge a comet (I do not know whether man has ever beheld another like it and so vast) portends, presages and forewarns many disasters, and, as your Reverence very correctly remarks, its effects will hardly be beneficial. This signifies many calamities for Europe and means, in particular for three or four countries, unproductiveness, famine, storms, and several earthquakes, disturbances on a vast scale, fevers, epidemics and numerous deaths, especially of eminent persons. May our lord look upon us with eyes of compassion!⁴⁰³

From what we have seen, these forecasted effects seem disappointingly vague. Kino excused this by saying, "the fact that the comet is so colossal means that its evil effects will be all the more universal and affect more people and countries."⁴⁰⁴ It would be

⁴⁰² Kino to Duchess of Aveiro, 28 December, Burrus, trans. 97.

⁴⁰³ Kino to Luis de Espinosa, S.J., 8 January 1681, trans. Burrus, 99.

⁴⁰⁴ Kino to Luis de Espinosa, S.J., 8 January 1681, trans. Burrus, 99.

impossible to locate the particular, local effects of the comet because its size indicated that these effects would not be localized, but global.

The extent of Kino's understanding of how these effects might come about is unclear. His delay in revealing his knowledge to the Duchess may indicate that he required more time for research before showing his expertise to his patron. However, Kino had evidently been studying astronomy shortly before the comet first appeared, since, still hoping for his transfer to China, he wrote that the trip to China via the Pacific would be easier than the route around Africa, but the return trip would fare better on the latter course, because "it seems to me that the reason in both instances can be that the motion of the ship and the sailing would always be more in keeping with the *primum mobile* ever revolving from East to West."⁴⁰⁵ This idea demonstrated some expertise in astronomy and physics, but showed little if any knowledge of meteorology. Additionally, his comments regarding the effects of the comet and its shape and color showed a command of observation and astronomy but not of the principles of astrology.

On 11 January he updated the Duchess as to the motion of the comet, providing the first evidence of his attempt to locate the comet in the sky in a manner more precise than locating it within a specific constellation—in other words, his first attempt to demonstrate mathematical authority. He observed the declination and right ascension of the head of the comet on 8 January, and measured its length at 57 degrees. Again he promised the Duchess more information about the comet's "daily motion, its distance

⁴⁰⁵ Kino to the Duchess of Aveiro, 6 December 1680. Trans. Burrus, 89-90.

from the earth's equator and from us, its size, its tragic and disastrous foreboding . . . of considerable evil . . . and disastrous events, of unproductivity, diseases, storms, of the death of many persons, and perchance of national upheavals” in the future.⁴⁰⁶

These repeated promises provided sufficient explanation for Kino's decision to publish the *Exposicion astronomica* once in Mexico. Kino found himself already committed to a particular traditional position when he arrived at the harbor of Veracruz; he may very well have regretted the obligation to oppose Sigüenza's pamphlet after the latter had shown him hospitality. By January 1681, however, refuting Sigüenza's *Manifiesto* had become necessary for preserving his own reputation with the Duchess and the vicereine, whom the Duchess had contacted on his behalf with a letter of recommendation. The fact that he continued to hope for a transfer to China made it all the more imperative for him to demonstrate his mathematical skill, which he saw as his chief asset in gaining an assignment to that mission. He never mentioned Sigüenza, and may not have known about the seething resentment Sigüenza bore him until much later. Even if he did, however, it seems plausible that he saw an erudite book on mathematics and astronomy as his own personal salvation from a dreary fate on the California frontier.

In his final goodbye to the Duchess before leaving port in Spain, Kino wrote that he had little more to say about the comet except that it continued to diminish in size. However, closing this paragraph, he noted that “fear of the epidemic continues to

⁴⁰⁶ Kino to the Duchess of Aveiro, 11 January 1681, trans. Burrus, 104.

abate, but it has not completely vanished.”⁴⁰⁷ Kino did not specify whether fear of the epidemic had been related to the comet—he had complained of plague much earlier, in November—but given his knowledge of the effects of comets and the close proximity of these observations, it is not implausible to suggest he saw them as related.⁴⁰⁸ Indeed, he would have been on sound medical, meteorological, and astrological footing had he done so. Given this, it is strange that he did not relate them more clearly, or give a brief account of the hot and dry exhalations of the comet and the resulting threat of sickness. This again suggests his knowledge extended only to mathematics and astronomy, but not medicine or meteorology, which put him on less than solid ground when it came to predicting the effects of the comet.

5.7 Defending Portents

Upon his arrival in Mexico City, Kino set to work on his promised account of the comet. However he found that Carlos Sigüenza y Góngora, who had shown him considerable kindness in allowing him the use of his library and his maps, had already printed the *Manifiesto* against the point Kino had promised to make. In his *Exposición astronómica*, Kino invoked the need to combat those who have come to believe that

⁴⁰⁷ Kino to the Duchess of Aveiro, 26 January 1681, trans. Burrus, 106.

⁴⁰⁸ Kino to the Duchess of Aveiro, 26 January 1681, trans. Burrus, 106.

comets had no meaning for man, and that they had no bad effects.⁴⁰⁹ He clearly had Sigüenza's treatise in view.

Nonetheless, Kino was no wanton providentialist. In November, just before his first letter regarding the comet, he amended a postscript describing how the "day before yesterday lightning struck the flagship of the galleon fleet, killing a man and injuring three others; the ship was not damaged." This, however, he saw as a regular occurrence without providential import—he simply added, in a dejected reference to his own extremely delayed departure from Spain, "nonetheless it is doubted that they can get under way before March."⁴¹⁰ This purely natural prodigy did not move him to contemplate any special divine message. On the other hand, he was not above taking the receipt of a letter full of good news on the feast day of St. Francis Xavier, his patron saint, as portentous.⁴¹¹ He also seemed partially to attribute the cessation of plague in Puerto de Santa María to the town's decision to make a solemn promise to St. Francis Xavier to honor him as its patron and celebrate the feast day with special solemnity.⁴¹²

His temperance with regard to the interpretation of natural prodigies, as opposed to those associated with religious figures, was also indicated by the fact that he saw no need to mention the comet during the first few weeks of its appearance. He

⁴⁰⁹ While it seems likely that Kino wrote his treatise specifically to respond to Carlos Sigüenza y Góngora's *Manifiesto* (1681), as Sigüenza accuses him of doing, the evidence remains inconclusive. Kino would have almost certainly run into such arguments in Spain, Italy, or Austria.

⁴¹⁰ Kino to Duchess of Aveiro, 16 November 1680. Trans. Burrus, 86.

⁴¹¹ Kino to Duchess of Aveiro, 6 December 1680, trans. Burrus, 90

⁴¹² Kino to Duchess of Aveiro, 14 December 1680, trans. Burrus, 94.

noted in a letter of 28 December 1680 simply that he had “no doubt that it is the same comet which many say they saw before sunrise (between four and five a.m.) some four or five weeks ago. They beheld it in the east with its nebulous train pointing westward.”⁴¹³ Perhaps its smaller size did not raise Kino's alarm, or he was simply too busy with Francis Xavier's feast day (for which he had been given many responsibilities) and the Christmas season to pay much attention to it. Certainly, even with his zeal for mathematics, he seemed to have made no effort to rise early to observe it before it rounded the sun, despite the collection of instruments likely available to him at the Jesuit college where he was staying in Cádiz.

For Kino, the fact that comets signaled the deaths of kings and the overthrow of dynasties as well as natural disasters was key evidence for his thesis: comets are signs of the mercy and justice of God, and their final cause was to warn humanity and prompt them to turn to God. Kino argued the comet augured negative fortune for the world, though, like Increase Mather in Boston, he did not claim to know (as an astrologer might) where and when God's punishment would come.

Kino offered six “foundations” for the argument that comets were signs of disasters to come. Sigüenza's summary of Kino's own arguments is perhaps uncharitable, but not inaccurate: of Kino's six foundations, Sigüenza said Kino gave us “in his first foundation, what the learned say; in the second, what the poets say; in the third, what the historians say; in the fourth, what the philosophers say; in the fifth, what

⁴¹³ Kino to Duchess of Aveiro, 28 December 1680, trans. Burrus, 96.

the moderns say; and in the sixth, what the Reverend Father [himself] says.”⁴¹⁴ Kino argued that the “universal public,” “learned and unlearned” agreed with him that comets were signs, and that the copious body of aphorisms and maxims that maintained that comets should be feared constituted good authority for his position.⁴¹⁵

Kino also relied on the testimony of modern authorities on the three recent comets of 1664, 1677, and 1680. He quoted his Ingolstadt professor, Leinberger, who had written that the body of history and annals proved comets bring terrible disasters. Kino’s proof through the “testimony” of the moderns, then, amounted to a quotation from his teacher affirming that the ancients should be trusted. As proofs for the veracity of historical sources, this was hardly sufficient, as Sigüenza would point out. But Kino also attempted to make arguments from more contemporary authorities. Since he believed the “universal public” agreed with his malefactivist position, Kino felt free to cite the authority even of those unlearned in astronomy and astrology, including poets and aphorists.⁴¹⁶

Kino even used himself and the Duchess of Aveiro as authorities by virtue of her noble birth and his relationship with her. He included the text of his letters to her about the comet, and also of one of her replies, in which she celebrated the comet as a sign from God for the missions and lamented the scant attention paid to it by her

⁴¹⁴ SGLA S. 186. “En su fundamento 1. que lo dicen los doctos, dixo en el 2. que lo dicen los Poetas, y en el 3. que lo dicen las historias, y en el 4. que lo dicen los Philosophos, y en el 5. que lo dicen los modernos, y en el 6. Que lo dice tambien el R.P.”

⁴¹⁵ SGLA S. 130.

⁴¹⁶ Kino, 21r.

acquaintances in Madrid. Of course, he cautioned, one needed prudence to trace cause and effect in the case of comets, but better to go with the opinion that learned men had held for centuries than to discount the idea that God intended comets as a message for mortals.

Each of these arguments relied upon marshalling an extensive body of authorities and historical evidence. Kino did concern himself with natural philosophy in the majority of the treatise, which dealt with the nature and the motion of the comet. What is unusual is the almost exclusive degree to which he relied upon arguments from authority in order to prove his position that comets were signs of disaster. He likely intended this merely as a show of his command of the relevant authorities, and, given that his teacher in Ingolstadt had a history of defending that position, may very well have been ignorant of the large number of authorities, including poets and natural philosophers, ancients and moderns, who argued that comets could bring good fortune or that they signified nothing at all. His purpose, in the short term, was probably to fulfill his promise to the Duchess and present a book which *primarily* showed off his mathematical expertise—books one through nine focused on natural philosophy and mathematical description of the comet's path and parallax—and his rhetorical skill in order to improve his reputation among the Jesuits in Europe.

This is further suggested by Kino's behavior after the publication of his book. Kino did not simply publish the *Exposición* and leave its fate to chance. He actively oversaw its distribution among important people and continued to write to the Duchess, offering small reminders of what he had said in that book and how his prognostications

were coming true. On 23 June 1681, at six o'clock in the evening, he wrote to her that “we experienced a severe earthquake. Many public processions with prayers have taken place to secure rain. I suspect that the exceptional drought is one of the results of the comet; torrential rains occasionally follow a drought. May the divine clemency in its compassion protect us and ever keep us from harm!”⁴¹⁷

He also took great pains to see that copies of his book made it to European Jesuits. Kino sent letters and copybooks to his old teacher in Ingolstadt, Father Leinberger, via the Jesuit General Charles de Noyelle, who acknowledged receiving them and passing them on to Germany in a letter to Kino dated 2 January 1683.⁴¹⁸ He also begs the Duchess herself for her assistance in forwarding his work to the relevant people in Europe:

A few days before leaving Mexico City, I wrote a book there on the comet and left eighty and later twenty copies (one hundred in all) of the treatise with Father Francisco de Castro who, assisted by Father José Vidal, was to forward them to your Excellency in Madrid. Have the copies distributed among your friends in Spain and Portugal and wherever your Excellency wishes. It was to Your Excellency that I was on the point of dedicating the treatise [this sentence is incomplete; Kino did not elaborate further]. It would give me special satisfaction to know that they had reached you. If they have arrived, or when they do, I ask you to do me the favor of sending a half dozen of them to Seville to Father Pedro de los Escueros S.J., and another half dozen to Father Assistant of Spain,

⁴¹⁷ Kino to the Duchess of Aveiro, 4 July 1681, trans. Burrus, 111. On the earthquakes, see Robles, *Diario*, I, p. 299.

⁴¹⁸ Burrus 107, n. 2. To my knowledge the content of these letters and copybooks is not known, but given Kino's profuse praise of Leimberger's mathematical ability in the *Exposición* it is reasonable to think some material on the comet may have been within them.

whom I shall write telling him to what acquaintances in Rome he is to give them.⁴¹⁹

Kino included a summary of the *Exposición* in a letter to Father Leinberer, which he had enclosed to the 3 June letter to the Duchess and which, unfortunately, does not survive. He asked the Duchess to forward this letter to Father Charles Noyelle, the Vicar General of the Order, in Rome, who would then send it to its final destination. It seems likely that Kino hoped the Vicar General would see it, along with the treatise, and commend him to the Chinese mission for this mathematical ability (even though he professed in that letter to have accepted the mission to California as God's will).

On 12 August 1683, Kino wrote that he hoped the Duchess had received his book. "I would be happy if you have received the booklets on the comet (or comets), whose manifold effects we have continued to witness and experience."⁴²⁰ Unfortunately, he did not elaborate further on what these supposed effects might be or where he had experienced them. It is also not clear whether, at this time, Kino knew that Sigüenza had written a scathing treatise against him but had chosen not to publish it. After 1683 as his work on the frontier occupied more of his time, he spoke of the *Exposición* only in passing. If he intended it as a ticket to China, he was disappointed.

⁴¹⁹ Kino to the Duchess of Aveiro, 3 June 1682, trans. Burrus, 121.

⁴²⁰ Kino to the Duchess of Aveiro, 12 August 1683, trans. Burrus 142.

5.8 The *Libra Astronómica*

The life of Carlos Sigüenza y Góngora has been well studied.⁴²¹ He joined the Jesuit order as a young man, but, for unknown reasons, was asked to leave the Society. He seemed to have carried this wound with him for the remainder of his life, expressing great admiration for the Jesuits even as he seemed to harbor some resentment toward individual members of their order. Sigüenza's complex history with the Society of Jesus influenced the later progress of the debate, since his chief adversary, Eusebio Kino, was a member of that order. In the *Libra* he took pains to assure his readers that his feud was not with the Jesuits, but rather with Kino alone. Throughout the treatise, Sigüenza noted when an authority he cited was a member of the Jesuit order and wrote of his high esteem for these writers and their mathematical ability.

Sigüenza seemed to have placed great hope in the arrival of Kino, a Jesuit supposedly very learned in natural philosophy and mathematics and trained in Ingolstadt. Sigüenza consistently expressed dismay at the dismal state of learning in New Spain and longed for more worthy intellectual companionship. When Kino arrived, Sigüenza recounted that he opened his library—one of the greatest in New Spain—to the missionary, including his great collection of maps, which he hoped would assist Kino in his travels to the northern frontier of New Spain.

⁴²¹ Antonio Lorente Medina, *La prosa de Sigüenza y Góngora y la formación de la conciencia criolla mexicana* (México D.F., Madrid: Fondo de Cultura Económica, Universidad Nacional de Educación a Distancia, 1996); More, *Baroque Sovereignty: Carlos de Sigüenza y Góngora and the Creole Archive of Colonial Mexico*; Irving Leonard, *Don Carlos de Sigüenza y Góngora, a Mexican Savant of the Seventeenth Century*. (Berkeley: University of California Press, 1929).

While Kino was exploring California and seeing to the fortune of his own book, Sigüenza seethed in righteous anger that the man to whom he had shown such hospitality had dared to publish a book attacking him without notifying him first. Not only that, but in Sigüenza's account, Kino had shown up to hand Sigüenza a copy immediately before leaving, telling Sigüenza cryptically that he would find much to entertain him in it. Finally, Sigüenza took Kino's decision to dedicate the *Exposición* to the Viceroy himself as a direct affront to his own dedication to the vicereine. In the introduction to the *Libra*, the professor sarcastically wondered if Kino had sought to rescue her from the prison of fearlessness into which he had tried to lead her, and instead encouraged her to be needlessly afraid of comets. In response to Kino's publication, Sigüenza immediately set to work on the *Libra*. However, for unknown reasons, he did not publish it until 1690.

In the *Libra*, Sigüenza directed his attack primarily against the "authorities" whom Kino brought to defend the malefactivist theory of comets. Against this, Sigüenza not only provided a litany of experts who denied comets were signs, but offered sustained critique of arguments from authority.⁴²² In effect, Sigüenza demonstrated his mastery of the very traditions in which Kino had sought to show his expertise. Kino spent much of the *Exposición astronómica* rehearsing a series of historical arguments, ranging through a broad swath of the baroque literature on the history of prodigies

⁴²² SGLA S. 135.

meant to demonstrate his erudition. Yet the record of comets and the disasters they signaled was open to interpretation.

Sigüenza, in his response to Kino, was able to amass a huge amount of evidence against his opponent thanks to the availability of comet catalogs published in the late sixteenth to mid-seventeenth century. These works, some of them beautifully illustrated folio editions, provided a complete index of every reference to every comet since the creation of the world in modern and classical literature, often alongside summaries of natural-philosophical theories about comets as well as writings on the interpretation of these objects.

One of these catalogues was the cometography of Gemma Frisius, a professor at the University of Louvain who observed the comet of 1577 and published an account of historical comets and their supposed effects. Kino also used Gemma's catalog, but Sigüenza was quick to point out the chorological faults in Gemma's book. Because Sigüenza had a stronger command of the historical literature underlying Gemma's claims, he could use flaws in these accounts to undermine Kino. Kino, for example, repeated Gemma's argument that a comet predicted the final illness of Carlos V. Sigüenza retorted that, according to Gemma, the comet appeared in 1558, but Carlos got sick in 1550—thus, if the comet was a sign from God, God was eight years too late.

Another source Sigüenza used was the catalogue of comets printed by Polish astronomer Jan Lubienietzki in Latin in the 1660s. Lubienietzki was more skeptical about comets as presages of disasters. Sigüenza translated the following passage from Lubienietzki in its entirety in his *Libra*. Regarding the death of Carlos V, Sigüenza wrote

that because Kino was superstitious, he spoke according to the vulgar idea that the death was announced by a comet. He wrote, borrowing from Lubienietzki,

but what produced it and signified it, more than the comet, was his long sickness with gout which had plagued him since his fifties, not at intervals but continuously, through the violence of which sometimes he almost died and because of which Andre Vesalius, his chief physician, had predicted that the life of Caesar would not be long.⁴²³

Having Lubienietzki's catalogue at his fingertips allowed Sigüenza to critique Kino's few historical examples in meticulous detail, and to provide historical examples of his own.⁴²⁴ Kino may have had access to the same works, but for whatever reason, he did not read them as critically as Sigüenza.

In the course of his argument against those who believed comets posed no threat to kings, Kino recalled the "great comet of the year 1664 which, "as was agreed throughout Spain, and as was manifest and factual, rather than a matter of opinion, undoubtedly presaged the death of his Most Catholic Majesty Felipe IV," the father of the currently-reigning monarch, Carlos II. Kino wrote that when Felipe IV saw the comet, he remembered the comet of 1618, which had appeared shortly before the death of his own father, Felipe III. Upon seeing the comet, Felipe IV supposedly intoned, "I saw

⁴²³ Carlos Sigüenza y Góngora, *Libra astronómica* (1690), s. 162. "La muerte de Carlos V. . . porque [Kino] era supersticioso, haya dicho según el sentir popular que le era anunciada por medio del cometa. . . lo produjo o significó, más que el cometa, la larga enfermedad de gota que desde los cincuenta años le aquejaba, no a intervalos sino continuamente, por cuya violencia en ocasiones se moría y por la cual Andrés Vesalio, médico en jefe, había predicho que no sería larga la vida del César, enfermedad que se agravaba cada vez más y presagiaba los últimos momentos."

⁴²⁴ SGLA S. 208-214.

another one just like this when my father died,” and resigned himself to bed rest before his death later that year.⁴²⁵

Sigüenza argued that Felipe IV could not have spoken this lament, because Sigüenza believed the king would not have lied. It would have to be a lie, since the comet came in 1618 and Felipe III did not die until 1621. He wrote, “I remember reading somewhere, I don’t know in which book . . .”—he may have been making fun of Kino’s source here, whom he accuses of making things up without support—“that, his courtiers having shown him that comet, he said with very circumspect prudence, ‘What other comet is there to kill me but my infirmities?’”⁴²⁶ Sigüenza went on to cite Lubienietzki instead, translating from the Latin:

Before the comet we all presaged that in a short time would soon follow the death of the king of Spain; furthermore we presaged it invoking as a handmaid of our prophecy his advanced age, which had surpassed seventy years in number, the harsh decades, the multiple symptoms and attacks of his sicknesses.⁴²⁷

⁴²⁵ Kino, *Discurso astronómico*, 10. “. . .Gran cometa del año de 1664 que, como fue constante y más pública experiencia que opinion de toda España, fue indubitable presagio de la muerte de la majestad católica de Felipo IV. Cuyo también dicho y testimonio, como de tal solemne excepción, hace superior feal triste anuncio del otro insigne cometa del año 1618, que poco antes de la muerte del señor Felip [sic] III, su padre, apareció, porque habiendo visto la majestad católica de Felipo IV el que casi fue inmediato a su fallecimiento, rompió así: ‘Otro como éste vi yo cuando murió mi padre’; y dándose poravisado de su cercana muerte, desde que hizo cama (no sin dificultad) para ponerse en cura de sus achaques por consejo de los medicos, se dispuso; y dispuso como para morir todas las cosas de su dilatada monarchia.”

⁴²⁶ SGLA, s. 163. “Acuérdome haber leído, no sé en qué libro o sermon. . .”, “. . .el que, al mostrarle aquel cometa sus cortesanos, dijo con prudencia muy circunspecta: ‘¿Qué más cometa para matarme que mis achaques?’”

⁴²⁷ SGLA, S. 164. “Antes del cometa todos presagiamos que en breve seguiría la muy reciente muerte del rey de España; más aún la presagiamos, invocando como auxilio del presagio le edad senil, que había sobrepasado el número de sesenta años, las decaídas fuerzas, los multiples síntomas y accesos de la enfermedades.”

Sigüenza ended, ironically, asking God to free him from “dysentery, typhus, pains in my side and similar things, which are the true comets, and which snuff out the lives of kings and rich men and private and poor men alike.”⁴²⁸

Despite Sigüenza’s mockery of Kino’s constant argument from authority, he was anxious to demonstrate a mastery over those authorities that far exceeded his European opponent’s. He littered his work with extended Latin passages from philosophers, mathematicians, historians, and poets, ancient and modern. He took particular delight in using an author, such as Kircher or Riccioli, whom Kino had cited as a source and showing how other works or a more careful reading of the very same source undermined Kino’s position.

When Kino invoked the authority of the famous Jesuit Athanasius Kircher to argue that comets are signs from God, he was likely unaware that he was writing against a scholar who owned a complete library of Kircher’s works, and, along with Sister Juana de la Cruz, was perhaps the most careful and eager reader of Kircher in the New World.⁴²⁹ Sigüenza countered Kino’s example with a letter from Kircher to Gaspar Schotto on the comet of 1665, in which he quoted Pope Alexander VII being rather blasé about the comet. The letter was, not surprisingly, quoted in Lubienietzki. In doing this,

⁴²⁸ SGLA, S. 164. “disenterías, tabardillo, dolor de costado y sus semejantes, que son los verdaderos cometas, que así a reyes y ricos como a particulares y pobres quitan la vida.”

⁴²⁹ “A Jesuit’s Books in the New World: Athanasius Kircher and His American Readers,” in Paula Findlen, ed., *Athanasius Kircher: The Last Man Who Knew Everything* (New York: Routledge, 2004), pp. 329-364.

Sigüenza not only blocked Kino's attempt to use Kircher to prove his position, but he also provided the words of a Pope in favor of his own.

The second section of the *Libra* responded point-by-point to Kino's own refutation of the points Sigüenza made in the *Manifiesto*. This section reprinted large parts of Kino's own text, creating a kind of "hypertext" fit for Sigüenza's scholastic style of argumentation. Here, Sigüenza criticized Kino not only for misunderstanding the authorities he brought to bear on his arguments, but for misunderstanding Sigüenza himself. Sigüenza frequently claimed he did not recognize Kino's restatements of the positions in the *Manifiesto* as his own at all. He did offer a long philosophical argument—one of his most original—for the comet's beneficial effects based on a spagyric account of the comet's nitrous and salty composition. He recounted how this cometical ash, like ash from fires, was good for the soil and thus augured plenty rather than dearth.⁴³⁰ However, most of his propositions in this section related to Kino's misuse of authority.

It was Kino's decision to insert, as his sixth "foundation" for proving that comets are signs of disasters, his own writings that raised Sigüenza's ire most. He observed that Kino's religious modesty must have been very great, since as his final piece of evidence, where the rules of rhetoric dictated that he should put his strongest argument, Kino inserted his own words and his own letters.⁴³¹ Kino's attempt to impress the reader with the extent of his correspondence and the number of people asking him for

⁴³⁰ SGLA S. 95-106.

⁴³¹ SGLA S. 218.

interpretations of the comet fell flat. The professor responded that he would like to know if any of these people were mathematicians, or simply curious onlookers interested in what Kino had to say. Only if they possessed sufficient mathematical expertise could Sigüenza take them as true authorities.⁴³²

A final aspect of the debate between Kino and Sigüenza, however, remains to be examined. The feature of the *Libra* that has, in recent years, garnered the most interest from scholars is its clear and fierce defense of Creole scholars against what Sigüenza saw as an arrogant dismissal from a recent European transplant. Famously, he attacked Kino for his hubris in thinking that he could offer misleading or outright false historical examples and not have them found out by provincial readers:

May the Reverend Father live a thousand years for the high opinion he had of us Americans in writing these lines. They think in certain, especially northerly, and, what is more, remote, parts of Europe, that not only the Indian inhabitants who originated in these lands, but also those of us who happened to be born here from Spanish fathers, either walk on two feet by divine dispensation, or that even using English microscopes you could hardly discover anything in us of the rational.⁴³³

Sigüenza, then, alone of the commentators in 1680, seemed to carry on the tradition of “patriotic astrology” that came to maturity in the early part of the century. However,

⁴³² SGLA S. 217.

⁴³³ SGLA S. 166: “Viva mil años el muy religioso, y R.P. por el alto concepto que tuvo de nosotros los Americanos al escribir estas clausulas. Piensan en algunas partes de la Europa, y con especialidad en las septentrionales, por mas remotas, que no solo los Indios habitantes originarios destos paises, sino que los que de padres Españoles casualmente nacimos en ellos, o andamos en dos pies por divina dispensacion, o que aun valiendose de microscopios ingleses apenas se descubre en nosotros lo racional.”

Sigüenza used the uniqueness of the New World not as a call to reform astrology, but as a reason for discarding its principles entirely.

In the *Libra*, Sigüenza offered a lengthy critique of the principles of astrology as part of his examination of the philosophical reasons for believing comets could not be signs of evil. Among his reasons for dismissing astrology was its unsuitability for a New World—or indeed, for the whole world, in which immediate causes such as climate and geography played a far more crucial part in determining events than the stars and planets. “What,” he asked, “would the ancients say if they knew that it being summer on the coasts of Peru, it is winter in the *punas*, or Andes . . . and in the intermediate lands, with hardly ten leagues between them, you observe yet another climate!”⁴³⁴ If an astrologer, observing stars that were sure to bring rain, predicted that rain, it would probably never arrive, “even though there might be the strongest influences of Mars and Venus and Mercury and Jupiter, since the disposition of the mountains, which impedes the winds, opposes itself to all the influences of the heavens.”⁴³⁵ This example, like most, returned to his primary point, the criticism of authority. He concluded, “so even if it were true that Adam himself made [astrological] observations, and that they

⁴³⁴ SGLA S. 369. “Que dixeran los antiguos si supieran, que en las costas del Perú siendo Estio, en las Punas, o Andes. . .es invierno, y en las tierras intermedias, con sólo diez leguas de diferencia, en partes se nota otro temperamento.”

⁴³⁵ SGLA S. 369. “Por ventura, no se expondría a erra el que en esos llanos por haver advertido en el cielo configuracion que dento lluvias y tempestades las pronosticase, quando alli jamas esto sucede, aunque sea en las fortissimas aperperciones de Marte, y Venus, y de Mercurio, y Jupiter, pues la disposicion de los montes que impiden a los vientos se opone a todos los influxos de los cielos.”

were preserved until our times, what would they do for astrology, not being accommodated to all climates and latitudes?"⁴³⁶

Thus, Sigüenza provided a primarily historical critique of the fear of comets by attacking the chronology itself and Kino's shallow use of his sources. Using the skeptical history of comets provided by Lubienietzki as well as his strong command of historical sources, Sigüenza put together an alternative historical narrative that emphasized the distance between comets and their supposed effects. Doing this allowed him to demonstrate the extent of his learning in order to embarrass Kino, who competed with him for patronage, to show that a Creole in New Spain could carry his weight in a philosophical discussion, and to show the paucity of the evidence for the belief that comets caused disasters.

5.9 Conclusion

Sigüenza's book proved extremely influential in New Spain; a century later, the scholar José Alzate printed one of Carlos Sigüenza's famous maps of Mexico, and below the map, he attached the following elegy:

He was born in New Spain at the beginning of the seventeenth century, a century in which even in Europe the applied subjects of the natural sciences were very rare, a time in which application [to those subjects] was seen not only as useless, but as prejudicial

⁴³⁶ SGLA S. 369. ". . .luego aunque fuera verdad haver hecho observaciones el mismo Adam, y que se conservasen hasta estos tiempos, de que le servirian en general a la astrologia, no siendo acomodables a todos climas y paralelos."

to custom, and when the instruments necessary for progress were crude and defunct.⁴³⁷

He praised Sigüenza as a beacon of learning in such unfavorable circumstances. Yet by studying those to whose customs Sigüenza's work appeared prejudicial, and the reasons why his opponents insisted on clinging to custom and authority, it is clear that even those who submitted to authority did so for understandable reasons. Authority proved flexible; observations that contradicted a particular authority, or even a body of authorities, did not always lead to skepticism or to calls to abandon arguments from authority all together. However, the Latin American debate over the comet showed that, by 1680, the status of such authorities and the observations they supposedly provided was in doubt. Authorities were subject to new kinds of criticism, and open to new kinds of defense.

⁴³⁷ Carlos Sigüenza y Góngora, *Provincia de Tescucu, in cartouche: mapa de las aguas que por el circulo de 90 leguas vienen a la laguna de Tescuco...* [map] (Mexico: reimpresso con algunas adiciones por Don Joseph Alzate), 1786. John Carter Brown Library.

CHAPTER 6:

CONCLUSION: WAITING FOR HALLEY

Sigüenza's was, without doubt, the most powerful critique of providentialist accounts of nature to appear in English or Spanish until Pierre Bayle's *Miscellaneous Reflections* on the comet of 1680 was finally translated into English in 1708.⁴³⁸ Bayle, like Sigüenza, attacked the philosophical foundations of astrology and the flawed chronology proposed in favor of comets causing or signifying disasters. He provided many novel arguments for the skeptical position, more than perhaps any writer in the seventeenth century. His treatise ranged far more widely than Sigüenza's, perversely wondering whether atheism, which the (Protestant) providentialists sought to avoid by championing comets as signs of an active God, was really worse than the sin of idolatry, which the fear of comets had fostered throughout history. The boldness, breadth, and ingenuity of the *Miscellaneous Reflections* have justly earned it its place as a historiographical touchstone in the history of the decline of beliefs in celestial "superstitions."⁴³⁹

⁴³⁸ Bayle, *Miscellaneous Reflections, Occasion'd by the Comet Which Appear'd in December 1680. Chiefly Tending to Explode Popular Superstitions. Written to a Doctor of the Sorbon, by Mr. Bayle.*

⁴³⁹ In, for example, Daston and Park, *Wonders and the Order of Nature, 1150-1750.* and Cameron, *Enchanted Europe: Superstition, Reason, and Religion 1250-1750.*

Yet Bayle's treatise circulated in Latin for nearly thirty years before anyone translated it into English—and this suggests a curious feature of English discourse on superstition, one that comes out clearly only in comparison with other regions. In England, a sharp divide existed between those literate men who participated in the debate over the comet's divine significance, and those who did not. In New England, all agreed that the clergy possessed sole authority to interpret the comet, at least in public. In Spain and Latin America, astrology and philosophy, not religion, governed the discourse over the comet's meaning. In all three of these regions, those who spoke of the comet respected the need to "speak philosophically" rather than theologically on such matters.

So, to return to the questions I raised in the introduction, who did participate in this debate, and why? The most common participants were astrologers, or at least those who supplemented their income by printing almanacs, who produced pamphlets on the comet in all four regions. Astrologers, especially in Spain, drew on the theory that comets arose from planetary conjunctions in order to claim the ability to interpret the natural effects of the comet with reasonable specificity. Elsewhere, astrologers explained the comet on the basis of their expertise in matters celestial, on the one hand, and meteorological, on the other—thus, no matter what consensus about the nature of the comet prevailed, they always possessed the necessary expertise to offer a ruling on it.

Astrologers, even when they touched on religious topics, tended to speak "philosophically" rather than offering interpretations on theological matters. Even

when astrologers spoke at length on religious matters, such as Martín de la Torre in Mexico or Luis Aldrete y Soto in Madrid, such claims were almost always made to bolster the legitimacy of astrology as a whole, rather than proclaim the comet as a punishment for sin. In the Spanish-speaking regions, Kino came closest to providing a truly religious interpretation, and his status as a Jesuit and missionary would have permitted him that luxury. However, Kino treated the moral purpose of the comet almost as an afterthought. What was important was the weight of authorities arguing that comets and disasters were related—not the urgent need to repent in order to prevent the wrath of God. When religious concerns took center stage, they tended to come from the pens of *skeptics*. Miguel Yepes, Juan Bravo de Sobremonte, and Sigüenza all chastised astrologers and providentialists alike for claiming to know the status of future contingents that were reserved to God.

In New England, John Foster explicitly yielded his authority to speak on the moral purpose of the comet to Increase Mather. Even John Gadbury, who despite his status as a Tory astrologer never shied away from spectacular descriptions of prodigies as signs of great changes to come, limited his interpretations of the comet to the natural, the formulaically general warning to repent, or the cryptically political. He did not engage at length with the political or religious meaning of the comet. He explicitly sought to distance himself from the vulgar prodigy-mongers through his repeated assertions of his astrological expertise.⁴⁴⁰ He wished to align himself with the silence of

⁴⁴⁰ John Gadbury, *Ephemeris, Or, A Diary Astronomical, Astrological, Meteorological, for the Year of Our Lord, 1682 It Being the Second after Bissextile, with Predictions and Experiments Sydereall, Also*

the natural philosophers but the nature of the subject-matter, and undoubtedly the market, prevented him from doing so.

In the case of England, these “vulgar” politico-religious partisans participated in order to appropriate the comet as a sign of God’s favor for their chosen cause, or to dispute such claims. The presence of such a group was unique among these four regions. In no other place were men without philosophical, astronomical, or religious training able to participate in the discussion about the comet’s meaning, and astrologers and natural-philosophers had good reason to be alarmed by their sudden and overwhelming dominance of the pamphlet press.

In English-speaking regions, clergymen also asserted their authority to speak on the comet as a pastoral exercise, in order to draw attention to the sins of the people. These sins could be general, as for Mather or Edwards, or particular, as for the anonymous author of the *Petitioning-Comet*.⁴⁴¹ In all regions, astrologers and natural philosophers respected disciplinary boundaries between those who could speak philosophically and those who could speak theologically.

Something of the (London: Printed by J.D. for the Company of Stationers, 1682); John Gadbury, *Ephemeris, Or, A Diary Astronomical, Astrological, Meteorological, for the Year of Our Lord, 1683, Being the Third after Bissextile, or Leap-Year : With a Further Account of the Late Terrible Comet* (London: Printed by J.D. for the Company of Stationers, 1683).

⁴⁴¹ Increase Mather, *Heavens Alarm to the World, Or, A Sermon Wherein is Shewed that Fearful Sights and Signs in Heaven are the Presages of Great Calamities at Hand*; Increase Mather, *The Latter Sign Discoursed Of, in a Sermon Preached at the Lecture of Boston in New-England August, 31. 1682. Wherein Is Shewed, That the Voice of God in Signal Providences, Especially When Repeated* ([Boston], 1682); Edwards, *Cometomantia, A Discourse of Comets*; Democritus, *The Petitioning-Comet, Or, A Brief Chronology of All the Famous Comets and Their Events, That Have Happened from the Birth of Christ, to This Very Day : Together with a Modest Inquiry into This Present Comet*; Anthony Grafton, April Shelford, and Nancy G. Siraisi, *New Worlds, Ancient Texts: The Power of Tradition and the Shock of Discovery* (Harvard University Press, 1995).

The absence of pastoral voices in Spain and Latin America is one of the more surprising results of this study. This study's focus on printed material and public polemics has left out Catholic religious responses to the comet which may have taken the form of *Te Deum* masses, processions, special prayers to saints, and personal choices to light candles or make use of any number of sacramentals available to pious Catholics in fear of the wrath of God. These responses to disasters and signs persisted well into the eighteenth century.⁴⁴²

However, it is striking that Catholic clergy, even if they wished to speak "theologically" of the comet as a warning to live rightly, felt no need to defend this view in the press. In other words, there seemed to have been no reason for the Church to defend its right to interpret the comet in writing, even in the face of skeptical critiques such as Sigüenza's. Those who came to the defense of the providential view, like Dávila y Heredia or Aldrete, came from the military or from unknown backgrounds.

Why should this have been the case? At the very least, this observation requires us to question the association, active even in the 1680s, between Catholicism and superstitions about natural phenomena. Even those English partisans, making the most audacious claims about the comet, condemned "superstition" among Catholics.⁴⁴³ But

⁴⁴² Martí Gelabertó, *La palabra del predicador: contrarreforma y superstición en Cataluña, siglos XVII-XVIII* (Lleida: Editorial Milenio, 2005); Stuart Schwartz, *Sea of Storms : A History of Hurricanes in the Greater Caribbean from Columbus to Katrina*, 2015; Charles Walker, *Shaky Colonialism : The 1746 Earthquake-Tsunami in Lima, Peru, and Its Long Aftermath* (Durham: Duke University Press, 2008).

⁴⁴³ Titus Oates, *The Witch of Endor, Or, The Witchcrafts of the Roman Jesebel* (London: Printed for Thomas Parkhurst and Thomas Cockeril, 1679); William Winstanley, *The Protestant Almanack for the Year from the Incarnation of Jesus Christ 1683, from Our Deliverance from Popery by Queen Eliz. 124, Being the Third after Bissextile or Leap-Year* (London: Printed for the Company of Stationers, 1683).

the superstition they decried related to sacramentals, to the Eucharist, and to ritual—other groups, but not radical anti-Catholics, used “superstition” to refer to improper attribution of divine causes to natural phenomena. The role of religion in the Catholic debates over the comet was, on the whole, far less prominent than it was in the Protestant regions.

Catholic natural philosophers, astrologers, and men of letters seemed to have possessed relative autonomy in discussing matters within their purview, provided of course they did not transgress certain prohibitions protecting free will. This autonomy resulted in a debate that focused far less on the moral, political, and religious purposes of the comet than on the philosophical and historical evidence for any natural link between comets and disasters. In other words, Catholic participants in the debate, on the whole, saw the comet as a natural object rather than as a prodigy, a wonder, or a miracle.

Only in England, however, did a significant proportion of interested parties refrain from speaking *at all* about the meaning of the comet, and restrict their public discussion of it to mathematical and physical matters, excluding even philosophical speculation about its effects on the earth. These were the men participating in the Republic of Letters, whose unspoken but rigid codes of conduct excluded such topics from the realm of polite discussion.⁴⁴⁴ Arthur Storer, writing from Maryland to his

⁴⁴⁴ A Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680-1750*, 1995. On the exclusion of providentialism in particular from the Republic of Letters, see Schechner, *Comets*.

family at Cambridge, understood this code well when he declined to include even a formulaic nod toward the comet's providential nature in his letters.

When I say this occurred only in England, that is obviously an artifact of this study—such exclusion was the norm in discussions of comets, eclipses, storms, earthquakes, and other potentially portentous phenomena throughout Europe among men professing an interest in natural philosophy.⁴⁴⁵ This remained true even as the *Philosophical Transactions* continued to pump wonders from around the world into England, stripped of any moral meaning.

This silence meant that members of natural-philosophical networks abiding by this code of conduct, including the Royal Society, did not actively advocate for their authority to interpret the comet. Bayle's treatise would seem an ideal vehicle for continuing the reform of manners that Royal Society members like Sprat had pursued in the 1660s to expurgate vulgar errors. Yet the absence of translations, or other vernacular treatises, condemning the political co-opting of the comet suggests that members of the Society were reluctant to get involved in the controversy. Though this may have been because of the "vulgarity" of the discourse, learned men who were *not* natural philosophers, such as Henry More, did not hesitate to involve themselves in such discourse by defending their condemnations of astrology in the early 1680s.⁴⁴⁶

⁴⁴⁵ Daston and Park, *Wonders and the Order of Nature, 1150-1750*. The exclusion of beliefs about the effects of comets from the Republic of Letters began much earlier; see Tabitta Van Nouhuys, *The Ages of Two-Faced Janus: The Comets of 1577 and 1618 and the Decline of the Aristotelian World View in the Netherlands* (Leiden: Brill, 1998).

⁴⁴⁶ Henry More, *Tetractys Anti-Astrologica, Or, The Four Chapters in the Explanation of the Grand Mystery of Godliness, Which Contain a Brief but Solid Confutation of Judiciary Astrology, with Annotations*

The existence of a powerful group using its silence to maintain a polite distance from the political fray stood out in England, and it raises questions about how (and, indeed, whether) natural philosophers managed to establish a “scientific culture” in which they appropriated for themselves the authority to interpret nature on the eve of the eighteenth century.⁴⁴⁷ Aside from this small—though powerful—group, providentialist interpretations of natural phenomena remained the norm well into the eighteenth century.⁴⁴⁸ Understanding how the modern West came to be a scientific culture will require serious engagement with the subtle changes visible within the beliefs of those beyond the Royal Society, in order to understand why, and whether, the idea of a non-intervening God won out against such resistance.

In 1755, a massive earthquake, followed by a tsunami and a fire, leveled the city of Lisbon. Within days, this disaster had provoked the publication of reports and pamphlets all over Europe, and in time, the Americas as well. These pamphlets

upon Each Chapter: Wherein the Wondrous Weaknesses of John Butler, (London: Printed by J[ohn]. M[acock]. for Walter Kettilby, at the Bishops-Head in St Paul’s Church-Yard, 1681). More reprinted these four chapters of his earlier *Explanation*, with new criticism, in response to Butler, *Hagiastrologia, Or, The Most Sacred and Divine Science of Astrology*. Butler had originally addressed his defense of astrology against More’s work personally. It may be this personal attack that demanded response, and such personal attack was missing in the case of the comet pamphlets.

⁴⁴⁷ The question of how natural philosophers earned such authority is taken up in Gaukroger, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity, 1210-1685*.

⁴⁴⁸ See, for example, John Wesley, *Serious Thoughts Occasioned by the Earthquake at Lisbon To Which Is Subjoin’d an Account of All the Late Earthquakes There, and in Other Places*. (London: Printed in the year, 1756); Defoe, *The Storm Or, A Collection of the Most Remarkable Casualties and Disasters Which Happen’d in the Late Dreadful Tempest, Both by Sea and Land.; A Form of Prayer for a Perpetual Fast in the Island of Jamaica, on the Seventh of June. Being the Anniversary of the Dreadful Earthquake* (London : Printed for R. Smith, under the Royal Exchange, and E. Symon, the Corner of Pope’s-Head-Alley, Cornhill, 1718); *Gods Voice to Christendom, Or, Alarum to Europe by the Remarkable Earthquakes, with the Several Kinds Thereof, Two Hundred Years before the Birth of Christ. The Causes and Kinds, Antecedents, and Consequents, (Pestilence, Sword, Famine) Following Thereupo* (Edinburgh re-printed: [s.n.], 1693); Joshua Hampsher, “English Interpretations of the Earthquake at Lisbon,” 2006.

discussed whether the earthquake was of natural or supernatural origin, whether God used it to punish the sins of evildoers, political or religious miscreants, or whether it was part of nature's usual course. By and large, the providentialist explanation won out, with those seeking to set the earthquake within a purely natural vision of a God who did not intervene in his own natural laws accused of atheism or impiety.⁴⁴⁹

Four years later, Halley's comet came round again, more or less exactly as predicted, offering glorious confirmation of Newton's astronomy to the Enlightenment thinkers who had by then taken on Newton and Halley as heroes. Yet few, very few, warned that the comet was sent as a warning from God. It is not that no one thought the comet would cause disaster—worries about the toxicity of the comet's tail, or its heat, abounded. It is not even that no one thought such a disaster was meant to punish sinners—John Wesley, in his *Serious Thoughts* upon the earthquake at Lisbon, proposed that the earth could only escape the scorching comet through repentance.⁴⁵⁰ There were even those who still argued that comets formed from earthly exhalations in the highest regions of the air.⁴⁵¹ But none, to my knowledge, proposed an *entirely* supernatural origin for the comet, as so many did for the earthquake.⁴⁵²

⁴⁴⁹ See Jonathan Israel, *Democratic Enlightenment Philosophy, Revolution, and Human Rights 1750-1790* (New York : Oxford University Press, 2011), 39–55.

⁴⁵⁰ Wesley, *Serious Thoughts Occasioned by the Earthquake at Lisbon To Which Is Subjoin'd an Account of All the Late Earthquakes There, and in Other Places*.

⁴⁵¹ Sebastian López, *Relacion, en que declara el Cometa ò Phenomeno que se dexò vèr el día 9 de Noviembre de este presente año de 1758*, (Madrid: 1758).

These two kinds of phenomena were, in 1680, almost universally seen as the same kind of event—one with both natural and supernatural causes, though authors could emphasize one over the other. Providentialism had not disappeared, even long after Halley solved the mystery of their appearance and long journeys around the sun. But in the 1750s, only the earthquake prompted intense speculation about God's role in its origin, its moral purpose. Only the earthquake launched the Enlightenment furor over the problem of evil, which occupied philosophers for the rest of the century (and since).

Despite these differences, the debate over the meaning of this disaster, and who had the authority to interpret it, echoed many of the concerns presented in 1680. As in 1680, opponents accused one another of superstition or of impiety, of credulity or of timidity. Natural philosophers and astrologers continued to offer interpretations of the comet and the earthquake. What changed, and what stayed the same, cannot be captured within a simple narrative of the decline of superstition or the naturalization of wonders. Each of these processes has a regional history, a local history, in which deep changes in ideas about nature occurred in fits and starts outside the bounds of scientific institutions and codes of conduct. My intention has not been to tell the story of the comet, but rather to accept, as a starting premise, that when people wrote about the comet they were almost always writing about something else. Comets continued to spur debate precisely because they allowed authors not simply to describe what they saw in the world, but to use what they saw to understand their own place within that world.

APPENDIX A:

BOOKS RELATING TO COMETS IN THE ATLANTIC WORLD, 1680-1684

A.1 Great Britain and Ireland

A Full and True Relation of a Comet or Blazing-Star, That Lately Appeared, and Was Seen by Many Eye-Witnesses Thereof, in This City of London, on the 28th and 29th of July Last, Etc. Pp. 4. [London c.1680], 1680.

A Song upon the Randizvous [Sic] on Hounsley-Heath with a Paralel of the Destruction of Our English Turks in the West, and the Mahomitans in Hungary: How the Christian Army, Compos'd of Forty. London: Printed for James Dean, 1685.

A True Account of That Famous Conjunction of Saturn and Jupiter on Monday the 9th of October 1682 Being the Seveth [Sic] Conjunction since the Creation, Which Conjunction Happens Once in 794 Years,. London: Printed for J. Hyther, 1682.

A True Relation and Description of the Strange and Prodigious Blazing Comett Seen in the Heavens by Many Thousands of People in London and Westminster, on the 11th and 12th Days of This Instant. London: Printed for Benjamin Harris at the Stationers Arms in the piazza under the Royal Exchange in Cornill and Enoch Prosser at the Rose and Crown in Sweetings-Rents at the east end of the Royal Exchange, 1680.

An Address from Earth to Heaven, Or, A Defensative against the Portentous Significations of the Late Comets and Blazing-Stars : That May Concern London or Oxford. London: [publisher not identified], 1681.

An Answer of a Letter from a Friend in the Country to a Friend in the City, Or, Some Remarks on the Late Comet Being a Relation of Many Universal Accidents That Will Come to Pass in the Year 1682 according to the Prognostications of the Celestial Bodies,. London: Printed by George Croom, 1681.

Andrews, William. "News from the Stars, Or, An Ephemeris for the Year 1683 with Astrological Judgements upon the Eclipses, Solar Ingresses, and Configurations of

Heaven Happening Therein : Being the Third from the.” [London] : [Printed by A.G. for the Company of Stationers], 1683.

Andrews, William. *News from the Stars, Or, An Ephemeris for the Year, 1682 with Astrological Judgements upon Several Eclipses, Positions, and Configurations of Heaven Happening Therein : Being the Second from the Bissextile or Leap-Year, and from the Creation of the World*. London: Printed by J.G. for the Company of Stationers, 1682.

Bayle, Pierre. *Miscellaneous Reflections, Occasion'd by the Comet Which Appear'd in December 1680 Chiefly Tending to Explode Popular Superstitions. Written to a Doctor of the Sorbon, by Mr. Bayle. Translated from the French. To Which Is Added, the Author's Life. In Two*. London: printed for J. Morphew near Stationers-Hall, 1708.

Bromhead, A. *Strange and Wonderful Prophecies and Predictions Taken from the Apparition of the Late Dreadful Comet* : London: printed for J. Smith, 1682.

Case, John. *A Prophecy on the Conjunction of Saturn & Jupiter in This Present Year 1682 with Some Prophetical Predictions of What Is Likely to Ensue Thereupon in the Year 1684*. London: Printed for J. Smith, 1682.

Coelson, Lancelot. “Speculum Perspicuum Uranicum, Or, An Almanack for the Year of Christ 1683.” London : Printed by A. Grover, 1683.

Coley, Henry. *Nuncius Coelestis, Or, The Starry Messenger for the Year of Our Redemption 1682 ... Being the Second from the Bissextile or Leap-Year : Wherein Is Contained (1) Astronomical and Meteorological Observations (2) Astrological Predictions*. London: Printed by J.G. for the Company of Stationers, 1682.

Coley, Henry. *Nuncius Coelestis: Or, The Starry Messenger for the Year of Our Redemption 1684*. London: printed by A[lice]. G[rover]. for the Company of Stationers, 1684.

Edwards, John. *Cometomantia, A Discourse of Comets*. London: Printed for Brab. Aylmer, 1684.

Gadbury, John. *Ephemeris, Or, A Diary Astronomical, Astrological, Meteorological, for the Year of Our Lord, 1682 It Being the Second after Bissextile, with Predictions and Experiments Sydereall, Also Something of the*. London: Printed by J.D. for the Company of Stationers, 1682.

Gadbury, John. *Ephemeris, Or, A Diary Astronomical, Astrological, Meteorological, for the Year of Our Lord, 1683, Being the Third after Bissextile, or Leap-Year : With a*

Further Account of the Late Terrible Comet. London: Printed by J.D. for the Company of Stationers, 1683.

Green, William, and William Knight. *Memento's to the World; Or, An Historical Collection of Divers Wonderful Comets and Prodigious Signs in Heaven, That Have Been Seen, Some Long before the Birth of Christ, and Many since That Time ... Together, with Ample Discourses, and Profitable Observa.* [London: Printed by T. Haly, for T. Passinger, 1680.

Hill, John. *An Allarm to Europe, by a Late Prodigious Comet Seen November and December, 1680 with a Predictive Discourse: Together with Some Preceding and Some Succeeding Causes of Its Sad Effects to the East.* London: Printed by H. Brugis for William Thackery, 1680.

Holwell, John. "Remarkable Observations on the Comet, in the Year 1680 as Also on the Blazing-Star, Now Seen, This Present Month of August, 1682." London : Printed for E. Smith, 1682.

Holwell, John. *An Appendix to Holwel's Catastrophe Mundi Being an Astrological Discourse of the Rise, Growth and Continuation of the Othoman Family : With the Nativities of the Present French King, Emperors of Germany and Turkey, All Truly Rectified, and Astrologically H.* London: Printed by J.G. for F. Smith ..., 1683.

Houschone, William, Théodore de Bèze, John Knox, and Johannes Widekindi. *Scotland Pulling down the Gates of Rome: Or, Christ against Antichrist. The Lambs Friends against the Dragons Followers. Containing First, Christs Herauld Proclaiming His Second Coming, in Allarum to Most Kingdoms of Europe, from the Late Presaging Comet .* London, 1683.

J, B. *Good and Joyful News for England:* London: Printed for Allen Banks, 1681.

Jones, Thomas. *An Astrological Speculation of the Late Prodigy. Or A Clear Discovery of the Approaching Miseries Signified by That Comet, or Blazing Star, Which Hath so Long Been Visible, to Several Countries and Nations in November, December and January; in the Year 16.* London: Printed for the author, and are sold by him, in Pauls Alley, in Redcross Street, 1681.

Kirby, Richard. *Vates Astrologicus, Or, England's Astrological Prophet, Fortelling What Is Likely to Befall Great-Britain and Ireland, Particularly the Great and Famous City of London.* London: Printed for Thomas Malthus, 1683.

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