The Two Comets of 1664-1665 : A Dispersive Prism for French Natural Philosophy Principles

Sophie Roux

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INTRODUCTION

In November 1664, a comet—the brightest since the three comets of 1618, say the reports of the time—appeared in the European skies. This comet first moved very quickly from the East to the West, that is, in a retrograde way with respect to the planets; then it reversed its direction and became much slower, to the point that it seemed to be stationary; in February it was not to be seen anymore to the naked eye and, by early March, it disappeared completely. At this very moment, another comet appeared, which was even brighter than the first one, had a longer tail and stayed among the stars until mid-April. Observations of these two comets were made all over Europe, and even beyond. In Rome, they were observed by the Jesuits Honoré Fabri, Gilles-François de Göttignies and Athanasius Kircher, but also by Gian-Domenico Cassini, who happened to be staying there at the time and was solicited by Queen Christina who wanted him to participate in the observations; in Bologna by Geminiano Montanari and Giovan Battista Riccioli; in Pisa by Giovanni Alfonso Borelli, who published a book under the pseudonym of Pier Maria Mutoli; in Firenze by Lorenzo Magalotti; in Venezia by Gaudentius Brunacci; in Lisbon by Antonio Pimento; in Valencia, by Enrique Miranda; in Majorca by Vincent Mut and Miguel Fuster; in Jena by Erhard Weigel; in Leipzig by Christoph Richter; in Ulm by Jakob Honold, Johannes Prateor and Christoph Schorer; in Dresden by Johannes Philip Hahn and Matthias Dannerwald; in Wittenberg by Michael Strauch; in Nuremberg by Christian Theophile and Johannes Christoph Kohlansen; in Hamburg by Stanislas de Lubienietski; in Würzburg by Caspar Schott; in Franeker by Gravius; in Liège by François-René de Sluse; in Leyden by Christiaan Huygens; in The

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Hague by Samuel Carel Kachel of Hollenstein; in Rostock by Johannes Quistor; in Dantzig by Johannes Hevelius and his nephew Johannes Hecker; in Magdeburg by Otto van Guericke; in Ratisbonne by Johannes von Rautenstein; in Copenhagen by Erasmus and Thomas Bartholin; in Stockholm by Nicolaas Heinsius; in London by Samuel Pepys, Robert Hooke and Christopher Wren; in Oxford by John Wallis; in Cambridge by the young Isaac Newton. Across the Atlantic, Samuel Danforth published a book of observations that seems to have been one of the very first works of astronomy printed in America; in French Québec, the comets were also seen and reported on by Jesuit missionaries and by Marie Guyard, also known as Sainte Marie de l'Incarnation, a mystic born in Tours who introduced the Ursulines in New France.[2]

Although most secondary literature dedicated to these two comets has been focused on England and Italy, France was not to be outdone in terms of observations, small talk and publications.[3] The observations of Adrien Auzout, Ismaël Boulliau, Jacques Buot and Pierre Petit, who lived in Paris, had the best instruments, and were in contact with the international community of the time, are still remembered. They should not make us forget observers living in the provinces who night after night did their best in the midst of a cold and rainy winter to identify and locate these comets among persistent clouds. Among them were Nicolas de Croixmare de Lasson, Pierre-Daniel Huet and André Graindorge in Caen, Mignot de la Voye in Rouen, Claude Comiers in Embrun, Robert Luyt in Tonnerre, Gabriel de Malapeyre in Toulouse, Montalegre in Lyon. Predictably, in each city of France there was at least one Jesuit ready to send a report on his observations to other Jesuits in other cities—Jacques Grandami in Paris, Jacques de Billy in Langres, Michel Seneschal in Douai, Michel Beaussier at La Flèche, Vincent Léautaud in Embrun, Jean Bertet and Claude-François de Chales in Lyon, Henri-Ignace Régis in Aix, Mercure Verdier in Poitiers, Ignace-Gaston Pardies in Bordeaux, Louis Nyel in Pont-à-Mousson.[4] Pictures of the trajectories of the

[2] Marie Guyard to her son, 28 July 1665, in Guyard 1681: 601; Le Mercier 1666: 105–117.

[3] In the case of England and northern Europe, see Hetherington 1972; Yeomans 1991: 69–93; Jensen 2006: 51–110; Shapin 1994: 266–291. In the case of Italy, see Aricò 1998; Aricò 1999; Cassini 2003; Lugli 2004, Ch. 10; Campinoti 2006: 217–228; Boschiero 2009. In the case of France, the literature is sparse; see however Atkinson 1951; Drévillon 1996.

[4] Grandami 1665a: 10; Billy 1665: 6. As is well known, the Jesuit network was one of the first scientific networks to circulate such observations. Two qualifications are however necessary. First, most of the time, we know that a given Jesuit received observational reports from his fellow Jesuits, but we have no information on the content of these reports. Second, the expression "Jesuit network" should not give the impression that one has to deal with a network isolated from the other networks: on matters like comets, Jesuits were integrated in the larger network of astronomers.

comets were also drawn -- the frontispiece of the present book is taken from Pierre Petit's Dissertation sur la nature de la comete.

Correspondences and private diaries show that these comets also made a great impression in France on what can be called the general public of the time. Although her main preoccupations at this time were the last episodes of Nicolas Fouquet's long trial, Madame de Sévigné wrote a few lines on the first comet to Pomponne, the Prince de Condé described it to the Queen of Poland, and the Marquis de Castries warned Jean-Baptiste Colbert about predictions and prophecies that were made by an old astrologer in Montpellier.[5] The physician and *libertin érudit* Guy Patin joked that, whatever the astrologists may say, the first comet would certainly not been followed by a cut in taxes, but that, for once, their predictions concerning the diseases that the comet may bring about could turn out to be right, since, in order to contemplate it, everybody got cold by standing on the Pont-Neuf at three in the morning after the midnight Mass.[6] Charles Cotin, who is said to have inspired Molière's Trissotin, wrote a courteous piece on the comet, while Nicolas Boileau, who used to mock Jean Chapelain's old, greasy and filthy wig, ad-libbed during a party with friends a short nonsensical comedy in which this wig was transformed into a comet by Apollo.[7] A *Ballet de la comète* was danced at the Oratorians in Soissons on 9 February, and a *Balet des comètes pour la tragédie d'Irlande* at the Jesuits in Paris on 6 August.[8] Anti-cometary remedies were sold.[9] Even the gender of comets was a matter of inflamed discussion—that is, the question of whether one should say "une" or "un" "comète" in French, considering that the original Latin word is "cometa," one of these rare masculine words to end by the letter "a."[10] Confronted with this question, one of the authors who will be studied in this paper suggested

[5] M^me^ de Sévigné to Pomponne, 17 and 22 December 1664, in Sévigné 1853, I: 65 and 70; Prince de Condé to Marie-Louise de Gonzague, Queen of Poland, 19 and 24 December 1664, in Condé 1920: 114–116; René Gaspard de La Croix, Marquis de Castries, to Jean-Baptiste Colbert, 29 December 1664, in Debbing 1855: 682–683.

[6] Patin to Falconnet, 25 and 30 December 1664, in Patin 2005, L. 804 and L. 805.

[7] Cotin 1665; Boileau, "La Métamorphose de la Perruque de Chapelain" in Boileau 1782: 218; the rationale behind this comedy was that, in early modern French, the tail (*chevelure*) of comets was also sometimes designated as their wig (*perruque*), "perruque" meaning not only artificial hair, but long and abundant hair (*chevelure*) and "chevelure" being the French word for tail. In a similar genre, see also the anonymous *Les effets ridicules du comète, envoyez à Lysandre malade*.

[8] *Ballet de la comète*; Diez 1665.

[9] Patin to Falconnet, 2 January 1665, in Patin 2005, L. 807.

[10] *Journal des scavans*, 2 February 1665, in Salo 1665: 94–95; Patin à André Falconet, 23 January 1665, in Patin 2015, L. 809; Lantin, n.d., fol. 33; Comiers: 7.

an analogy between the undetermined gender of the word “comet” and the undetermined nature of comets, which are neither planets nor stars, nor both at the same time.[11]

In this paper, I would like to use the books that were published on these comets in France as a dispersive prism to enable us to see the ongoing controversies about which principles should be accepted in natural philosophy in the mid-sixties. Although these comets are less famous than those of 1577 and 1680–1681, their significance for the history of science has been the subject of scholarly attention. The main question concerns how a consensus was built among astronomers, who indeed formed for the first time a truly international network, but made observations neither from the same places, nor at the same times, nor even in a continuous manner, because of uncertain weather, but also of the frequent ailments that affected everybody in those days.[12] The purported identification of one comet rather than two different ones, or on the contrary, of two different comets rather than one, was in these circumstances problematic: how could one decide if discontinuous observations bear on one and the same comet or on different ones? Because of its sudden variation of luminosity and change of location, the first comet was sometimes seen as two different, successive comets. This was the case for the anonymous author of *Histoire des comètes qui ont paru depuis peu sur notre horizon*, but also (albeit briefly) for expert astronomers as Boulliau and Wallis.[13] Marie Guyard and Vincent Léautaud went as far as claiming three comets in a row appeared between mid-December and the beginning of February.[14] Conversely, some other observers believed that the two comets were one and the same, as testified by Grandami and Billy, who argued against them.[15] But, because a certain number of questions on comets were still unanswered at this time, they were also food for deep thought and for heated debates at the intersection between astronomy and natural philosophy. It was still disputed as to whether comets were permanent objects, as Seneca claimed, or transitory objects, as Aristotle prescribed. Discussions on their location, trajectory and origin had been refueled by the recent discoveries made by sixteenth-century astronomers. Tycho Brahe established that at least some of them were travelling above the Moon and ran across the paths of the planets, thus demonstrating that the heavens are not

[11] Malapeyre 1665: 55, 60–62.
[12] Shapin 1994: 267–287.
[13] Lubiniezky to Boulliau, 21 February 1665 and Boulliau to Wallis, 6 March 1665, in Lubiniezky 1667: 412, 472. Wallis to Oldenburg, 24 December 1664/3 January 1665 and 21/31 January 1665, in Oldenburg 1965–1973, vol. II: 339.
[14] Pardies 1665a: 18; Marie Guyard to her son, 28 July 1665, in Guyard 1681: 601; Léautaud 1665: 13–18. Petit 1665: 206–208, attributes this opinion to Comiers, but it seems to me that this comes from a misunderstanding.
[15] Grandami 1665b; Billy 1665.

incorruptible and that they contain no solid spheres. But the space above the moon was still so vast, that the questions of the location of comets and the question of their trajectory remained open. A distinction could be introduced between different kinds of comets, the ones below the Moon, the others above the Moon (Maestlin); and, for those who thought that comets were above the Moon, it was still to be decided whether they were between the Moon and Venus (Tycho) or even beyond Saturn (Descartes). Some argued that the trajectories of comets were irregular, others that they were regular, and, among these, some that these trajectories were circular, such as Maestlin and Tycho, others that they were rectilinear, such as Kepler; and it was still to be decided whether or not their motion was uniform. Intimately linked to these points was the question in the defense of which system of the world comets could be enrolled. Kepler ended up remarking that there were as many arguments in favor of the motion of the Earth as there were comets, since their apparent paths result from the combination of their real rectilinear paths with the motion of the Earth. That the tails of comets were almost always opposed to the Sun was, since Peter Apian, generally taken as the proof that, contrary to what Aristotle believed, they are not ignited bodies, but, rather, that they resulted from the refraction of the rays of the Sun through the body of the comet, but the nature of this body was itself debated again and again.[16]

That men of letters and scientists were enthralled with these questions on comets in general, and on these comets in particular, was not specific to France; but there were nevertheless several intellectual and institutional circumstances that gave a specific twist to the French debate. It should be first recalled that the sixties were the first years of the war between Jesuits and Cartesians that was to enflame learned France until the late nineties at least. On the Cartesian side, Claude Clerselier, Descartes' friend, correspondent, translator and executor, had launched a campaign for the propagation of Descartes' works. The *Discours de la méthode* was reissued in Paris, while Descartes' unedited works were posthumously published under the supervision of his followers, who in addition published their own works and organized conferences presenting Descartes' doctrines. On the Jesuit side, Honoré Fabri received from Jean Bertet the letters where Descartes suggested a physical explanation of transubstantiation and censured it *privatim*, that is, unofficially, on 15 April 1660. Following some troubles in Leuven and then the official censures of the *carme déchaux* Agostino Tartaglia and the *somasque* Stefano Spinula, Descartes' works were put on the

[16] For a general, standard account on comets in the sixteenth and seventeenth century, see Ruffner 1971; Yeomans 1991: 1–68, *passim*. On Tycho, see Lerner 1996–1997: 39–66; on Kepler, see Bonner 2013: 105–134; on Galileo and Grassi, see Gal and Chen-Morris 2011. For an overview of recent historiographical trends on comets, see Mosley 2014.

Index of Prohibited Books *donec corrigantur* in Rome in 1663. This was not to be the end of the controversy between Jesuits and Cartesians: on the contrary, it was only the beginning of a war among French natural philosophers.[17]

The early sixties were also the period of gestation for the future *Académie des sciences*.[18] The letters of Henry Oldenburg, first secretary of the Royal Society, and of Christiaan Huygens, who after his stay in London during the spring of 1661 remained a correspondent of Robert Moray, made French scientists aware of the experimental commitment of the Royal Society, which rapidly became a model for them.[19] This model became all the more desired because the *Académie Montmor*, founded by the end of 1657, was known to be doomed because of its endless discussions and bitter quarrels—and it indeed came to its end in June 1664. As early as July 1663, among various men of letters, Jean Chapelain, Pierre Petit, Samuel Sorbière, Pierre de Carcavy, Marin Cureau de la Chambre, Johannes Hevelius and Christiaan Huygens were awarded pensions by the King.[20] In 1663, Samuel Sorbière, then secretary of the *Académie Montmor*, wrote a letter to Colbert in which he showed this already dying society in the most favorable light. Several other competing projects for the future Academy were written. The most interesting one is the project of the *Compagnie des sciences et des arts*, probably written in 1664 by Thévenot, Auzout and perhaps Petit, but two other proposals were composed in 1666, probably at the request of Colbert, one by Jean Chapelain and the other by Charles Perrault, both members of the *Petite Académie*, a council in charge of proposing initiatives to glorify the King. The *Académie des sciences* was finally founded in 1666.

Finally, it is also during these years that French elites began to discredit systematically the practice of astrology as a popular superstition. Advancing spiritual or temporal arguments against astrology was indeed an old affair. Judiciary astrology, that pretends to predict with certitude what will happen to a given human being (contrary to natural astrology that concerns natural events that will probably happen) had been condemned in 1586 in the *Constitutio contra exercentes astrologiae iudiciariae artem* and in the papal bull *Coeli et terrae Creator Deus*, then again in 1631 in the bull *Contra astrologos iudiciarios*. The official concern of these bulls was to preserve the freedom of will, but they were also linked

[17] Roux 2013 presents in details the controversy between Cartesians and Jesuits on natural philosophy.
[18] On the circumstances preceding the foundation of the *Académie des sciences* and the story of Montmor Academy, see the pioneering work of Brown 1934; Roux 2014: 58–72.
[19] The following letters are particularly telling: Chapelain to Huygens, 30 May 1661, Huygens to Chapelain, 14 July, Chapelain to Huygens, 20 July 1661, in Huygens 1888–1950, vol. III: 273, 295, 299.
[20] The complete list of those who received pensions is given in Huygens 1888–1950, vol. IV: 405–406.

to the fear of the social troubles that predictions of the death of a pope would imply. The condemnation of the Church was relayed during the whole century by French Jesuits who published treatises against astrological predictions in 1619 (Jean Leurochon), 1649 (Nicolas Caussin), 1657 (Jacques de Billy) 1660 (Jean François), 1681 (Claude-François Menestrier).[21] As for the several royal decrees that were issued in France against illicit predictions in 1560, 1579 and 1628, they were increasingly inspired by socio-political reasons, rather than by religious and metaphysical reasons. Contrary to the 1560 and 1579 decrees, the 1628 decree does not ground its condemnation of illicit predictions on the "express commandments of God" that Christian princes should respect, but rather on the fact that these predictions, being "useless and without certain foundations, can only embarrass weak minds who believe in them."[22] Despite all this, it is only during the reign of Louis XIV that the elites began to turn away from astrological practices, which were now perceived as low-class and despicable. The sixties may have been a turning point in this respect: in 1668 Jean de la Fontaine published *L'Astrologue qui se laisse tomber dans un puits*, a fable that asserts that the stars can not reveal us the will of God and that astrology is nothing but a scam; two years later, Molière issued *Les amants magnifiques*, a comedy that depicts an astrologer as a venal charlatan.

The two comets arrived in the midst of this—the debate on comets that had been refueled by Copernicus, Kepler, Tycho and their followers, the budding confrontation between the Jesuits and the Cartesians, the excitement preceding the establishment of the *Académie des sciences* and the growing disregard of the elites for astrology. My working hypothesis in this paper is that, in such circumstances, the two comets of 1664–1665 were an occasion for each camp to advocate publicly its positions about the proper principles for natural philosophy. By natural philosophical principles, I mean here two things. First, ontological principles, that is, what kinds of beings one should have recourse in order to explain comets—to wit, whether one should admit substantial forms, which system of the world one should favor, whether a body would go on for ever once it has been moved, etc. Secondly, I mean epistemological principles, namely: what kind of knowledge can be reached about the nature of comets and about the effects that they may bring about—for example, if

[21] Drévillon 1996: 40, 57–61, 185–186, 211, 228–230.

[22] These decrees are to be consulted in Decrusy *et al.* 1821–1833, vol. XIV: 71, 390–391, vol. XV: 215–216. Drévillon 1996: 65–66, 100. For similar considerations in the case of early modern England, see Schechner 1997: 70–87.

such knowledge is certain or only probable, if it relates to signs or to causes, if it is to be obtained mostly through the senses or through reason, etc.

It is also to be noted that, if some of the authors I am going to study are explicitly speaking in terms of principles and indeed conceive principles as the source of all knowledge—those who have good principles will reach true knowledge, while those who have bad principles will reach only an appearance of knowledge—others do not describe their epistemic chances to attain some kind of knowledge in these terms. In the case of the latter, it is us who introduce the question of principles in texts written by authors who certainly had some principles that organized their beliefs, but did not consider that it is important to make them explicit. One of the questions explored in this chapter is to determine who speaks in terms of principles and who does not, and what are the implications of these differences.

My questions clear, I would like to add a few words on the corpus dealt with in this chapter. It consists of all the books on comets, whether they were written in Latin or in French, published in France in 1664 and in 1665 that I could recover by a systematic search in nowadays catalogues. Though systematic, such a search is not without bias: as scientific correspondences like those of Ismaël Boulliau, Gian-Domenico Cassini, Johannes Hevelius, Christiaan Huygens or Giovan Battista Riccioli make clear, astronomical observations were not circulated through books, but through letters.[23] But it would be another paper to reconstruct how observations were gathered, circulated and compiled. As for the organization of the maze of books that were published, it appeared to me that the most efficient way to present them in this chapter is the following. I will first report on those that were mainly concerned with astrological predictions; then I will analyze the philosophical opposition that developed between Jesuits and Cartesians; in the third place I will turn to those whom I call the Montmorians, because at some point or another, they participated in the *Académie Montmor*; finally, I will say a few words on a few books that are unique for one reason or other.

ARISTOTELIAN PRINCIPLES FOR UNCERTAIN ASTROLOGICAL PROGNOSTICATIONS

The first group I want to consider are those books that, according to their titles, aim to predict the effects that the comets would have on natural and human affairs, or at least to determine if

[23] An important source for such a project would be Lubiniezky 1667.

such predictions are possible. In chronological order of publication, they are Sieur de Montalegre's *Discours sur le comete*, D. de Vaissey's *De novo cometa*, Julio Giustiniani's *L'explication de la comète*, Henry de Leschener's *Traité des comettes*, the anonymous *Figure de la derniere estoille*, Robert Luyt's *Questions curieuses sur la comète*, Sombreval's *Advertisssement du ciel* and Claude Comiers' *La nature et présage des comètes*. Even before analyzing the opinions defended in these books, it is to be noted that, apart from Comiers' book—which was not published until the fall of 1665, had probably a greater circulation than the other books, and was an exception in many respects—they were the very first books to be published, as their licence to print indicates.[24] This chronological primacy is counterweighed by two kinds of marginality, one rather social and the other rather intellectual.

While the authors belonging to the other groups resided in Paris, the authors of the first group, at least those who are known, were either foreigners or provincials who did not publish much, or at least did not publish much on such matters. Montalegre's name indicates that he was probably from the south of France and some passages of his book imply that he lived in Lyon.[25] Vaissey's letter introducing his verses was written in Chalon-sur-Saône, a town in Burgundy. Although "Giustiniani" is the name of an aristocratic family from Venice––Marc Antonio Giustiniani was the Venetian ambassador in Paris from 1665 to 1668—Julio Giustiniani was probably a Spaniard attached to the Queen Mother Anne of Austria, since his book is dedicated to her. The title of Leschener's book mentions that its author is of German origins and its dedication suggests that he had been close to Prince de Condé since the successful military campaigns that the latter led against the Spaniards before being their ally during *The Fronde*.[26] Luyt was a doctor in theology, preacher in Ordinary to the King, who had lifelong ecclesiastic charges at the church of Tonnerre, another small town in Burgundy; his book on comets was his only incursion in "scientific" matters, his other publications being those befitting a devout scholar who had a particular interest in retracing the history of local

[24] Montalegre 1665: License to print, 25–26 December 1664; Vaissey 1665: Letter dated from 4 January 1665; Giustiniani 1665: License to print, 25 February 1665; Luyt 1665: License to print, 12 March 1665; Sombreval 1665: Approbation from Doctors and Prosecutor of the King, 13–26 March; Comiers 1665: Dedication, 28 April 1665; Approbation from Doctors and Prosecutor of the King, 15–17 September 1665. Although *Figure de la derniere estoille extraordinaire* has no license and Leschener 1665 no license and an undated Dedication, since they mention only the first comet, it may be inferred that they were published in March at the latest.

[25] Montalegre 1665, Dedication, sig. A1r, Observations, sig. B1r.

[26] "Composé par Henry de Leschener, Allemand." In the context of a controversy on the spelling of Boulliau's name, Granet 1738: 264, mentions that Boulliau gave his approbation to this book and signed it "Boulliau." But this approbation cannot be anything but the "Avis d'un particulier au Libraire sur le Traitté des comettes," which is signed by the letters "F. H. L. de Paris." Moreover, Nellen 1994 does not mention in which circumstances Boulliau would have written this approbation. No other publication from Leschener is known.

saints and local noble women.[27] Sombreval is presented as "aumonier de la Reine," but I have not find any indication which queen; he probably lived in the vicinity of Lyon though, since his book was published by François Larchier, the printer from Lyon who three months earlier printed Montalegre's book to which he answers and the only extant copy of his book is to be found in the Municipal Library of Bourg-en-Bresse. Comiers was to be associated to Paris' learned circles from the early seventies on and to collaborate extensively to different learned journals, from the *Journal des savants* to the *Mercure galant*, passing by the *Nouveautés journalières concernant les sciences et les arts* and the *Journal des nouvelles découvertes*. However, at the time of his book on comets, which was his very first, he was merely provost of the chapter of Ternand, a village north of Lyon, a charge he had obtained ten years earlier from his first patron, the marquis de Saint-André Montbrun.[28]

This social marginality goes along with what we would perceive today as a kind of intellectual marginality. Leschener is the only one to have heard about the conference at the *collège de Clermont*, which may of course be explained by the fact that the books of this group were the first to be published.[29] But the scarce references to sixteenth-century astronomers and seventeenth-century natural philosophers clearly indicate that these authors were intellectually isolated. The author of *Figure de la derniere estoille extraordinaire,* Vaissey, Giustiniani and Luyt refer to nobody at all. The most frequent references of the other writers, Montalegre, Leschener, Sombreval and Comiers, are the ancients, whether Fathers from the church, philosophers, writers or poets. Leschener mentions in addition Copernicus, Tycho, Kepler, and Sombreval refers to Riccioli, Fromondus, Alsted, Gassendi,

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[27] On Robert Luyt (1609 or 1619–1667), see Matton 1979. His other books include: *L'antiquité renouvelée, ou l'Éclaircissement d'un raisonnable doute, par lequel on recherche de scavoir si les nouvelles opinions sont moins recevables que les anciennes*, 1647; *Table généalogique des seigneurs de la maison de Clermont en Daupbiné, comtes de Tonnerre*, 1648; *La plus éminente sagesse du christianisme. Jésus-Christ enfant, traité de dévotion en deux livres*, 1648; *La Régence des reynes en France, ou les Régentes*, 1649; *La princesse charitable et aulmoniere ou l'histoire de la reyne Marguerite de Bourgogne*, 1653; *La découverte d'un saint caché en la ville de Tonnerre, ou l'histoire de saint Micomer*, 1657; *Le plus illustre ornement de la noblesse, les ordres de chevallerie institués par les rois et princes souverains*, 1661.

[28] On Claude Comiers (?–1693), see "Comiers, Claude," *Dictionnaire des journalistes*, to be consulted on line at: http://dictionnaire-journalistes.gazettes18e.fr/journaliste/189-claude-comiers. Once in Paris, Comiers resumed his contributions to scientific journals in his books, among which *La duplication du cube, la trisection de l'angle, et l'inscription de l'heptagone régulier*, 1677; *Le pantographe physico-mathématique*, 1677; *Nouvelles instructions pour réunir les Eglises prétendues réformées à l'Eglise romaine*, 1678; *Lettres de Monsieur Comiers [...] à Mgr le Marquis de Seignelay, sur l'excellence et usages de la nouvelle pompe*, 1682; *La médecine universelle*, 1687; *L'art d'écrire et de parler occultement et sans soupçon*, 1690; *Traduction polyglotte du verset du psaume 112*, 1691; *Traité de la parole, langue et écritures*, 1691; *La baguette justifiée et ses effets démontrez naturels*, 1693; *Factum pour la baguette divinatoire*, 1693; *calendrier perpétuel et invariable*, 1693; *Pratique curieuse, ou les oracles des sibylles*, 1694.

[29] Leschener 1665: 5.

but this is only in passing.[30] Comiers is something of an exception: he refers not only to Copernicus, Tycho and Kepler, but also to Longomontanus, Regiomontanus, Fromondus, Galileo and Descartes.[31] Moreover, it is to be noted that Montalegre, Vaissey, Giustiniani, Luyt, Leschener, Sombreval and Comiers are not mentioned in the books of the other groups. Some of them address criticisms to astrologists, but in quite general terms, and, with the exception of Pierre Petit's *Dissertation sur la nature des comètes*, not by referring to specific books.

Although I group these books together because they were concerned with predictions, Giustiniani, Vaissey and the anonymous author of *Figure de la derniere estoille extraordinaire* are the only true astrologists in the group. Their books are quite short leaflets, Giustiniani's ten pages, on which I shall focus, being the longest and the most detailed. The immediate sensible qualities of the earlier comet—its color, its position among the astrological signs and its celestial orientation—are briefly described. From this description, it is immediately and categorically inferred that the comet will bring along dreadful events: its Saturnian color predicts many deaths; its position near the Hydra means that these deaths will happen on waters, and rather in naval battles than because of tempests; its head pointing towards the Orient is a sign that "these bad accidents are firm and true."[32] The only thing about which doubts are expressed is the location where these accidents will happen, but the conjecture is that they will not happen in France because of the great piety of its king. In a word, Giustiniani is not interested in discussing principles, whether ontological or epistemological. He does not say a word about the ontological principles necessary to explain the nature of the comet, and he does not reflect on the epistemological modalities of his predictions—as I just said, he is happy with the description of sensible qualities, taken as immediate signs of the misfortunes to come. This is all the more true for the seven pages of Vaissey's *De novo cometa… carmen prognosticum* and of the really quite brief *Figure de la derniere estoille extraordinaire et professie mistique sur l'apparition du dernier comete*, which does not even describe the particulars of these two comets, but only asserts that a comet is a "spark of God's wrath, which is threatening you with the eternal fire, against which the sinners can not guard, except if they convert early."[33]

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[30] Leschener 1665: 4–7, 10, 12; Sombreval 1665: 12–14.
[31] Comiers 1665: 29, 31, 34–35, 40, 58, 63, 100, 102, 131–132, 329, 340, 398, 432.
[32] Giustiniani 1665: 6. On the different signs to be taken into account in the practice of prognostication, see Schechner 1997: 51–65.
[33] *Figure de la derniere estoille*: 5.

The other books of this first group, however, are different. First, opinions on the nature of comets are expressed. Except for Comiers, their authors all endorse Aristotle's opinion that comets are exhalations and vapors that rise from the earth up into the air. Montalegre falls in with this opinion by convention, noting simply that, although there are several opinions on the nature of comets, this one is the most common. He adds however that there are not only terrestrial comets, resulting from exhalations of the earth, but celestial comets as well, resulting from exhalations from the other planets.[34] Without giving any explanation at all, Luyt admits that, as Aristotle and all the other philosophers after him would have claimed, comets are meteors that belong to the highest region of our terrestrial air.[35] Sombreval does not take sides with any opinion on the nature of comets, but it seems reasonable to conclude that he shares Aristotle's opinion, since he explains their effects by referring to Aristotle and does not mention the anti-Aristotelians of the day.[36] Leschener's view is more elaborated than those of Montalegre, Luyt and Sombreval: he is not satisfied with the idea that Aristotle's position is to be accepted because it is the most common, but gives arguments to support it. According to him, natural philosophy came back to childhood in its elderly age: maturity was reached during Aristotle's time, when it was thought that heavens are incorruptible and that comets are terrestrial exhalations enflamed by the Sun when reaching in the highest region of the air; with the modern opinion that comets are celestial phenomena, we would have regressed to childish pre-Aristotelian opinions.[37] Leschener knows that Tycho Brahe called upon the absence of parallax to place the comets above the moon, but he opposes this conclusion with the argument that it never happened that two astronomers situated at different places were able to observe the same comet at the same time.[38] He then discusses if comets are clouds illuminated by the Sun or perhaps real fires inflamed by the Sun, to finally declare himself favorable to the former.[39] Curiously enough, he still seems to prefer the Copernican system of the world.[40] As for Comiers, he presents himself as theologian by profession, who for nine years has only been able to exercise his talent as a mathematician during his leisure (he did go on to publish extensively and successfully books dealing with

[34] Montalegre 1664, Questions curieuses concernant les Comettes, sig. D2r–v.
[35] Luyt 1665, Question 3 and Question 6: 7–10 and 14–18.
[36] Sombreval 1665: 11–12.
[37] Leschener 1665: 1–5.
[38] Leschener 1665: 4–5, 7. This argument against the use of parallax is had been put forwards by Giambattista Riccioli in his *Almagestum novem*, Bologna, 1651. On the consequences Parisian textbooks draw from parallax, or from its absence, see Ariew 1999b: 110–112.
[39] Leschener 1665: 9–12.
[40] Leschener 1665: 10, 12.

a mis en forme : Anglais (E.U.)

fashionable mathematical and physical subjects, like cryptography, optical illusions, and, by the end of his life, the divining-rod).[41] After presenting the different existing opinions on comets, he presents his own theory, that comets are planets that were invisible but now became visible by reflecting the light of the sun. What characterizes his way of proceeding is a rare combination of deference to ancient authorities and use of experiments: as in the First Day of Galileo's *Dialogue*, which is briefly quoted for its view on comets, common optical and chemical experiments made on Earth are used to understand what happens in the Heavens.[42]

If Montalegre, Luyt, Leschener, Sombreval and Comiers have a different story to tell than those I called the true astrologers, it is also because of their ambivalent epistemological stance towards astrological predictions. On the one hand, they indisputably make predictions; on the other, they distance themselves from these predictions in all sorts of manners, rehearsing some of the already common arguments against astrology. First, reporting on the distinction between natural and judiciary astrology, they stress that their predictions are only natural predictions about some natural causes which will probably bring about some effects. For example, the dryness of the exhalations may bring bad crops that could cause famines, which could possibly in turn be causes of social turmoil. These are not judiciary predictions that state what will certainly happen to a given human being.[43] Although such a distinction was often linked to the distinction between comets as causes and comets as signs, Luyt and Sombreval are the only ones who mention it. Adopting an argument put forward by Claude Pithoys, Luyt notes that predictions are uncertain, not only because it is difficult to know where, when, to which and to whom they will apply, but also because the relation between a comet and its effects, whether the death of a prince or a war, is not a natural and necessary relation as the causal relation between heat and burning wood, but only a conventional relation as the relation between white and peace, so that it is only the experience of many centuries that shows us that there is indeed a relation between the appearance of comets and unfortunate events.[44] Secondly, they make the point again and again that astrological beliefs being typical of children, women and the lower classes who are unable to listen to the learned, their own predictions are just specious fantasies, railleries and mockeries only

[41] Comiers 1665, Preface: 3.
[42] Comiers 1665: 35, 132 for reference to the *Dialog*; 75–78, 84–88, 95–99, 104–105, 130–132, 135–136, 143–145 for terrestrial experiments.
[43] Comiers 1665: 355–356; Leschener 1665, Avis d'un particulier au libraire, n.p; Luyt 1665, Au Lecteur, sig. a3v. Drévillon 1996: 32–36 notes rightly that the exact boundary between natural and judiciary astrology was in practice difficult to draw.
[44] Luyt 1665, Questions 21–22: 49–55; Sombreval: 5.

proposed in order to entertain their readers.[45] Thirdly, they doubt if the effects of comets are positive or negative. Although the traditional view was that comets foreshadow misfortunes, natural calamities and human tragedies, Montalegre advocated as early as December 1664 that comets in general were either only natural signs or that, if they announce something, it is only joyful events. He does not give many arguments but explains that such an opinion "pleases his mood, which amounts to avoid increasing purposely my sorrows and voluntarily frightening myself." There are a few examples though: the defeat of the Barbarians, the defeat of the Turks and the defeat of the "Diabolic Sect" and "Infernal Cabal" of Protestants were announced by the comets that appeared in, respectively, 405, 725 and 1618.[46] As for the comets of 1664–1665 in particular, they would be the premises of a new Gold Age when peace will be guaranteed by Louis XIV and abundance furnished by the many treasures discovered in the Isle of Madagascar.[47] Sombreval wrote his *Advertissement du ciel* to defend against Montalegre the traditional view "that comets are ominous presages in the physical and in the moral world, namely dangerous alterations in nature and upheavals in the republics and the states; that they do not bring any good except by accident, because the unhappiness of one is always followed by the happiness of the other."[48] Sombreval relates Montalegre's mood to his name, Montalegre's literally meaning "joyful mount" and opposes to it the authorities "of the Ancients, of The Fathers and of the Church itself."[49] Luyt stands somewhere between Montalegre and Sombreval: he notes that, in general, comets forebode calamities, but adds that it can happen that they are used by God to give a premonition of future prosperity. As for the 1664–1665 comet, he thinks that it announces rather a joyful event.[50] Comiers went farther than Luyt and proposed what he himself called a "problematic treatment" of the presages of the comets: in order to leave to his readers the freedom to judge if comets are bad omens, good omens, or no omen at all, he presented on almost three

[45] Comiers 1665: 356; Leschener 1665: 16, 32, 46; Montalegre 1664, sig. B2r–v. M^me^ de Sévigné to Pomponne, 17 December 1664, in Sévigné 1853, I: 65, notes as well: "at the beginning, it was announced only by women, and it was mocked; but now everybody saw it [the first comet]." On the distinction of beliefs on comets in high and low cultures during the early modern period, see more generally Schechner 1997.

[46] Montalegre 1664, "Présages et prophéties qu'on doit attendre du comete present," sig. D1r–v. In the same vein, Indovino 1665 wrote that the 1664–1665 comets announced the defeat of Jansenism.

[47] Montalegre 1664, "Présages et prophéties qu'on doit attendre du comete present," sig. C2v–D1r. Louis XIV founded the *Compagnie des Indes orientales* in September 1664, a first expedition to Madagascar was prepared during the winter 1664 and the ships sailed off in March 1665.

[48] Sombreval 1665: 4.

[49] Sombreval 1665: 3. "Sombreval" meaning "dark valley," it is tempting to think that it was a pseudonym answering "Montalegre," but I could not find any confirmation of this hypothesis.

[50] Luyt 1665, Questions 18–20: 40–49.

hundred pages the facts in favor of each of these three different opinions successively.[51] But since he devotes more than two hundred pages to the circumstances in which the first opinion has been confirmed, only twenty pages to the second opinion, and ten pages to the third opinion, it is tempting to conclude that he believes that comets are indeed bad omens. This is confirmed by his "General conclusion on the presages of comets," where he asserts that, "after having presented reasons from both sides and left the question as if it was undecided," he abandons this reserve: his own belief, shared by Augustine, Kepler, Carolus Magnus and Sennert, is that comets are signs sent by God to make his wrath known to us.[52] Comiers' treatise could have stopped here, but he still deals with another question; whether the misfortunes associated with these two comets are the harbingers of the end of the world announced by the Antichrist. In order to answer this question, he enters the delicate interpretation of religious prophecies and finally concludes that the only relevant prophecy here is that the present King of France will establish a universal empire.[53]

To sum up, if there were still Aristotelians in late seventeenth-century France as far as the question of nature of comets is concerned, they were to be found among those who, even if not astrologers in the strict sense of the word, were nevertheless concerned with predictions and, in the case of Comiers, with prophecies. However, I have shown that not all of them were Aristotelian in this respect, and that among the three of them who were, Montalegre and Luyt were such by adherence to an established orthodoxy rather than because of careful arguments. As far as heliocentrism is concerned, both Leschener and Comiers imply that, were it not for the Church's condemnation, they would subscribe to Copernicus' principles.[54] As for their epistemological commitments, except for *L'explication de la comète* and for *Figure de la derniere estoille extraordinaire*, these books were not only distancing themselves socially from the vulgar astrological beliefs of women and members of the lower classes, they were also expressing epistemological doubts about the possibility of using comets to make any prediction at all. Although some of them present traditional arguments against astrology and discuss them, they do not engage in any polemics against the authors of

[51] Comiers 1665: 147–151.

[52] Comiers 1665: 432–436. *Pace* Drévillon 1996: 186, who, probably because he did not go farther than the Dedicace, writes that, according to Comiers, comets are "innocent."

[53] Comiers 1665: 466–480. On both the distinction and the complementarity of astrological predictions and religious prophecies, the first ones resulting from a human science using observation and reason, the second ones being given by God through direct revelation, see Boudet 1990. It is not clear whom Comiers was targeting; treatises on prophecies that he enumerates pp. 453–458 date from the sixteenth century. That there were such treatises at the time is however exemplified by Courcelles 1665.

[54] Leschener: 10, 12; Comiers 1665: 110.

these arguments; rather, the only existing controversy among them seems to be on whether comets are good or bad omens—a question that, in its own way, indicates that astrological beliefs were disappearing. Whether one considers ontology or epistemology, it is to be noted that these authors do not express themselves in terms of principles, even when there is some disagreement between them, as is the case between Montalegre and Sombreval. As we will see in the next section, the situation was different in the case of the Cartesians and the Jesuits.

CARTESIANS AND JESUITS: A PREDICTABLE CONFRONTATION ON ONTOLOGICAL PRINCIPLES

Cartesians and Jesuits are treated together in this chapter because they are the most well-defined groups, both in social and in epistemological terms, but also because of the controversy developing between them, or at least because of the confrontation between some of them. It all began during the learned ceremony—or courtly workshop, or scientific drama––that took place at the *collège de Clermont* as early as 10 January 1665, that is, only one month after the appearance of the first comet in Paris and at a moment when only prognostications by Giustiniani, Vaissey, and Montalegre were in circulation. The most detailed report of this event is to be found in the newly born *Journal des savants*, which presents "an admirable summary of all that happened at this conference."[55] In the presence of the Prince de Condé, his first male born the Duc d'Enghien, his brother the Prince de Conti, and of many prelates and noble persons from the Royal Court, four opinions concerning comets in general were successively defended.[56] A local Jesuit, Nicolas d'Harouys, first argued that comets were occasional clusters of small wandering stars, which were unseen beforehand. Then Gilles-Personne de Roberval, professor of mathematics at the neighboring *Collège royal*, said that he subscribed to Copernicus' system and that the comets were exhalations of what he called the elementary sphere, that is, the sphere that extends from the Earth to the Moon. The third one to speak was the physician Vincent Phelippeaux, at the time residing in Paris after he had caused some trouble in Leuven because of his Cartesian

[55] *Journal des scavans*, 28 January 1665, in Sallo 1665: 66–71. This event is reported with less scientific details, but with more insistence on the greatness of the assembly, in *La Gazette*, 17 January 1665, in Renaudot 1665: 67; it was also described in verses in *Gazette rimée*, in Loret 1857–1891, vol. IV: 299.

[56] Louis II de Bourbon-Condé, also known as Le Grand Condé (1621–1686), was at the time Prince de Condé; his son Henri-Jules de Bourbon-Condé (1643–1709) was Duc d'Enghien; his brother Armand de Bourbon-Conti (1629–1666) was Prince de Conti. On their scientific patronage, see Béguin 1999; on their education at Jesuit colleges, see Chérot 1896; on the scientific education that was more especially to be given to Louis de Bourbon (1669–1710) and to Louis-Henri (1692–1740), grandson and great-grandson of Le Grand Condé, see Mormiche 2011.

positions on the human body: he explained Descartes' opinion, according to which a comet is an obfuscated sun which does not belong to any vortex in particular but passes from one vortex to another.[57] Finally, another local Jesuit, Jacques Grandami, repeated what he had already asserted at the occasion of the comets of 1618, that they are parts of the celestial matter condensed by the action of the sun.[58] Still according *Journal des savants*, night fell and the conference came to an end before a third and last local Jesuit, Jean Garnier, could present his opinion, that comets are fires gathered in the air.[59] The order of the speeches was important: the Jesuits obviously wanted to open and to conclude a ceremony that was set up to organize the debate by bringing about the true doctrine while a variety of opinions were displayed. They were unsuccessful in the sense that the different protagonists left *collège de Clermont* without having reached a consensus. But they were successful in the sense that, thanks to the report of their meeting that was immediately published in *Journal des savants*, they set the agenda for most of the books published thereafter.[60] Moreover, the fact that these, together with Denis' book, are nowadays much easier to find in French libraries indicates that they most probably had a greater circulation than the other books in my corpus. In what follows, I first analyze some of the opinions that were presented in this conference; then I examine the Jesuit reaction to Jean-Baptiste Denis' anonymously published book defending Descartes' opinion on comets; finally, I report on Cartesians and Jesuits who stayed out of this confrontation: Jacques Rohault on the one side and, on the other side, Jacques de Billy's in Langres and Ignace-Gaston Pardies in Bordeaux, whose books had a much lesser circulation and are still more difficult to find today than those of the Parisian Jesuits.

Grandami's opinions are detailed in his March 1665, *Le cours de la comète*. In *Le parallèle de la comète* that he published two months later, he only argues that the two comets,

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[57] On Descartes' theory of comets, see Camerota 2002.

[58] Grandami 1665a: 16 mentions the 1618 observations. *Journal des scavans*, in Sallo 1665: 70, and Denis: 51–52, insist that Grandami was only rehearsing what he wrote fifty years beforehand.

[59] On Jean Garnier (1612–1681), see Kane 1940 and "Garnier, Jean," *Scholasticon*, to be consulted on line at http://scholasticon.ish-lyon.cnrs.fr/Database/Scholastiques_fr.php?ID=585. Garnier first taught humanities, philosophy and theology at *collège de Clermont*. Traces of his teaching at are to be found in his textbook, *Organi philosophiae rudimenta, seu Compendium logicae aristotelicae, traditum a J. G. P. S. J.*, 1651, in his *Physica*, Paris BNF, Ms. Lat. 11257 (on which Brockliss 1995: 203–204 comments briefly) and in the theses in philosophy that he made defend (*Theses peripateticae de logica philosophiae organo, propugnatae a nobilibus adolescentibus in collegio claromontano S.J.*, 1650; *Theses de philosophia morali morum magistra, propugnatae a nobilibus adolescentibus in collegio claromontano Societatis Jesu, a kalendis martiis anni 1650 ad kalendas julias ejusdem*, 1651). After a few years spent in Bourges, he came back in Paris and became the librarian of *collège de Clermont*, probably in 1674. In 1678, he published a *Systema bibliothecæ collegii parisiensis Societatis Jesu*, which is an outline of how to classify the books of this library, and, more generally, of any library.

[60] The January conference is mentioned in *L'esprit du sage*: 21–35; Croixmare 1665: 6; Leschener 1665: 5; Denis 1665: 17–149; Huet 1665: 233–234, who adds two other opinions on the nature of comets.

the one of December 1664–March 1665 and the one of March–April 1665, are different.[61] *Le cours de la comète* begins by presenting the numerical tables describing the trajectory of the first comet; it then includes the more philosophical *Traité de la comète*, which, according to the Dedication to Prince de Condé, reiterates what Grandami said in January on the nature of comets in general. The first point to be noted is that Grandami is no Aristotelian as far as the nature of comets is concerned; as Denis should ironically conclude in his criticisms of the Aristotelian position on comets, "at this famous conference held at the *collège de Clermont*… not even one philosopher was to be found, who but dared to suggest Aristotle's opinion."[62] Like most Jesuits from the beginning of the seventeenth century, Grandami adopts Tycho's main claims: he believes that the Sun revolves around the Earth while the other planets revolve around the Sun, that the celestial matter is fluid, that comets are situated above the Moon and even above the Sun, that they have a circular path, and that comets are made of incorruptible celestial matter, like stars and planets, although they are themselves corruptible.[63] When he discusses the location of the first comet, Grandami makes explicit that, contrary to Copernicans and following Riccioli's criticism of Kepler, he does not believe that comets move along straight lines; even if they had such a motion, this would be no more a proof of heliocentrism than the motion of Mars around the Sun is a proof of the motion of the Earth around the Sun.[64] He finally refers to an experiment he made a long time ago at Bourdelot Academy and a book he published more than twenty years earlier to establish that, magnetic bodies being immobile, and the Earth being a magnetic body, the Earth is immobile.[65]

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[61] Jacques Grandami (1588–1672), also known as Grandamy, occupied several important positions by the Jesuits, including those of rector at the colleges of Bourges, Rennes, Tours, and Rouen. Although he never taught mathematics, he had a lifelong interest in astronomy and cosmology: he observed the comets of 1618 and his first known publication was *Nova demonstratio immobilitatis terrae petita ex virtute magnetica*, 1645. From the mid-sixties on, probably in retirement, he published extensively in astronomy (*Deux eclipses en l'espace de quinze jours. La premiere de lune horizontale le 16. de juin. La seconde de soleil le 2. juillet. Supputées suivant les tables astronomiques de Kepler, du P. de Billy, & du P. Riccioli*, 1666; *Tractatus de eclipsibus solis et lunae, ex parte secundâ chronologiae christianae*, 1668), but also in sacred chronology (*De die supremo et natali Christi quaestio evangelica. In qua asseritur perfecta consensio annorum Christi et Aerae communis, in Ecclesia a mille et amplius annis* usu, 1661; *Tractatus euangelici. De summa dei gloria in Christo Iesu domino nostro. Ad materiam et formam concionum accomodati*, 1664; *Chronologia christiana. De Christo nato et rebus gestis ante et post eius nativitatem*, 1668).

[62] Denis 1665: 37–38.

[63] Grandami 1665a. Grandami's positions on comets are also analyzed in Ariew 1999b: 115–119. On the adoption of Tycho's cosmology by the Jesuits, see more generally Lerner 1995.

[64] Grandami 1665a: 17.

[65] Grandami 1665a: 19–21. On Grandami's magnetic demonstration that the earth is immobile, see Pumphrey 1990.

The main question that this Tychonian Jesuit had to deal with was how a corruptible comet could appear from such an incorruptible matter and if this implied the apparition of a new substantial form. Grandami's solution to this problem amounts to saying that a comet appears when the fluid celestial matter is condensed in such a way that it becomes able to reflect the rays of the Sun that it receives and to transmit them. Such a condensation does not imply a change from one substantial form to another—the corruption of a substance and the generation of another substance—but "only an accidental alteration, as the one occurring between flowing and iced water; or between milk and blood and clotted milk and blood, and finally between soft juices and the same things when they have hardened."[66] So far we have the material cause and the formal cause. As for the efficient cause that condenses celestial matter into comets, Grandami thinks that it is the natural virtue which the heavens, the Sun, the Moon and the planets received from God: "Nobody doubts that they condense clouds in the sky, that they harden gold and gems in the earth and pearls in the sea: why would they fail to have the virtue to condense and thicken comets in their own womb?"[67] To this, Grandami adds the swift motion of the celestial matter, which helps the compression of comets exactly as the wind helps with the condensation of clouds.[68] Finally, dealing with the final cause of comets leads Grandami to condemn astrology in quite classical terms.[69] If Grandami is no longer Aristotelian as far as the nature of comets is concerned, he is completely Aristotelian in the categories that structure his thought: the four causes, for example, and the kind of questions that he asks—for example, whether a comet and the celestial matter that surrounds it have the same substantial form or not.

To present in more details the other positions at stake at the January conference is difficult, if not impossible: there is no trace of Vincent Phelippeaux's discourse; the only known books by Nicolas d'Harouys are rhetorical pieces; as for Roberval, his only published writing dealing with comets is a chapter of the *Aristarchi Samii De mundi systemate, partibu… libellus* that he published twenty years earlier.[70] However, if one takes into account the theses that were defended at the *collège de Clermont* that year and Jean-Baptiste Denis'

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[66] Grandami 1665a: 2, translation from Ariew 1999b: 117.
[67] Grandami 1665a: 7.
[68] Grandami 1665a: 8.
[69] Grandami 1665a: 21–23.
[70] Roberval 1644: 114–137, according to which comets are exhalations of the Earth, which is provided with a sensible soul that draws air and rejects vapors and exhalations. *L'esprit du sage*: 36, confirms that Roberval did not publish the presentation he made at *collège de Clermont*: "It would be ungraceful to print something against somebody that only gave a talk (*qui n'a parlé que de vive voix*) and I would fear to attribute to him what he does not think."

Discours sur les comètes, a coherent story emerges, in which a war was waged against Descartes' natural philosophy. Three theses in mathematics were defended at the *collège de Clermont* on comets this year. (Without going into the details of what defending a thesis in a Jesuit college implied, it should be mentioned that Jesuit teachers wrote the theses of their students, that the oral defense consisted in resolving some problems mentioned in the written thesis, and that, for several institutional reasons, theses in mathematics allowed more space for discussion than theses in philosophy).[71] On 29 January, less than three weeks after the January conference, and at a period of the year most unusual for engaging oneself in such an exercise, Jérôme Tarteron defended a thesis called *De cometa ann. 1664 et 1665. Observationes mathematicae*.[72] Six months later, Louis Ragayne de La Picottière defended two theses in a row, *De duplici cometa vero et ficto positiones mathematicae* on 12 June, and *De hypothesi cartesiana positiones physicomathematica* on 13 June.[73] Even if Nicolas d'Harouys officially stopped teaching mathematics at the *collège de Clermont* in 1664, he was the one who wrote all these theses with the intention, first to expand on the view that he presented at the January conference that comets are clusters of small stars that happen to gather occasionally for a while, then to answer Denis' book, and, finally, to counter-attack Denis with a general criticism of Descartes' principles on natural philosophy.[74] This confrontation could have turned into a protracted controversy if Denis had answered; he did not however, nor did any of the contemporary followers of Descartes. This is why I describe it as a "confrontation" rather than "controversy."

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[71] On these details and on the content of the theses defended at *collège de Clermont* between 1637 and 1682, see Collacciani and Roux forthcoming.

[72] Jérôme Tarteron (1644–1720) was only twenty-two in 1666. He was to be a Jesuit teacher in humanities and rhetoric and to translate in French the Latin works of Persius, Juvenal and Horace. According to *Catalogue collectif de France*, this thesis is also attributed to Louis Prou; it was not unusual for different students to defend the same thesis. The letter from Guy Patin to Charles Spon, 1 January 1665, in Patin 2005, L. 806 may allude to this thesis: "It [the taxes] will be worse than the comet, which does not show up anymore. The Jesuits made a very dry thesis on that [the comet], where there is almost nothing to learn." In this case, there would be an error on the date of this letter, but it is anyhow a surprising date, because the first comet was still around at this time.

[73] I could not find any information on Louis Ragayne de la Picottière, but there were some Ragayne de la Picottière who were bourgeois in Sées, a small city in Normandy. According to *Catalogue collectif de France*, these theses were defended by Louis de la Bletonnière and Louis Prou as well.

[74] Nicolas d'Harouys (1622–1698) was to be rector at the Jesuit colleges of Rennes and Nantes. According to Dainville 1954: 111, he taught mathematics at *collège de Clermont* from 1661 to 1664, and was then replaced by Michel Beaussier, who came from La Flèche; however, *La Gazette*, 17 January 1665, in Renaudot 1665: 67, when presenting the Conference of 10 January, called him "Professor of Mathematics in this college." His known works are two Latin tragedies played at the *collège de Clermont* in 1659 and 1661 and, in between, a Panegyric to the Queen Marie-Theresa of Austria, who married Louis XIV in 1660. Although internal evidence is enough to attribute the three theses to him, this attribution can be externally confirmed by the letters from Huygens to his father, 15 January 1665 and from Petit to Huygens, 7 August 1665, in Huygens 1888–1950, vol. V: 195 and 433.

The first thesis, *De cometa ann. 1664 et 1665. Observationes mathematicae*, begins with the remark that, having discussed comets in general, it remains to deal with a particular comet.[75] Considering the chronology, the fact that, according to *Journal des scavans*, comets were discussed only in general during the January conference, and the resemblance between the opinion on comets defended in this thesis and d'Harouys view, it may very well be that at the January conference, d'Harouys presented his opinion on comets in general.[76] As for the body of the thesis, it consists of twenty-four sections entitled "observations." Each of these sections starts by presenting an observation in the strict sense of the word—that a comet appeared on our horizon, that it was seen out of the Zodiac, that it was seen for almost two months, that its tail changed its form, that its tail grew progressively before diminishing, etc.; it is then asserted that this observation cannot be explained by any of the competing opinions, except by the opinion that the comets are made by a cluster of innumerable small stars; a problem related to the observation at stake is finally formulated, probably to be solved by Tarteron during the defense.

In general, the authors of the competing opinions on comets are not identified by name, with the exception of Descartes, whose name appears in three of the problems that the young Tarteron was supposed to solve. Observations 12, 14 and 15 ask the defendant to "demonstrate that according to the first principle of the Cartesian doctrine (*e primario Cartesianae doctrinae principio*), which is quite necessary to explain the phenomena of comets, there would not be a cow, an elephant or another beast that would not be carried away by all its effort through the skies," to "prove that, according to the principles of the Cartesian philosophy (*ex principiis Cartesianae Philosophiae*), a comet created by God cannot maintain itself by itself," and to demonstrate that, "according to the famous law of the Cartesian philosophy (*ex celebrimo Cartesianae Philosophiae decreto*), it can happen that a comet, once set in motion, even slightly, will not stop moving before a chimera is produced."[77] At stake are Descartes' "principles" that, although comets are more solid than planets, they move more quickly; that no creature can exist without God's concurrence; and finally that, once something has been set in motion, it will continue to move forever.[78] It is not clear why d'Harouys highlighted these specific propositions, but it is clear that, already in the January thesis, Descartes' philosophy is characterized by its principles. D'Harouys' aim

[75] Tarteron 1665, sig. A1r.
[76] *Journal des scavans*, 28 January 1665, in Sallo 1665: 70.
[77] Tarteron 1665, Observatio 12, 14, 15: 7–8.
[78] Descartes, *Principia philosophiae*, III 126–127, I 51, II 35, in Descartes 1996, vol. VIII–1: resp. 174–177, 24 and 62–63.

was not only to fight against the explanation of comets proposed by Descartes, but, taking literally the claim that the whole system of the world depends on a few principles concerning matter and motion, to oppose these very principles because of the paradoxes that they imply. However, this is a relatively light opposition compared to what we shall see in the two June theses.

At some point in the spring, the young Jean-Baptiste Denis published anonymously a *Discours des comètes selon les principes de Mr. Descartes.*[79] Like d'Harouys in the *Observationes mathematicae*, Denis proceeds dialectically: Descartes's view is that comets are old stars which have been so obscured by their spots that they stop having their own vortices and began to wander from one vortex to the other. Denis intends to establish it by refuting the other opinions, first Aristotle's, then the four that were presented during the January conference. D'Harouys' position, which is introduced as first formulated by Democritus and Anaxagoras, is the one on which Denis is the more negative.[80] Interestingly enough, he uses comparisons that do not appear in *Observationes mathematicae*, but that could have been used orally by d'Harouys during the January conference: comets are like a swarm of gnats flying together or like a company of travelers riding together; their tails are like footmen that stand sometimes before the carriage and sometimes behind it.[81] His judgment on d'Harouys is particularly harsh: he would make as many suppositions as there are questions; his position would be contradictory.[82] According to Denis, while the others instituted "some principles that have no other use except for explaining the phenomena of comets [*ont pose des principes qui n'avoient aucun autre usage, que pour expliquer les Phœnomenes des Cometes*]," Descartes has recourse only to principles "that are used to

[79] On Jean-Baptiste Denis (c. 1640–1704), see "Denis, Jean-Baptiste," *Dictionnaire des journalistes*, to be consulted on line at http://dictionnaire-journalistes.gazettes18e.fr/journaliste/220-denis-jean-baptiste. Nothing is known for sure on Denis's initial formation, but, around 1664, he began to give conferences on scientific subjects on Saturdays at his home in Paris. His anonymously published book on comets was his first book; in 1667–1668 he performed experiments on the transfusion of the blood for which he was to be famous. In 1672–1673, he published a journal competing with *Journal des savants*, called first *Mémoires concernant les arts et les sciences*, then *Conférences présentées à Monseigneur le Dauphin*. It is in this Journal that, on 1 April 1672, while another comet was passing by, he admitted that he was the author of *Discours sur les comètes* (*Sixième Mémoire concernant les arts et les sciences*, in Denis 1682: 95). However, it was known that he was the author since, on 1671, the famous satirical *Requeste des Maistres es arts, Professeurs, & Regens de l'Université de Paris* required that "Sir Denis will be obliged to fix immediately and is own expense all the gaps and crevasses that he introduced in the heavenly vault in order to make a way for the last comets that appeared in 1664 and 1665" (Boileau Despreaux and Bernier 1671:7). Petit, Auzout and Cassini are then mentioned as attemting to Aristotle's authority.

[80] Denis 1665: 56–57, does not name d'Harouys by his name, but mentions "the professor that proposed [this opinion] a few months ago."

[81] Denis 1665: 59, 64–65, 70–71. The comparison with insects flying together is also employed in Petit 1665: 17, in reference to d'Harouys' opinion.

[82] Denis 1665: 62, 72.

explain all the physical motions, mostly the motions of planets, fixed stars, and other celestial bodies. So that, if somebody finds a difficulty in that, it won't come from the thing itself, but from him who, because he does not know well enough the principles of this philosophy, will have difficulties applying it [*celuy qui, n'estant pas verse dans les principes de cette Philosophie, aura peine à en faire l'application*]."[83] Denis adds that such principles might appear paradoxical to "those who had never a glance at another philosophy than the one of Aristotle," but that, if one does not accept them, one is obliged to stay with "occult qualities, secret influences, attractions, sympathies, antiperistases, and the other words that, because they fill in only the mouth and leave the mind void, are now reputed to be an asylum and refuge for ignorance."[84] In a word, Denis insists that the only existing alternative is between being an Aristotelian and being a Cartesian, and that this choice is a choice that does not only concern comets, but the general ontological principles that are to be defended in natural philosophy.

In June, d'Harouys replied to Denis's attack in two theses written as short treatises: in particular, unlike most theses in mixed mathematics they do not include problems to be solved by the defendant. While in the first of these theses, *De duplici cometa*, d'Harouys concentrated on comets, in the second one, *De hypothesi cartesiana*, he launched a much more general attack on Cartesian natural philosophy, explicitly formulated in terms of, and focusing on, principles. In the Foreword of *De duplici cometa vero et ficto positiones mathematicae*, d'Harouys explains that he had to write it because "the hypothesis on the matter of comets that he proposed and publically defended was recently attacked by a Cartesian (*Cartesianus quidem*) who forgot the Cartesian method, which seems to have this particularity, that it establishes its own claims as far as possible, but does not attack others' claims."[85] This unnamed Cartesian is Denis, not only because his book was published anonymously and because it actually proceeds by attacking the other opinions, but also because *De duplici cometa* is a point-by-point answer to *Discours de la comète*, based on the opposition between two comets, the true, or at least verisimilar comet, which is the comet in as much as it is described according to d'Harouys' principles, and the false and fantastic comet on the other hand, which is the comet in as much as it is explained by "the Cartesian." The first part (§§ 1–38) answers Denis' book paragraph by paragraph, and even line by line;

[83] Denis 1665: 77–78.
[84] Denis 1665: 105–106.
[85] Ragayne de la Picottière 1665a, sig. A1r. A few lines later, the assailant is accused of retaining his name purposely.

the second part (§§ 39-61) counterattacks by criticizing it, here again following it quite closely.[86] Last, but not least, is a list of paradoxes that would follow from Descartes' philosophy (*consectaria e principiis Cartesianae Philosophiae*). This list is interesting because, except for one consequence concerning Cartesian doubt (§ 31, "What is doubted by many is better known than what is doubted by nobody"), it concerns only natural philosophy, but also because it reveals which principles in Descartes' natural philosophy were difficult to digest for d'Harouys. First, there are paradoxes coming from the identification of matter and extension (§§1, 2, 3, 10, 11, 13, 27; for example §2, "The infinite in act is not only possible[87] in material things, it is also necessary," or §13, "God can not add or subtract anything to this universe, not even an insect or an atom"). To these first paradoxes, some paradoxes on magnitudes (for example §4, "The part is not smaller than the whole") may be related, the idea probably being that there is an infinite number of actual parts in a smaller chunk of matter as well as in a bigger chunk of matter. Second, there are paradoxes arising from the definition of motion that Descartes gave in *Principia philosophiae*, like §5, "There is not a particle of this universe that can change place," §6, "A boat following the course of the Rhône is as steady as a rock on the earth," §29, "In order to say that a body is at rest, it is not enough to say that it is immobile," or §32, "In the Copernican hypothesis, the Earth is much steadier than in the Tychonian hypothesis." Third, there are paradoxes arising from the reduction of qualities to matter and motion, for example from the reduction of solidity (§§14, 15, 20, 33), of hardness (§8, "If the parts of this air that we inhale would rest, they would be harder than any metal"), of attraction (§34) or of life (§§16, 22, "a clock can fall ill and die just like a horse"). For d'Harouys, a paradox is not something that contradicts a particular philosophical doctrine, let alone a theological one, but, true to the etymology, what goes against received opinions and revolts against common sense.[88] In particular, d'Harouys neither alludes to substantial forms and real accidents, nor speaks of the Eucharist, which were at the heart of the condemnation of Descartes in 1663.[89]

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[86] Ragayne de la Picottière 1665a, § 21, 27 and 31: 7–8, complains that Denis did not read the theses on comets and on magnetism that were defended one year earlier.

[87] The text read "In rebus materialibus, non tantum impossibile est infinitum actu, sed etiam necessarium," but one should read "possibile" rather than "impossibile."

[88] Ragayne de la Picottière 1665a, § 38: 10, explicitly says that, while some of Descartes "first dogmas" contradict the light of nature, others contradict the rules of art, and almost all of them contradict common sense.

[89] After many others, I told the story of this condemnation in Roux 2013: 63–65. Although it is improbable that such a condemnation was not known by the Jesuits teaching at the *collège de Clermont*, it is still to be established how it was diffused in France. For example, *Le Journal des savants* mentions it only in passing on the occasion of a review of Plempius' *Fundamenta medicinae* published in 1665 in Louvain, 1 February 1666:

The process of "principlization" triggered in this list—starting with a discussion on the comets, one ends up with an examination of the principles of Descartes' natural philosophy in general—is still amplified in *De hypothesi cartesiana positiones physicomathematicae* that was defended the next day. Moreover, while in *De duplici cometa* "mathematical positions" were at stake, in *De hypothesi cartesiana* "physico-mathematical positions" are presented. More precisely, *De hypothesi cartesiana* considers first the principles of "the Cartesian hypothesis" in general (part I), then one by one (part II), and finally with regards to their consequences (part III). D'Harouys obviously read *Principia philosophiae* very carefully: he takes numerous expressions *expressis verbis* from it. The first kind of problem that he encountered in Descartes' natural philosophy comes from its use of fictional hypotheses. D'Harouys points out repeatedly that Descartes allowed himself a certain *libertas fingendi* and that he presented his natural philosophy as a hypothesis, a fable and a fiction.[90] The title itself of the thesis, *De hypothesi cartesiana*, makes sense when one reads paragraphs 14 and 15 of the first part, according to which Descartes is only a mathematician who makes hypotheses and forges fictions, while Aristotle is a philosopher who advances true theses and explains the reality of things.[91] In another passage, d'Harouys refers to the astronomical machines that he built for teaching the different "astronomical hypotheses (the Ptolemaic system, the Copernican system, the semi-Copernican system, the Tychonian system, the Harouysian system and all the others" and makes the point that, although one can build machines full of gears to explain the motions of the stars, no sane person will assume that these machines can show how things actually happen in the sky.[92] Hence, the criticism that d'Harouys addresses to Descartes from a methodological point of view amounts to reestablishing the traditional division of labor between the mathematician and the natural

61: "He says that several articles from this doctrine were censured by the Faculty of Theology in Louvain, and that some books were condemned in Rome by the Inquisition, and reports its decree."

[90] Ragayne de la Picottière 1665b, I § 2, I § 18, III § 16: 3, 6, 15. This theme was already present in Ragayne de la Picottière 1665a, § 9: 5. It might refer to *Le monde*, in Descartes 1996, vol. XI: 31, 48, where Descartes presents his cosmology as a fable, in which case, as Domenico Collacciani pointed out to me, d'Harouys would have been a quite early reader of this book, which was first published in 1664. Note however that in the Preface that he wrote in 1647 for the French version of *Principia philosophiae*, Descartes recommended to his readers that they read the book "first in whole as if a novel (*tout entier ainsi qu'un roman*)," that is to say all at once, not interrupting the reading, and suspending the question of truth (Descartes 1996, vol. IX–2: 11). On the critic of Descartes' physics as being only a novel, that is an unjustified hypothesis, see Roux 2014: 77–84.

[91] Ragayne de la Picottière 1665b, I § 14–15, § 19: 5–6. The distinction between mathematical hypotheses and physical theses appeared already in the former thesis, but more briefly, see Ragayne de la Picottière 1665a, § 3, 4, 39: 3–4, 11.

[92] Ragayne de la Picottière 1665b, I § 7: 4. Garnier 1678: 118, gives a brief description of d'Harouys' machines and explains that, because of their number and magnitude, they could not be stored in the rooms of the Library, not to speak of the smaller rooms devoted to the museums, but had to be kept in a large room of their own. They were to be seen by eminent travelers, see for example Huygens' *Journal*, in Huygens 1888–1950, vol. XXII: 545; André de Graindorge to Huet, 9 May 1665 and 5 August 1665, in Tolmer 1942: 267, 303.

phlosopher and condemning Descartes for being only a mathematician. The second kind of problem that Cartesian natural philosophy arouses according to d'Harouys comes from Descartes' ontological principles. As in the thesis of the previous day, it is common sense which d'Harouys defends, against the paradoxes that, according to him, would be implied by the identification of matter and extension.[93] the existence of infinitely divisible parts in matter,[94] the confusion of animals and machines or the assimilation of nature and art,[95] the conservation of motion,[96] the transmission of motion from one body to another body,[97] the persistence of rectilinear motion,[98] etc. Contrary to the thesis defended the day before however, the final nail is put in the coffin: although briefly, it is said that, the one who follows Descartes' philosophical principles does not need substantial forms and that he can not explain the conversion of the bread and wine into the body and blood of Christ.[99]

The confrontation between d'Harouys and Denis thus presents three characteristics. First, there is what could be called a dialectization of the debate on comets. While Grandami presented his own opinions without discussing his contemporaries, except to mention their observations, both d'Harouys and Denis proceed dialectically, establishing their respective positions by refuting the opposing ones. Second, a polarization of the debate is also to be noted. While there were four positions at the January conference, even five if Garnier is taken into account, and much more if we consider all the books on comets published in 1665, Denis and d'Harouys ended up polarizing the debate between two and only two positions: the only choice is between being Cartesian or being a Jesuit. Third, and perhaps most importantly, there is a radicalization, or perhaps "principlization," of the debate, in the sense that it is no longer opinions on comets that are important, but, much more generally, the kind of ontological principles that are assumed in natural philosophy. In this respect, two things are relevant. First, this principlization manifests itself in words: d'Harouys and Denis use the term "principle" every single line. Second and foremost, principles enable these natural philosophers to draw boundaries and make the distinction between friends and foes. Friends are not those with whom one agrees on everything, but those with whom one agrees on principles. Some amount of disagreement was possible between the Jesuits, precisely as long

[93] Ragayne de la Picottière 1665b, I § 3–4: 3.
[94] Ragayne de la Picottière 1665b, I § 4–5, § 9, II § 18: 3–4, 11.
[95] Ragayne de la Picottière 1665b, I § 9, I § 23, II § 3: 4, 7, 9.
[96] Ragayne de la Picottière 1665b, I § 3, I § 22: 3, 7.
[97] Ragayne de la Picottière 1665b, II § 14: 10.
[98] Ragayne de la Picottière 1665b, II § 15: 10.
[99] Ragayne de la Picottière 1665b, II § 2–4, III § 22: 8, 16.

as it did not concern ontological principles: Grandami and d'Harouys did not agree with Aristotle, and not even between themselves on the origin of comets—d'Harouys said that they come from the gathering of small stars, while Grandami claimed that they result from the condensation of parts of celestial matter—but they nevertheless agreed on basic ontological assumptions, for example, that the nature of a material entity like a comet depends on its location in the universe, that there exist real qualities in nature, that every natural being is associated to a substantial form. These basic assumptions were the principles which they would not abandon and which defined the boundaries between their camp and the Cartesian. In a confrontation like this, Cartesians and Jesuits sometimes pretend that their principles were what everybody agrees on, although they were only what defined their intellectual identities against others'.

These three characteristics—dialectization, polarization, principlization—are often to be seen in protracted controversies, but as I noted at the beginning, the confrontation between Denis and d'Harouys did not develop after the June theses. Denis left the ground and there was no Cartesian to take over the fight against the Jesuits. Indeed, the notes taken by a lawyer on the lecture on comets that Jacques Rohault gave in his *Mercredis* that very year contain neither allusion to the January conference nor to any kind of controversy about the nature of comets between Cartesians and Jesuits or, more generally, "Ancient philosophers," as they were called. Rohault was apparently happy to establish that comets are neither stars nor planets, to put forward overused arguments against Aristotle and, finally, to shortly introduce the theory of comets that Descartes presented in *Principia philosophiae*.[100] On the Jesuit side as well, there was more variety in the field than one might have suspected. Without doubt, contemporaries took d'Harouys' theses as the official Jesuit answer to the Cartesian camp. Petit announced to Huygens "Denis was mistreated at the public disputes by the Jesuits because this same author has refuted Father Darouys (sic), and as you know these Gentlemen (*ces Messieurs*) do not forgive anything. They wanted to take their revenge by defending even their bad opinion that comets are the gathering of several stars."[101] Similarly, Oldenburg, who received the theses from Thévenot, immediately reported on them to Boyle, going as far as recopying most of the paradoxes with which the first thesis ends as well as the concluding paragraph of the second thesis.[102] It is striking however that, among the Jesuits, there were different ways of conceiving the interplay between natural philosophy and

[100] Rohault 1660–1661, fol. 83r–91r.
[101] Petit to Huygens, 7 August 1665, in Huygens 1888–1950, vol. V: 433.
[102] Oldenburg to Boyle, 14 July 1665, in Oldenburg 1965–1973, vol. II: 431–432.

astronomy than those illustrated by the Jesuits from *collège de Clermont* in Paris. This is particularly true of Jacques de Billy and Ignace-Gaston Pardies, both of them mathematicians, both of them settled in the provinces, the first in Dijon, the other in Bordeaux.

Jacques de Billy published two books on the 1664–1665 comets.[103] Like Grandami's *Parallèle des deux comètes*, the short *Traité de la comète* only attempts to establish that the first and the second are different comets; it ends with some brief considerations against judiciary astrology, against which Billy had already written a book.[104] The longer *Crisis astronomica de motu cometarum*, which was published in 1666, that is a year later than the other books I discuss in this chapter, is a technical astronomical book, devoted to refuting the opinion that the apparent motions of comets can be explained if one attributes to them rectilinear motions, in which case, as Kepler argued in his *De cometis libelli tres* in 1619, their variations of speed and their curvilinear paths would only be appearances resulting from the annual motion of the Earth, exactly as the stations and retrogradations of planets. Billy claims, rather, that comets follow the arc of great circles on the celestial spheres, as Tycho believed. He does not refer to Kepler and Tycho, however, but to two French astronomers: Adrien Auzout, whom I shall come back to in the next section, and Pardies, on whom I concentrate now.[105]

Like Billy, Pardies published two books on the 1664–1665 comets, one shorter in French and a longer one in Latin. [106] The shorter *Remarques sur les comètes et autres phaenomènes extraordinaires de ce temps* includes first some reports on recent well-attested

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[103] On Jacques de Billy (1602–1679), see Romano 1999: 564–565. Billy spent part of his career at *collège des Godrans*, Dijon's Jesuit college, where he filled various spiritual functions between 1638 and 1678; when a chair in mathematics was established in Dijon in 1666, he was the first professor to occupy it. He may have aimed at a wide readership through some of his short books that were written in French (*Le siège de Landrecy dédié au Roy*, 1637; *Abrégé des préceptes de l'algèbre*, 1637; *Le tombeau de l'astrologie judiciaire*, 1657). Most of them are however longish books written in Latin for specialists in pure and mixed mathematics. In astronomy, he published *Tabulae Lodoicoecae, seu universa Eclipseon doctrina tabulis, praeceptis ac demonstrationibus explicata*, 1656; *Le tombeau de l'astrologie Judiciaire*, 1657; *Opus astronomicum*, 1661; *Discours de la comète qui a paru l'an 1665 au mois d'avril*, 1665, and *Crisis astronomica de motu cometarum*, 1666. In mathematics, apart from *Nova geometriae clavis algebra*, 1643, and *Tractatus de proportione harmonica*, 1658, Billy is known for his editions of Diophantus (*Diophantus Geometra*, 1660; *Diophanti Alexandrini arithmeticorum libri sex*, 1670; *Diophanti redivivi, pars prior*, 1670).

[104] Billy 1665; Billy 1657.

[105] Billy 1666: 1, 8, 42–44.

[106] On Ignace-Gaston Pardies (1636–1673), see Ziggelaar 1971. Born in Pau, brilliant mathematician, Pardies was professor at La Rochelle and Bordeaux, then in Paris (1670–73). Already suspected for his "strange opinions (*opinions étrangères*)" while in La Rochelle, he was accused of Cartesianism after he published the *Discours du mouvement local* (1670); he wanted to wash away this accusation with his *Discours de la connaissance des bêtes* published in 1672, but this presented Descartes' thesis that animals have no soul with such verve that Pardies was definitively identified as a crypto-Cartesian.

extraordinary phenomena, like the ghosts that were seen during an earthquake in Canada or the rain of blood that fell on Apulia, then astronomical observations of our two comets.[107] The longer *Dissertatio de motu et natura cometarum* is a most interesting book. Pardies' intention is to put forward a hypothesis that would reduce the irregular motions of comets to regular motion as, he claimed, the hypothesis of ancient Chaldeans did.[108] Unlike other astronomers, especially Auzout, he is quite explicit on the different instruments for situating a comet among the stars and on the method to be used to calculate its direction and predicting its future positions, a method which relies on this hypothesis precisely.[109] The hypothesis he formulated is that comets have uniform rectilinear motions, an hypothesis already defended by Kepler.[110] Contrary to Kepler, however, Pardies does not associate such a rectilinear path with the transitory nature of comets; instead, he places comets among the eternal works of nature, and this, precisely because he sees rectilinear motion as the perpetual motion *par excellence*.[111] Gassendi had already claimed for comets not only rectilinear paths but an everlasting nature, but, in his case, it was not a problem since he supposed that the universe "begins nowhere and ends nowhere."[112] It is not clear whether Pardies realized that maintaining both rectilinear paths *and* a perpetual nature was somewhat contradictory in a finite universe, but, as an excursus on Seneca and the Ancients indicates, he may have thought that uniform rectilinear motions were only an approximation of the truth, which was that the comets moved along extremely large circumferences.[113] Later on in the book he defends opinions that cannot but sound Cartesian: the tails of comets would come into being because of a specific kind of refraction; there would be a celestial matter moving in vortices and carrying around the different planets; the direction of the tails of comets should be explained by the centrifugal effort that pushes away the lighter and more subtle parts; which would raise the question why planets do not have tails.[114] By the end of his *Dissertatio*

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[107] Pardies 1665a.

[108] Pardies 1665b, § 1, 20: 5, 47.

[109] Pardies 1665b, § 7–11: 16–24. On page 47, Pardies notes that Auzout probably relied on this method. Huygens is clear that the first one to propose this method was Kepler, see the minutes of the letter that he sent to Auzout, 12 February 1665, in Huygens 1888–1950, vol. V: 230.

[110] Pardies 1665b, § 1–2: 5–7. Kepler conceded that the rectilinear motion of comets was not uniform at the beginning and at the end of their trajectories, see *Astronomia pars optica*, in Kepler 1937–, vol. II: 287, quoted in Ruffner 1971: 181.

[111] Pardies 1665b, § 20: 48–49, to be compared with *De cometis libelli tres*: 93–94, in Kepler 1937–, vol. VIII: 213, quoted in Ruffner 1971: 181.

[112] Gassendi 1658: 710.

[113] Pardies 1665b, § 20: 50. Towards the end of his work, § 30: 65–66, he attributes to them a motion in spirals.

[114] Pardies 1665b, § 21–24: 51, 52–53, 53–54, 55, to be compared with Descartes, *Principia philosophiae*, III, 134–135, 30, *passim*, 58 *sqq.*, 139, in Descartes 1996, vol. VIII–1: 173–174, 92 *sqq*., 109 *sqq.*, 191.

anyhow, probably because Kepler, as we saw linked the opinion that comets have rectilinear paths to the defense of Copernicus Pardies takes care of distancing himself from heliocentrism.[115] Neither the senses nor reason can make us decide which system of the world is true, but, as theses defended by Chrétien François de Lamoignon at the *collège de Clermont* in 1663 prudently indicate, "even if it were true that the Earth moves and that the firmament stays immobile, the hypothesis that places every motion in the Heavens and that considers the Earth as immobile would be stronger," and this because "the one who puts the world in motion and who alone understands which of the two is moved, said so clearly, so distinctly and so expressly: *the Earth stands for ever: the Sun rises and sets, and changes it course at noon; sometimes it stands still, obeying God through the voice of a man*."[116]

Commenté [PA1]: It would be more natural to say 'said so clearly, distinctly and expressly'. Does the original have intensifying adverbs for 'distinctly' and 'expressly'?

Thus, although the confrontation between d'Harouys and Denis was perceived by their contemporaries as part of the controversy on principles that was then developing between Cartesians and Jesuits, it was not representative of all the attitudes available for Jesuits and Cartesians at this period. Rohault avoided entering this confrontation. Contrary to Grandami and d'Harouys, mathematician Jesuits like Billy and Pardies were practicing an observational and mathematical astronomy, which at first sight was not as concerned with establishing ontological principles as with finding the true locations and paths of the comets. However, the question which system of the world was to be adopted could not but lurk in the background of their enterprise, and it seems that Pardies was well aware of Descartes' doctrine concerning comets, and even somehow favorable to it.

BETWEEN GASSENDISM AND EXPERIMENTALISM: THE MONTMORIANS

The next group is constituted of members of the Montmor Academy, that came to a definite end in June 1664: its former secretary Samuel Sorbière, Caen's erudite Pierre-Daniel Huet, the astronomer Adrien Auzout and the *Intendant des fortifications* Pierre Petit. Contrary to the Jesuits and to the Cartesians, among whom one finds at least theoretically a certain uniformity of doctrine, in as much as they refer to an authoritative text, be it Descartes' or Aristotle's, the Montmorians do not defend the same opinions, adopt the same attitudes or even develop friendships among themselves. In order to carry out astronomical and

[115] Kepler, *De cometis libri tres*: 98, quoted in Ruffner 1971: 180. See also the letter to Herwart von Hohenburg, 7 October 1602, in Kepler 1937–, vol. XIV: 283, quoted in Ruffner 1971: 181.
[116] Pardies 1665b: 61–74, 69 for the quotation. On the political context of Lamoignon's thesis, see Lerner 2001: 534–537.

anatomical observations, Petit, Auzout and Thévenot began to meet independently from the other Montmorians, whom they reproached for being idle talkers, while Sorbière criticized them for their radical commitment to observations and experiments.[117] In this respect, one finds among Montmorians a distinction similar to the distinction to be found among Jesuits: some of them were astronomers actually committed to observations, the others were natural philosophers who, rather than making observations, refer to observations in a kind of rhetorical way. But in the case of Montmor Academy, there were personal enmities as well: while Sorbière condemned Petit for his crude manners, explaining for example to Hobbes that he is "apt to destroy orderly arrangement and philosophic moderation" and that "we know no one who is more of a troublemaker among the ex-Peripatetics or exponents of a more refined philosophy," Petit wrote to Oldenburg to accuse Sorbière of having unduly pretended to represent the Montmor Academy at the Royal Society.[118] Following the chronological order of their publications, I shall begin with the natural philosophers who were taking inspiration from Gassendi, Sorbière, Chapelain and Huet, and continue with Auzout and Petit who conceived themselves as astronomers, founding their work on observations and mathematics.

Samuel Sorbière was a multi-faceted man of letters who in 1654 converted from Protestantism to Catholicism out of careerism; he consequently succeeded in becoming one of the royal historiographers, in getting the patronage of Montmor and in being appointed secretary of Montmor Academy when it was officially founded in 1657.[119] In 1664 however, he wrote such a deprecating presentation of some of the most illustrious members and patrons of the Royal Society, whom he had visited in 1663, while the Montmor Academy was already nearing its end, that, to calm down the ensuing diplomatic tensions between France and England, he was stripped of his charge of historiographer and sent to lower Brittany for a few months. Returning to Paris from his short exile, he published in 26 January 1665 a *Discours sur la comete* in the form of a letter to Claude Auvry, Bishop of Constance.[120]

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[117] Petit to Huygens, 8 March and 5 May 1662, in Huygens 1888–1950, vol. IV: 73, 127; Petit, Auzout and Thévenot are mentioned meeting on Tuesdays in the letter from Petit to Huygens, 17 October 1664, in Huygens 1888–1950, vol. V: 124; they met Christopher Wren when he came to Paris a few years later (Oldenburg to Boyle, 24 August 1665, in Oldenburg 1965–1973, vol. II: 480). For more details, see Roux 2014: 67–69. As for Sorbière's judgment on them, see the letter to Colbert of 1663, commented in Roux 2014: 63–65.

[118] Sorbière to Hobbes, 5 January 1663 [?], in Hobbes 1994, II: 551–553; *Proceedings of the Royal Society*, the entry dated 21 October 1663.

[119] On Samuel Sorbière (1615–1670), see Sarahson 2004. Born Protestant in Languedoc, he was in Paris by the early forties, where he converted to Catholicism. In his letter to Charles Spon, 25 November 1653, in Patin 2015, L. 332, Patin placed his conversion among "the miracles of our ages which are rather political and economic rather than metaphysical." Believed to have fostered the quarrel between Gassendi and Descartes in the forties, he was friend and translator of Hobbes his lifetime long.

[120] Sorbière to Hobbes, 3 February 1665, in Hobbes 1994, vol. II: 668–669.

Sorbière mentions Boyle's experiments on the void that he may have seen at the Royal Society, but there is no other allusion to English scientists. His booklet is rather placed under the intellectual patronage of Gassendi: not only is it written in the form of a letter to Claude Auvry, who asked Gassendi his opinion on the 1654 lunar eclipse, but its explicit purpose is to say what Gassendi would have said on the 1664–1665 comets had he been alive.[121] However, Sorbière does not mention any specific observation concerning these particular comets and he refers only in passing to the opinion developed in the *Syntagma philosophicum* according to which comets would travel with uniform rectilinear motion. Instead he uses Gassendi to mark off the limits of Aristotle's, Galileo's and Descartes' the opinions on comets.[122] The reference to Gassendi is used as an occasion to get to grips with Descartes' philosophy in general, including his metaphysics. Sorbière recalls the reasons why one should resist Descartes' claim that void does not exist: void is a necessary principle in natural philosophy, without which it would be impossible to account for motion and for the distinction between bodies.[123] However, Sorbière's most important reproach to Descartes does not concern ontology, but rather his lack of certain intellectual virtues: contrary to Gassendi, who used to suspend his judgment, Descartes was imprudent and presumptuous.[124] Thus, Sorbière contrasts Gassendi's modesty to Descartes' dogmatism: while the first expressed clearly that, because of the imperfection of the instruments, the negligence and lack of exactitude of those who use these instruments and the absence of communication between observers, we can reach only conjectural knowledge when dealing with comets, the second pretended to "become the head of a party, or the founder of a sect, and to impose on the half-learned by the bold efforts of a fertile and strong imagination."[125] Although Sorbière uses the absence of parallax to refute Aristotle's stance that comets are sublunary meteors, he also insists that, while it is difficult to trust celestial observations in general, because of "the comets from different places," it is almost impossible to say anything certain about parallaxes, considering that we do not know the exact distances between two places and that we are not sure that the observations were made at the same time exactly.[126] Last but not least, Sorbière condemns Descartes for starting from unproven hypotheses that have no other

[121] Sorbière 1665: 1. Claude Auvry (1606–1687) became a favorite of Mazarin, who made him Évêque de Coutances (1646–1658) and Trésorier de la Sainte-Chapelle (1653–1687).
[122] Gassendi 1658: 700 *sqq.*
[123] Sorbière 1665: 11.
[124] Sorbière 1665: 11. See Roux 2014: 79–84, for other texts illustrating this "moral" criticism of Descartes.
[125] Sorbière 1665: 4, 17–18, 18 for the quotation.
[126] Sorbière 1665: 4–5, 7.

guarantee than "some metaphysical thoughts that are more embarrassing than persuading." Starting from such hypotheses, Descartes cannot prove that it is necessary that things happen in such a way, but only tell a story about how things could have happened.[127] In a word, what characterizes Sorbière is a certain use of the reference to Gassendi: his point is not to expand his doctrine on comets, nor to oppose to Gassendi's principles to Descartes', but to assert that what matters is the moral attitude that one adopts with regard to the discovery of truth.

The same kind of attitude is to be found in the letter Pierre-Daniel Huet sent to Chapelain by early March 1665, a letter that was published posthumously in his *Dissertations sur diverses matières de religion et de philologie*.[128] Although Huet did not come regularly to the meetings of Montmor Academy, he was introduced into this circle by Chapelain, took part to its meetings when he happened to be in Paris, and even presented a talk on glass-drop in 1661.[129] In 1662 or 1664, together with André Graindorge, he instituted a scientific circle in his house in Caen, which devoted most of its studies to anatomy, but which, between dissections, found time enough to comment on the 1664–1665 comets, if not to observe them.[130] In the letter he sent to Chapelain on the subject, he first presents seven different opinions, among which the five opinions presented at *collège de Clermont*, including the one that Garnier could not put forward because of the falling night, then the opinion that they are planets revolving around other suns that happen to pass by, and finally the opinion that they are inflamed bodies, which was proposed by Isaac Vossius. Then he unveils dialectically the difficulties that each of these opinions raises, in order to finally detail his own view, which he himself presents as an eclectic combination of what is the most valuable in the other opinions.[131] Even if Huet does not agree with Sorbière on what comets are and does not mention him either, he agrees with him in two other respects. First, he casts doubts not only on Descartes' opinion on comets, but on the principles that are supposed to ground this opinion: "Those principles [of Descartes] being so uncertain, and subject to so many

[127] Sorbière 1665: 10–16, 11 for the quotation.
[128] Chapelain acknowledges receipt of Huet's letter in the letter from 14 March 1665, in Chapelain 1880–1883, vol. II: 389–390. On Pierre-Daniel Huet (1630–1721), see Shelford 2007.
[129] Huet 1853: 106–108. The date of 1661 can be inferred from the letter from Chapelain to Huet, September 1661, vol. II: 152–153; Tolmer, in Graindorge 1942: 256, refers to two manuscripts corresponding to Huet's talk. Huet 1853: 107, had the same judgment as others on Montmor' secret commitment to Cartesianism, see for example Chapelain to Heinsius, 22 September 1667 and to Bernier, 16 February and 26 April 1669, in Chapelain 1880–1883, vol. II: 530, 622, 640; for more references to testimonies according to which Montmor's agenda when he established his Academy was to propagate Descartes' doctrine, see Roux 2014, note 42.
[130] Huet 1853: 143, asserts that Caen's academy was instituted in 1662; Huet 1706: 173, that it was at the occasion of the 1664 comet. Huet 1665: 145 confesses that because of bad weather and an eye ailment, he was not able to observe it; observations are however mentioned in Huet 1853: 145, 198–199. These and other contradictions are examined and solved in Lux 1989: 22–28.
[131] Huet 1665.

contestations and objections, from which his supporters will not be able to extricate themselves, the consequences that he draws from them to establish the nature of comets are no more certain."[132] Second, he adopts a skeptical stance that was then considered as the main feature of Gassendism, concluding in particular that "he is not in love [with his hypothesis] enough, for not being ready to change it when something more verisimilar will have been found."[133] Thus, like Sorbière, Huet identified Descartes through his principles; contrary to the Jesuits, he does not want to juxtapose him against other principles, but against another moral attitude to the discovery of truth.

That this was a general characteristic of Gassendism in this period can be confirmed briefly through Chapelain. His own view on comets is that they are a kind of planet that revolve around a remote Sun, so that we see them only when they happen to pass close to our solar system.[134] His judgment on Sorbière's book is harsh, but it is probably out of personal enmity rather than skeptical attitude towards it.[135] In a letter to Huet, Chapelain indicates "in a question as problematic as the one on the nature and the motions of comets, it would be imprudent to give one's definitive opinion and, according to me, it is only permitted to fall in with the most verisimilar opinion until another opinion comes up, where more probability is to be seen."[136]

Auzout and Petit were different from the Gassendist Montmorians; they emphasize not so much the uncertainty of all knowledge than the necessity to develop expert observational and mathematical skills. To put their texts in proper context, it should be remembered that, as early as in the spring of 1662, Petit, Auzout and "a bit," Thévenot, who felt themselves as lone partisans of experiments among the Montmorians, began to carry out various astronomical observations on their own.[137] One year later, in the spring of 1663, Huygens

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[132] Huet 1665: 236. On Huet's anti-Cartesianism, see Shelford 2007: 133–136, 163–183.

[133] Huet 1665: 245. On Huet's Gassendism and skepticism, see Shelford 2007: 120–126, 136, *passim*.

[134] Chapelain to Graindorge, 3 April 1665, in Collas 1912: 336.

[135] Chapelain to abbé de Francheville, 16 March 1665, in Chapelain 1880–1883, II 39: "there are several places where he [Sorbière] stepped aside from what he [Gassendi] meant, not to contradict him, but for want of understanding him. He speaks easily, but he does not bite into things, and I do not know why he takes the risk of treating them, while his genius is so improper. The book of this Gentleman (*ce Monsieur là*), which was celebrated, does not sell. If it was ever published, it was at the expense of his purse."

[136] Chapelain to Huet, 6 April 1665, in Chapelain 1880–1883, vol. II: 393.

[137] Petit to Huygens, 8 March and 5 May 1662, in Huygens 1888–1950, vol. IV: 73 and 127. From the beginning of his correspondence with Huygens, Petit complained of the way in which, in France, people of quality neglected mechanics, see Petit to Huygens, 18 October 1658, in Huygens 1888–1950, vol. II: 257. Petit, Auzout and Thévenot are mentioned meeting on Tuesdays in the letter from Petit to Huygens, 17 October 1664, in Huygens 1888–1950, vol. V: 124. The same three would meet Christopher Wren when he came to Paris a few years later (Oldenburg to Boyle, 24 August 1665, in Oldenburg 1965–1973, vol. II: 480).

being in Paris, a "general assembly for telescopes" was organized at the home of Auzout: the power of various telescopes was tested by Auzout, Huygens, Petit, Monconys, and Étienne d'Espagnet, who used a new process to make the lenses for some of these telescopes.[138] The issue of the day in 1663 was also to establish "new laws and ordinances" for the *Académie Montmor*, or rather to re-found it in a new form, giving it a much more experimental and practical orientation. The project written on this occasion, known as the project of the *Compagnie des sciences et des arts* has a very Baconian orientation: it insists on linking together the sciences and the arts, on writing histories of nature and of the arts, on making discoveries useful to the public, on testing secrets, etc.[139] The attitude of this group is well summarized by the quite negative verdict that Boulliau returned when Lubiniezky happened to ask about Denis' book, which I discussed above, and *Le Courrier de traverse ou le tri-comète*, which I will discuss below: "since both of these authors do not pay attention to the astronomical foundations that exact observations are, I think that they have neither understood this matter correctly nor defined it properly."[140]

Of the astronomers, Auzout was particularly active on an international level, exchanging observations with foreign correspondents, like Huygens, Cassini, Hevelius, and, through Oldenburg, with the English virtuosi.[141] He was respected for that and his name is mentioned with praise by all protagonists of the debate, sometimes associated to those of Pardies and Cassini because the three of them proposed ephemerides.[142] He published successively *L'éphéméride du comète* (at the end of January), *L'éphéméride du nouveau comète* and the *Lettre à Monsieur L'abbé Charles sur le Ragguaglio di due nove osservationi, etc.*, *da Guiuseppe Campani* (both of them by mid-April). Auzout did not take a stand on the nature of comets in any of these, and his central claim is rather that, with only three observations at his disposal, he was able to find out what he calls the "law" of the

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[138] Christiaan Huygens to Lodewijk Huygens, 6 April 1663, in Huygens 1888–1950, vol. IV: 324–325. Christiaan Huygens to [Constantyn Huygens], 20 April and 4 May 1663, in Huygens 1888–1950, vol. IV: 333, 338. Contrary to what the editors of Huygens's *Œuvres complètes* affirm, the d'Espagnet who appears here can not be the chemist Jean d'Espagnet (1564–1637?), first *Président* of the *Parlement* of Bordeaux: it is more likely his son, Étienne d'Espagnet, counselor at the same *Parlement*.

[139] Huygens 1888–1950, vol. IV: 325–329, commented in Roux 2014: 69–71.

[140] Boulliau to Lubiniezky, 14 August 1665, in Lubiniezky 1667: 533.

[141] On Adrien Auzout (1622–1691), see Brown 1934: 138–141 and "Auzout, Adrien" in Gillispie et al. 2008: 341–342. Auzout was an aristocrat born in Rouen who in the late forties contributed to Pascal's experiments on the vacuum, in particular with the experiment of the vacuum in the vacuum. He worked as an astronomer with Jean Picard at the *Académie des sciences* and at the Royal Observatory, of which he was briefly a member (1666–1668) before retiring to Italy and England, for having criticized Charles Perrault's translation of Vitruvius.

[142] Billy 1665: 4; Grandami 1665a: 9–10; Grandami 1665b: 6; Denis 1665a: 49–50 and 122–123; Petit 1665: 194–195, 303–308, *passim*.

comet. However, he formulates explicitly neither this law nor the method that would have allowed him to deduce it from observations. The only thing he provides his readers with are tables predicting the positions of the comet from early December 1664 to early February 1665.[143] In fact, *L'éphéméride du comète* was out only *after* the dates of his alleged predictions. Auzout himself claimed that it was the fault of the printer and called upon Huygens, Thévenot and Petit to give a testimony that his predictions preceded the publication of the book.[144] But in a letter to Thévenot, Huygens notes "that they should be suppressed rather than to raise the suspicion of a falsification."[145] If this suspicion was so easy to have—Huygens undoubtedly appreciated Auzout—one can ask oneself why Auzout was so keen on boasting to have found out the law of the comet.

One of the obvious reasons was that he wished that the King, to whom his first *Éphéméride* is dedicated, would support the construction of large telescopes and an astronomical observatory. As he wrote in the *Lettre à Monsieur L'abbé Charles*, he did not want to publish any book, knowing that being an author carries unwanted consequences, but he changed his mind when the comet appeared, because, as he was the first to predict its day-by-day progression, it gave him the opportunity to make the King understand that Paris was lacking the wherewithal for exact observations, and that a proper place with suitably qualified men and up-to-date instruments was called for. Consequently, Auzout's *Éphémérides* rest on two almost contradictory constraints: on the one hand, he has to brag about an important discovery based on exact observations; on the other hand, he has to make the point that he made his observations with only ropes, rulers, set squares and sticks, and that he would have done much better with proper equipment. He makes it no secret that, in this way, he wanted to contribute to the establishment of the *Compagnie des sciences et des arts*, the glory of the King and the reputation of France demanding that such a company would be supported and subsidized by the King. [146]

Besides this question of patronage, the law of the comet was important in at least two other respects for Auzout. First, it helped him make the point that subjecting comets to laws and showing that they are natural bodies that have regular motions demonstrate that they have no signification at all, astrological or other; and, if one comet has no signification, neither do

Commenté [PA2]: Too many 'propers' in this sentence.

Commenté [S3]: It was intended! But never mind, it you did not understand it that way, most readers won't.

[143] Auzout 1665a: 7–8: 1, he says that he will later on "explain" the law if it happens to be true. As I mentioned earlier, his method was used already by Kepler and explicitly formulated by Pardies.
[144] Auzout 1665a: 6.
[145] Huygens to Thévenot, 29 January 1665, in Huygens 1888–1950, vol. V: 210.
[146] Auzout 1665a, Au Roy, n.p.; Auzout 1665c, Au lecteur, n.p.

two or three.[147] Secondly, Auzout initially hoped that comets might help to decide if the Earth moves or not.[148] Although his method for predicting the future positions of comets presupposes that comets have rectilinear paths and although it was known to his correspondents that such was his conviction,[149] he does not mention it in his first books, perhaps because it was difficult to express such a conviction in works dedicated to the King, because it had been linked by Kepler to heliocentrism. In his third book, however, Auzout openly declares his Copernicanism and writes quite explicitly that comets might give us reasons to believe that the Earth moves, not "by a mathematical and metaphysical conviction," but "by a conviction as reasonable as the conviction which makes us judge that the Sun and the planets do not revolve around Jupiter and Saturn, but rather all the planets including Jupiter and Saturn around the Sun."[150] Quoting and following the Jesuit Honoré Fabri, Auzout explains then that the condemnation of heliocentrism by the Church was meant to be only provisional, "in order to prevent the scandal that novelty causes or could cause," with respect to what the common opinions were at a certain time.[151]

Although Auzout was known in these years to oppose the Cartesians, especially Rohault, he does not allude here to Descartes' opinion on comets, probably because he was not interested in saying anything on the nature of comets, but in finding their laws.[152] It is not the same with Petit, who was a lifelong opponent to Descartes.[153] In certain respects,

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[147] Auzout 1665b: 7. The opposition between being a natural cause and being a divine sign is constant in the literature on comets.

[148] Auzout 1665a: 6; Auzout 1665b: 5.

[149] Huygens to Thévenot, 29 January 1665 and to Auzout himself, 12 February 1665, in Huygens 1888–1950, vol. V: 210, 230; Chapelain to Huet, 24 May 1665, in Chapelain 1880–1883, vol. II: 396.

[150] Auzout 1665c: 17–18, 54 for the quotation.

[151] Auzout 1665c: 49–56, which is resumed in *Journal des savants*, 11 January 1666, in Salo 1666: 22. See Lerner 2001: 536–545, for other restrictions by French theologians and scientists concerning Galileo's condemnation.

[152] Huygens 1888–1950, vol. XXII: 543, mentions for example "a dispute between Rohault and Auzout." Auzout 1665c: 22–23, attacks however Descartes' proposition for grinding hyperbolic lenses for being only a theory, that can not be "reduced in practice" and "reduced in use."

[153] Pierre Petit (1598–1682), born in Montluçon, resided in Paris from 1633 on as *Commissaire provincial de l'artillerie*. When *Discourse on Method* and the *Essays* were published, he wrote objections against Descartes' metaphysics and his explanation of refraction, which Descartes treated contemptuously; a few years later, Petit communicated Torricelli's experiment to Pascal and helped him to make barometric experiments. He became *Intendant général des fortifications* in 1649; since he was part of various scientific circles in France, it was a bitter blow to him that he was never appointed member of the *Académie des sciences* (see the letter from Boulliau quoted by Brown 1934: 138). The explanation is perhaps to be found in his character as well as in the confusion of his writings; see the cruel portrait made of him in a letter from Sorbière to Hobbes quoted *supra*, note 102; and Christiaan Huygens to Lodewijk Huygens, 28 September and 9 November 1662, in Huygens 1888–1950, vol. IV: 241, 256, *passim*. In April 1667 however, he was elected at the Royal Society. His book on comets was commissioned by the King, see Petit 1665: 347; Patin to André Falconnet, 30 December 1664, in Patin 2015, L. 805. According to Petit to Huygens, 23 January 1665, in Huygens 1888–1950, vol. V: 207, it was written "for the Court and the Ladies rather than for Mathematics."

however, Auzout and Petit have similar positions. Like Auzout, Petit dedicates his book to the King and also has the ambition to discover some regularity in the appearance of comets. In Petit's case, the idea is that each comet describes a very large circle and appears at regular intervals.[154] In the case of the 1664–1665 comet, it would be every forty-six years. This number comes from Petit's conjecture that the 1664 comet is the same as the 1618 comet. He then notes that 1664 minus 1618 equals forty-six and continues that 1618 minus 1572 also equals forty-six. As the reader might know, what appeared in 1572, according to Tycho's observations, was not a comet, but a star. Yet Petit argues that the brilliant star discovered by Tycho might have prevented us from seeing a less brilliant comet, and then searches in various historical reports for proofs of the apparition of a comet every forty-six years.[155] The last point that Petit has in common with Auzout, but not the least, is that he was a Copernican, or at least, as Huygens would say, a "semi-Copernicist," since he accepted the daily rotation of the Earth but not its annual rotation.[156] To the usual arguments against the condemnation of Galileo—for example that the Church may not have authority concerning natural matters—Petit adds a Gallican argument, according to which the Church of Rome has no authority to promulgate a decree in France until it has been approved by the Parliament and the Faculty of Theology of Paris.[157]

Apart from his determination to find some regularity in the paths of comets and from his commitment to Copernicanism, Petit is different from Auzout, if only for the length and confusion of his book, which piles appendix upon appendix, each written when Petit happened to read a new book on comets—as he explained at some point, he had to "write hastily, at the same time as his book was printed."[158] In one of these appendices, he criticizes not only astrology in general, but also Leschener, in order to show that "he is not feigning enemies in order to fight against them."[159] Another appendix, the longest of all with almost

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[154] Petit 1665: 58, 272, is explicit that a comet can not have a rectilinear motion because, according to him, this kind of motion would be infinite, which would be impossible.

[155] Petit 1665: 47–55.

[156] Huygens to Petit, 8 October 1665, in Huygens 1888–1950, vol. V: 499; on 6 November: 530–531, Petit answered that he was in fact a full Copernican, but that "he did not want to show it by fear of looking like a ridiculous fool in our Court and among most of the honorable people in France. In the same letter, he added that he and Auzout now doubted how to deduce Copernicanism from the motion of comets; the reason for this doubt might be that, contrary to the motion of the first comet, the motion of the second one could not be rectilinear, see Huygens to Moray, 29 May 1664, in Huygens 1888–1950, vol. V: 361. According to Ariew 1999b: 114, Garnier defended such a semi-Copernican system in his 1651 course.

[157] Petit 1665: 151–155. On this argument, see Lerner 2001: 517–519, 531–533, 536.

[158] Petit 1665: 218.

[159] Petit 1665: 149 for the quotation, 153–182 for the criticism of Leschener. Comiers is criticized only in passing, in Petit 1665: 206–209.

seventy pages, is entirely devoted to refute the opinion of Denis, whom Petit did not identify: he is explicit that he does not know who hides behind the initials "I.D.P.M" under which Denis published his book.[160] At the beginning of his book, Petit reported Descartes' opinion on comets, but, rather than criticizing it in detail, he only indicated that "according to many, to report it and to refute it is the same thing."[161] But, when reading Denis' book, he explains, he decided to make public his judgment on Descartes' explanation of comets: the hypothesis that spots would completely cover the Sun is "visionary" and "does not conform to the laws of nature and mechanics about which those who defend Descartes' opinions speak so much"; how heavy comets could be moved by vortices of subtle matter is not comprehensible; Descartes' explanation of the tail of comets is "an enigma"; it is "evidently false" that comets are not going faster when they appear than afterwards.[162] Once again however, the question at stake is not only the question of comets, but, much more generally, Descartes' natural philosophy in general: subtle matter was only invented as an *ad hoc* explanation of Torricelli's quicksilver experiment; "sense and experiments" refute the "nice words and arguments drawn from the obscure, arrogant and presumptuous principles" through which Descartes pretended to explain how fire comes from flintstone; Steno proved that most of Cartesian anatomy is a fantasy.[163] And all these false explanations derive from fundamental errors: contrary to what Denis claimed, Descartes introduces particular principles for the phenomena he wants to explain; his very notion of explanation relies on a sophism, which consists of believing that one should consider that a hypothesis is proven if it is sufficient to account for an effect.[164] To conclude, quoting one of the many passages where Descartes says that, if one of his explanations is false, then his whole philosophy is false, Petit takes him at his word and concludes that, indeed, the whole of his philosophy might be false.[165]

Interestingly enough, such a criticism of Descartes is not grounded in a simplistic opposition between reason and observations. In several places, Petit insists that unfortunately amateurs are meddling in "scribbling paper and making printers sweat in winter," the result of which is that we have too many reports which contradict each other, preventing the establishment of the truth and wearing down the trust that good observations should inspire.

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[160] Petit 1665: 184.
[161] Petit 1665: 14–16.
[162] Petit 1665: 235–250, and 211–215, 213, 215 for the quotations.
[163] Petit 1665: 222–223, 252–254. Nicolas Steno (1638–1686) spent winter 1664–1665 at Thévenot's house, where the remnants of Montmor Academy met: he performed many dissections for Thévenot's guests.
[164] Petit 1665: 230–231, 251–252.
[165] Petit 1665: 255.

Hence both the necessity and the difficulty of distinguishing between skilled astronomers, who have the best instruments, and those who, with only "bad paper astrolabes" and not versed in astronomy, mistake latitudes and declinations, indicate meridian heights that are impossible and contradictory, and believe that they have seen the two comets at the same time.[166] Discriminating between reliable and unreliable testimonies does not concern only astronomical observations, but also the historical reports on which astrological pretentions were grounded. As Sorbière notes, the astrologers used to argue that "there is no better reason and no rule more assured, than the experience, about which the historians give evidence. And if in politics, medicine, and civil life, this kind of proof is received, it should not be rejected from astrology and the predictions made thanks to comets."[167] This is why Sorbière's refutation of astrology does not only concern unreasonable beliefs, such as the confusion between antecedents and causes, but also false, approximate or credulous testimonies.[168]

The Montmorians can be considered as a group not only because they happened to participate to Montmor Academy at some point, but also because of their commitment to a natural philosophy based on observations and experiments and because of their anti-Cartesianism. Although they might have some ontological reasons for not appreciating Descartes' way of philosophizing—Sorbière argued for example that there is necessarily some void in nature—their main reasons for objecting to it were rather linked to what they saw as the primary intellectual virtues: they thought that Descartes was too much of a dogmatist, imbued with his own ideas. Thus, contrary to d'Harouys, it was not in terms of ontological principles that they argued against Descartes; they rather objected to him because of his moral attitude towards truth and its discovery. However all of them did not have exactly the same attitudes towards truth: while men of letters like Sorbière, Huet and Chapelain were advocating a mild skepticism, in which observations are called upon rather than actually done, Petit and Auzout, as practitioners of mixed mathematics, were committed to the discovery of natural truths through observations. Strangely enough, while both of them thought that comets might be enrolled in the defense of Copernicanism, they did not attribute to them the same kind of trajectory, Auzout thinking that it is rectilinear, and Petit that it is circular.

Commenté [PA4]: I suggest 'metaphysical'

Commenté [S5]: I prefer "ontological". IN the French context of this time, "metaphysics" means what refers to the soul and to God (= Cartesian meaning). It is only with Malebranche that "metaphysics" began to refer to first principles in general. And my guess would be that the Newtonian sense (what is not empirical) was introduced only later on.

SOME ISOLATED VOICES

[166] Petit 1665: 76, 259–260, 278.
[167] Petit 1665: 100.
[168] Petit 1665: 96–101 and 87–100.

The groups that I have discussed so far were more or less closely knit, both socially and in their members' natural philosophical beliefs. It remains to analyze briefly three books published on the comets of 1664–1665 that do not fall under my previous categories and appear somewhat isolated. I have no coherent story to tell about these books, but I want to include them in order to present a picture as systematic as possible and because of the originality of some of them.

Le Courrier de traverse ou le tri-comète was written by Nicolas de Croixmare de Lasson, an aristocrat from Rouen, residing near Caen, member of its *Académie des sciences*, and interested in the fine arts as well as the sciences. It was, however, published under the name of M. Vortfischer, presented as the translator of this piece from English to French.[169] Considering the Anglomania that affected Graindorge and Huet, this pseudonym was probably de Croixmare's way of satirizing English virtuosi and their French followers.[170] At first sight, *Le Courrier de traverse* appears as a fantasy, making a mockery of geometric language, for example when the "prostasphereses" and "apocastastes" of the tri-comet are said to be identified thanks to a "spherical-spherical."[171] This explains why *Journal des scavans* assumed that *Le Courrier de traverse* was published to "laugh at false savants and at those who enjoy celestial observations and the vain curiosities of astrology."[172] At the same time, however, it claims to rediscover an ancient truth, already known to Seneca, Ptolemaeus, Lokon the Indian, the Babylonians and the Chaldeans, according to which comets are primordial stars made of the primitive light.[173] Considering that de Croixmare was implicated in alchemical studies that he kept secret, he might have seriously believed in this ancient truth, in which case Huygens' comment would be more exact than the one of *Journal des savants*: "It seems to me that the author of the Tricomete speaks seriously and consequently

Commenté [PA6]: Do you mean that it affected them negatively? Would it be better to say something like: 'Considering their disdain for the current Anglomania ...' ??

Commenté [S7]: Graindorge and Huet are referring constantly and quite positively to the virtuosi of the Royal Society. My hypothesis is that Croixmare de Lasson mocks them.

[169] On Nicolas de Croixmare, sieur de Lasson (1629–1680), see Collas 1912: 455–458; Lux 1989: 48–49, 60–62, 110–111. According to Graindorge to Huet, 24 June and 13 August 1665, in Graindorge 1942: 203, 287; Huet 1853: 147–148; Brown 1934: 146, 158–159, he was working at the construction of a huge metallic mirror, but also trying to grind lenses according to the method prescribed at the end of Descartes' *Dioptrics.* Huet 1706: 429 notes cruelly: "he would have been a greater man if he would have had less talents."

[170] This is suggested in Brown 1934: 229. For manifestations of such an Anglomania, see Graindorge 1942. De Croixmare was also probably the author of the report on worms who ate stones published in *Journal des scavans*, 9 August 1666. Boulliau to Lubiniezky, 4 September 1665, in Lubiniezky 1667: 534 explains that neither he nor Auzout know who Vortfischer is but that he is probably not an English man.

[171] De Croixmare 1665: 5.

[172] *Journal des scavans*, 30 March 1665, in Sallo 1665: 88–89.

[173] De Croixmare 1665: 3, 6.

that he is insane."[174] In other words, there is clearly a parodic tone in *Le Courrier de traverse*, but this does not mean that de Croixmare did not believe in all what he wrote.

This ambivalence is all the more true of the second book, the anonymous *L'esprit du sage*. As with many others we followed in this chapter, its author presents the opinions of the "cometists" as they were expressed during the January conference, criticizes them on one ground or another (although with more vivid expressions than in other texts, d'Harouys' students being depicted as "tamed parrots," while Descartes is presented as thinking that "a gang of small corpuscles as black as Africans pounce on a star, conceal it, embrace it so strongly that it cannot anymore accomplish its ordinary function"), and finally proposes still another opinion, which, to modern eyes is not that different.[175] The first and last chapters are however distinctive. The first details how the truth on comets was revealed to the author: after a long day of work in his study, he began to walk along a stream, then climbed to the top of a mountain; he had barely reached it, when his senses fell dormant and his spirit was transported through the air, until he arrived in the middle of a thousand suns, where an astounding voice revealed to him the secrets of the world.[176] It is only in the third chapter that these secrets are displayed. They are important enough to be repeated in the very last chapter, written in smaller characters and with a separated pagination: the Earth moves around the Sun; fixed stars are as many suns; the world is infinite and eternal; "there is only one soul which exists in different degrees in all the Creatures, according to their needs, which makes the variety of so many things that is to be found in each species; there is nothing which is not a soul, even the most insensible and wretched things; this soul is placed at the highest degree of perfection in man, which makes him the most considerable of creatures."[177]

Finally and most intriguing is the third and last book of this improbable series, Gabriel de Vendages de Malapeyre's *De la nature des comètes*.[178] His Foreword is typical for an *honnête homme* of this time: de Malapeyre explains that he was not looking for anything except a quiet life, but was obliged to write a book on comets to answer many solicitations

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[174] Christiaan Huygens to Constantyn Huygens, 2 April 1665, in Huygens 1888–1950, vol. V: 301–302. For indications that de Croixmare was involved in secret alchemical researches, see the letter from Graindorge to Huet, 28 November 1667, quoted in Brown 1938: 150, and Huet 1706: 429.

[175] *L'esprit du sage*, Ch. 2: 19–40; Ch. 4–5: 68–89.

[176] *L'esprit du sage*, Ch. 1: 11–18.

[177] *L'esprit du sage*, Ch. 3: 41–66, Ch. 6: 3–4 for the quotation.

[178] Gabriel de Vendages de Malapeyre (1624–1702), an officer at *Présidial* in Toulouse, was an active figure in the academic circles of his city: he was a member of *société des Jeux Floraux*, he founded the society of Lanternistes and finally he contributed to the foundation of *Académie des sciences, inscriptions et belles-lettres* of Toulouse. A devout of the Virgin Mary, he instituted a prize to the best poem written in her honor and had the *Chapelle de Notre-Dame du Mont-Carmel* built, of which he gave a written description. His only known book in natural philosophy is *De la nature des comètes*, which is dedicated to Virgin Mary.

from his friends; that the radiant lights of philosophy are now dissipating the public terrors that comets inspired and that the darkness of our imaginations favored; that, "the attachment that most learned men have for an Author, and the oath of fidelity that they took in favor of a Master, being an insuperable obstacle to the possession of the truth," he will take what he finds pleasant and reject what he finds unpleasant in each author. Malapeyre concludes that his book is neither the book of an astrologist, since he does not make horoscopes, nor of an astronomer, since he does not propose an almanac or an ephemerides, but a physicist's book, dealing with the nature of celestial bodies.[179] What is surprising considering this beginning is the amount of information that *De la nature des comètes* displays on natural philosophy: Malapeyre refers accurately to parallax and to the ephemerides published by Auzout and Pardies; using an argument from the relativity of motion, he takes a stand for Copernicanism; he denounces attraction and other "terms full of vanity and ignorance"; his main references in natural philosophy are Galileo, Gassendi and Descartes.[180] Concerning comets in particular, he is the only one to understand how paradoxical it was that, in his controversy with the Jesuit Horatio Grassi, Galileo defended a quasi-Aristotelian position, according to which, comets being just luminous reflections of atmospheric exhalations, to calculate their locations, one cannot use parallaxes, that apply only to real and permanent objects. He attributes Galileo's move to psychological motivations, whether, as "a generous enemy… satisfied to have put Aristotle to the ground a thousand times, he testifies now that the only source of their quarrels and of his aversion was his reason," or as a mighty dialectician "to show that, in the worst cases, he is capable of inventing better reasons than would their most obstinate defenders."[181] His account of comets is more generally the most systematic one to be found in all the books that I have read: he first presents Aristotle's opinion (Ch. 7), then Galileo's opinion (Ch. 8), then the opinions of those who think that comets are ephemeral bodies, Malapeyre distinguishing between seven different positions (Ch. 9), and finally the opinions of those who consider that comets are as ancient as the world, among them Descartes and Gassendi (Ch. 10). It is only then that Malapeyre reports on his own opinion, which relies on what he finds more solid in each of the other opinions, that comets are planets that abandon their sun and pass through our solar system.

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[179] Malapeyre 1665: 1–8.
[180] Malapeyre 1665: 97 and 70, 52–53 and 173, 85, 48–49 and 142–150.
[181] Malapeyre 1665: 101, 104. He may have known the controversy between Galileo and Grassi through Gassendi 1658: 702b–703a.

CONCLUSION

The maze of books that the 1664–1665 comets gave rise to disappeared almost as rapidly as the comets themselves: the only book that was published on these comets after 1665 was Billy's *Crisis astronomica de motu cometarum*. Not only were these publications on comets ephemeral, but with no significant truth discovered, they seem to have been forgotten as soon as they were published—even if it remains to be determined whether any of the arguments we encountered here did not contribute to the debate on the 1680–1681 comets. Last, but not least, they appear to have occasioned one of the fools' games so common to intellectual life: every natural philosopher expresses his views, eventually defends them by indicating the weaknesses of all other opinions, but is not, for all that, able to take into consideration what the other natural philosophers said. If the 1664–1665 comets did not induce the discovery of new truths nor the interaction between different natural philosophers, they nevertheless reveal the various antagonisms existing in the field of natural philosophy in France in the sixteen-sixties and it is in this sense that they can be considered as a prism.

Seventeenth-century France is often associated with Descartes' legacy, Descartes himself being often associated with a kind of speculative and anti-experimental philosophy. Although I have not discussed Descartes himself in this chapter, such a judgment obviously depends on which work of Descartes one looks at. As far as Descartes' legacy is concerned, I have shown that the situation was more complicated than this common picture might suggest. There were groups in France who defended natural philosophical opinions that were not Cartesian, and among them at least two groups were defending an explicitly *anti*-Cartesian agenda. One such group consisted of Jesuits who attacked Descartes' followers because they would grab hold of wrong ontological principles. The other group comprised people with different positions, but united in their rejection of Cartesians, whom they perceived as unduly dogmatic and insensible to observations and experiments. In a word, if there was ever something like a Cartesian legacy in France, it was at least as much because Descartes was contested as because he was followed.

But the most important issue in a study like this is to know how diverse opinions were expressed in the field of natural philosophy. It is indeed remarkable that while there was a diversity of opinions on comets and more generally on natural philosophy, such diversity did not always instigate open conflicts, and that, when such a conflict did occur, it was not always expressed in terms of principles. While astrologists were not criticizing the others, astrological beliefs and practices were condemned by all the others. They were in a sense

condemned even by those interested in astrological predictions—as we have seen, they doubted their own predictions. But this does not mean that those who condemned astrology read contemporary astrologists and openly quarrel with them—except for Denis, they were content with an abstract condemnation of astrology in general, *in absentiam astrologorum*. It is only between Cartesians and anti-Cartesians that an open conflict developed. However, as we have seen, Gassendi's followers did not reproach Descartes so much for his principles as for his lack of certain intellectual virtues. Thus, the only full controversy that developed was between the Jesuits and the Cartesians, and this because they proposed two systems of the world founded on explicitly formulated principles between which a choice was to be made. In other words, in the situation described in this paper, principles are not self-evident propositions on which everybody agrees, as philosophers would like them to be, but controversial statements that delineate different social groups according to their different intellectual commitments. By contrast, observations concerning the successive positions of the comets were travelling both from one social group to another and from one country to another. Though these observations travelled mostly through letters, they are also present in the some books, like those of the Jesuit mathematicians (de Billy and Pardies) and of some Montmorians (Auzout and Petit), who were able to communicate beyond the boundaries of their social and national groups, precisely because they were not reasoning in terms of principles. In other words, the paradoxical nature of principles is that, while they are presented as what everybody should agree on, they are in fact what we are endlessly arguing about.

BIBLIOGRAPHY

Manuscripts

Billy, Jacques de (1665a) *Observations sur la comete par le P. de Billy*. Bibliothèque municipale de Toulouse, Res. C XVII 67 (5).

Lalane, sieur de (1664) *Discours des comètes par le Sieur de Lalane*. Bibliothèque nationale de France, MS 19947.

Lantin, Jean-Baptiste (n.d.) *Lantiniana, ou Recueil de plusieurs choses dites par M. Jean-Baptiste Lantin, conseiller au parlement de Bourgogne et remarquées par M. Pierre Le Goux Conseiller au même Parlement.* Bibliothèque municipale de Dijon, MS 962.

Rohault, Jacques (1660–1661) *Conférences, recueillies par M. F. avocat qui y a, dit-il, ajouté du sien*. Bibliothèque Sainte-Geneviève, MS 2225.

Sources

[anonyme] (1665) *Figure de la derniere estoille extraordinaire et professie mistique sur l'apparition du dernier comete*, [n.p.]

[anonyme] (1665) *Ballet de la comète, divisé en deux parties et dansé à Soissons le 9 Fevrier*, Soissons: Nicolas Asseline.

[anonyme] (1665) *Histoire des comètes qui ont paru depuis peu sur notre horizon, l'un sur la fin de l'année dernière et l'autre au commencement de la présente avec leur observation, figure et pronostic par un Mathématicien*, Besançon: Nicolas Couché.

[anonyme] (1665) *L'esprit du sage, informé sur le sujet des deux comètes de cette année où sont réfutés tous ceux qui en ont parlé jusqu'à présent, par une nouvelle hypothèse*, Paris: Pierre Josse.

[anonyme] (1665) *Les effets ridicules du comète, envoyez à Lysandre malade*, Paris: [n.p.]

Auzout, Adrien (1665a) *L'éphéméride du comète*, Paris: Jean Cusson.

—. (1665b) *L'éphéméride du nouveau comète*, Paris: Jean Cusson.

—. (1665c) *Lettre à Monsieur L'abbé Charles sur le Ragguaglio di due nove osservationi, etc.*, *da Giuseppe Campani*. Paris: Jean Cusson.

Billy, Jacques de (1657) *Le tombeau de l'astrologie Judiciaire*, Paris: Michel Soly.

—. (1665) *Discours de la comète qui a paru l'an 1665, au mois d'avril*, Paris: Sébastien Cramoisy and Sébastien Mabre-Cramoisy.

Billy, Jacques de (1666) *Crisis astronomica de motu cometarum*, Dijon: Pierre Palliot, and Paris: Helias Josset.

Commenté [PA8]: Is there a reason for the square brackets?

Commenté [S9]: Yes, there is: the book does not have a date. But it can be inferred from its content that it was published between the first and the second comet.

[Boileau Despréaux, François and Nicolas Bernier] (1671), *Requeste des Maistres es arts, Professeurs, & Regens de l'Université de Paris presentée à la Cour Souveraine de Parnasse: en semble l'Arrest intervenu sur ladite Requeste*, Delphes: ocitée des Imprimeurs de la Cour de Parnasse.

Chapelain, Jean (1880–1883) *Lettres de Jean Chapelain*, ed. Philippe Tamizey de Larroque, 2 vols, Paris: Imprimerie Nationale.

Comiers, Claude (1665) *La nature et présage des comètes. Ouvrage mathématique, physique, chimique et historique enrichi des prophéties des derniers siècles et de la fabrique des grandes lunettes*, Lyon: Charles Mathevet (also published under the title *La nouvelle science des cometes et histoire générale de leurs presages*, [n.p.]).

Condé, Prince de (1920) *Le grand Condé et le duc d'Enghien. Lettres inédites à Marie-Louise de Gonzague, reine de Pologne, sur la cour de Louis XIV (1660-1667)*, Émile Magne ed. Paris: Émile-Paul.

Cotin, Charles (1665) *Œuvres galantes tant en vers qu'en prose. Contenant... Galanterie sur l'astrologie judiciaire. Galanterie sur la comette*, Paris: Estienne Loyson.

Courcelles, F. de (1665) *Le desabusement sur le bruit qui court de la prochaine Consommation des Siecles, fin du Monde et du Jour du Jugement Universel. Contre Perrieres Varin qui assingne ce Jour en l'année 1666. Et Napeir Ecossois qui le met en l'année 1688*, Rouen: Laurens Maurry.

Croixmare, Nicolas de, sieur de Lasson [Vortfischer] (1665) *Le Courrier de traverse ou le tri-comète observé à Oxfort en Angleterre depuis le 22 novembre jusqu'au 28 janvier 1665, traduit de l'anglais de M. Vortfischer*, Paris: Jacques Bouillerot.

Decrusy, Isambert, François-André, Jourdan, Athanase-Jean-Léger, and Taillandier, Alphonse-Honoré (1821–1833) *Recueil général des anciennes lois françaises, depuis l'an 420 jusqu'à la Révolution de 1789*, 29 vols, Paris: Belin-Leprieur.

Denis, Jean-Baptiste [I.D.P.M] (1665) *Discours sur les comètes suivant les principes de M. Descartes où l'on fait voir combien peu solides et mal fondées sont les opinions de ceux qui croyent que les comètes sont composées ou d'exhalaisons terrestres ou des sueurs de toute la Sphère Elémentaire ou de quelque manière céleste plus condensée qu'à l'ordinaire ou d'une très grande quantité de petites étoiles qui se sont jointes ensemble*. Paris: Frédéric Léonard (but also: Jean Guignard, Pierre Promé, Charles Savreux; reprinted in 1672 with another title, *Divers sentimens sur les comètes, comparez avec celuy de Descartes, avec l'explication de plusieurs difficultez touchans le système du monde*, Paris: Frédéric Léonard.)

Denis, Jean-Baptiste (1668) *Discours sur l'astrologie judiciaire et sur les horoscopes, prononcé par J. Denis... dans une des conférences publiques qui se font chez luy tous les samedis*, Paris: Jean Cusson.

—. (1682) *Recueil des Mémoires et Conférences sur les arts et les sciences présentées à Monseigneur le Dauphin*, Amsterdam: Pierre Le Grand.

Depping, G. B., ed. (1855) *Correspondance administrative sous le règne de Louis XIV, recueillie et mise en ordre par G. B. Depping. Tome IV et dernier. Travaux publics - Affaires religieuses - Protestants - Sciences, lettres et arts - Pièces diverses*, Paris: Imprimerie nationale.

Descartes, René (1996) *Œuvres de Descartes*, C. Adam and P. Tannery eds., new presentation by Bernard Rochot and Pierre Costabel, 11 vols, Paris: Vrin.

Diez, François [also attributed to François Ridelle] (1665. *Balet des comètes pour la tragédie d'Irlande sur le théâtre du collège de Clermont de la Cie de Jésus le 6 aout*, [n.p.].

Garnier, Jean (1678) *Systema bibliothecae collegii parisiensis Societatis Jesu*, Paris: Sébastien Marbre-Cramoisy.

Gassendi, Pierre (1658) *Opera omnia in sex tomos divisa… Tomus primus quo continentur Syntagmatis philosophici pars prima, sive logica, itemque partis secundae, seu physicae sectiones duae priores*, Lyon: Anisson.

Giustiniani, Julio (1665) *L'explication de la comète qui apparut sur la fin de l'année 1664 et au commencement de 1665, présentée à la Reine mère en langue espagnole, & d'espagnol traduite en françois*, Paris: Alexandre Lesselin.

Graindorge, André (1942) "Une page d'histoire des sciences. Vingt-deux lettres inédites d'André de Graindorge à P.-D. Huet," Léon Tolmer ed., *Mémoires de l'Académie nationale des sciences, arts et belles-lettres de Caen. Nouvelle série. Tome X*, Caen: Charles Le Tendre, pp. 245–337.

Grandami, Jacques (1665a) *Le Cours de la comète qui a paru sur la fin de l'année 1664 et au commencement de l'année 1665. Avec un traité de sa nature, de son mouvement et de ses effets, présenté à Monseigneur le Prince par le P. Iacques Grandamy*, Paris: Sébastien Cramoisy and Sébastien Mabre-Cramoisy.

—. (1665b) *Le Parallele des deux cometes qui ont paru les années 1664. & 1665. Par le P. Iacques Grandamy*. Paris: Sébastien Cramoisy and Sébastien Mabre-Cramoisy.

Granet, François (1738) *Réflexions sur les ouvrages de literature. Tome Troisième*, Paris: Antoine-Claude Briasson.

Guyard, Marie (1681) *Lettres de la venerable Marie de l'Incarnation, Premiere superieure des Ursulines de la Nouvelle-France*, Paris: Louis Billaine.

Hobbes, Thomas (1994) *Thomas Hobbes: the Correspondence: 1660–1679. The Clarendon Edition of the Works of Thomas Hobbes*, N. Malcolm ed. Oxford: Oxford University Press.

Huet, Pierre-Daniel (1665) *XX. Dissertation de la nature des comètes*, in *Dissertations sur diverses matières de religion et de philologie… recueillies par Monsieur L'Abbé de Tilladet. Tome second*. Paris: François Fournier and Frédéric Léonard, 1712, p. 232–246.

—. (1706) *Les origines de la ville de Caen revûës, corrigées et augmentées. Seconde édition*. Rouen: Laurens Maurry.

—. (1853) *Mémoires de Daniel Huet, Évêque d'Avranches*, tr. fr. par Charles Nizard. Paris: Hachette.

Huygens, Christiaan (1888–1950) *Œuvres complètes de Christiaan Huygens*, Société Hollandaise des Sciences ed., 22 vols. La Haye: Martinus Nijhoff.

Indovino, Fortunato (1665) *Le Mystère caché dans le comète de ce temps, ou le Janssénisme agonissant dans ce météore*, Lyon: [n.p.].

Kepler, Johannes (1937–.) *Gesammelte Werke herausgeben im Auftrag der Deutschen Forschungsgemeinschaft und der Bayerischen Akademie der Wissenschaften*, München: C. H. Beck.

Le Mercier, R. P. (1666) *La Relation de ce qui s'est passé en la Nouvelle France es années 1664 et 1665*. Paris: Sébastien Cramoisy and Sébastien Marbre-Cramoisy.

Léautaud, Vincent (1665) *Copie d'une lettre escrite par un père jésuite du Collège d'Ambrun à M. de Ponnat, baron de Gresse, conseiller au parlement de Grenoble. Sur le sujet des Cometes apparuës ès mois passés de décembre et janvier*. Grenoble: Robert Philippes.

Leschener, Henry de (1665) *Traité des comettes où on voit leur causes, leur nature, leurs effets, le temps auquel elles se forment, les lieux où elles paraissent, le moyen de les prédire et de connaître non seulement ce qu'elles annoncent en général, mais aussi en particulier. Avis d'un particulier au libraire sur le traité des comèttes par F.H.L. Epistre à S.A.S Mgr le Prince*, Paris: Thierry Denis.

Loret, Jean (1857–1891) *La muze historique ou Recueil des lettres en vers contenant les nouvelles du temps : écrites à Son Altesse Mademoizelle de Longueville, depuis duchesse de Nemours*, Ch.-L. Livet ed. Paris: Jannet, then Daffis, then Champion.

a mis en forme : Anglais (E.U.)

Lubiniezky, Stanislaw (1667) *Theatri cometici pars prior. Communicationes de cometis 1664 et 1665*, Amsterdam: Frans Kuyper.

Luyt, Robert (1665) *Questions curieuses sur la comète qui a paru en France depuis le XV du mois de décembre l'an 1664 : ou le jugement astronomique que l'on en doit former et ce qu'elle pronostique*, Paris: Charles de Sercy.

Malapeyre, Gabriel de Vendages de (1665). *De la nature des comètes*. Toulouse: Arnaud Colomiez chez A. Pélissier.

Montalegre, sieur de (1664) *Discours sur le comete qui paroit à present ; avec sa figure, sa situation dans le ciel, & les bons ou mauvais effets qu'il presage. Suivant les observations de plusieurs scavants astronomes. Recueillies en faveur des curieux par le Sieur de Montalegre, amateur des sciences mathematiques*, Lyon: François Larchier.

Oldenburg, Henry (1965–1986) *The Correspondence of Henry Oldenburg*, eds. and trans. A. R. Hall and M. B. Hall, 13 vols. Madison, Milwaukee and London: University of Wisconsin Press, Mansell and Taylor and Francis.

Pardies, Ignace-Gaston (1665a) *Remarques sur les comètes et autres phaenomènes extraordinaires de ce temps*, Bordeaux: G. de la Court.

—. (1665b) *Dissertatio de motu et natura cometarum*, Bordeaux: Pierre du Coq.

Patin, Guy (2015) *Correspondance française de Guy Patin*, Loïc Capron ed. Paris: Bibliothèque interuniversitaire de santé.

Pithoys, Claude (1646) *Traitté curieux de l'Astrologie Judiciaire, ou préservatif contre l'astromantie des généthliaques, auquel quantité de questions curieuses sont resoluës, etc*. Montbéliard: Jacques Foylet (but also Sedan: Pierre Jannon, 1641 et 1661).

Petit, Pierre (1665) *Dissertation sur la nature des comètes. Au Roy. Avec un Discours sur les prognostiques des éclipses et autres matières curieuses*, Paris: Louis Billaine and Thomas Jolly.

Ragayne de La Picottière, Louis (1665a) *De duplici cometa vero et ficto positiones mathematicae. Propugnabuntur a Ludovico Ragayne de la Picottière in Collegio claromontano Societatis Iesu. Die 12 junii 1665*, [n.p.].

—. (1665b) *De hypothesi cartesiana positiones physicomathematicae. Propugnabuntur a Ludovico Ragayne de La Picottiere Parisino (i.e. Sagiensi) in Collegio Claramontano Societatis Iesu. Die 13. Junii 1665*, [n.p.].

Renaudot, Théophraste (1665) *Recueil des Gazettes nouvelles ordinaires et extraordinaires. Relations et récits des choses avenues tant en ce Royaume qu'ailleurs pendant l'année mil six cents soixante-cinq*, Paris: Bureau d'Adresse.

Roberval, Gilles-Personne de (1644) *Aristarchi Samii De mundi systemate, partibus, et motibus ejusdem, libellus*, Paris: Antoine Bertier.

Sallo, Denis de (1665) *Le Journal des sçavans de l'an MDCLXV*, Cologne: Pierre Michel.

—. (1666) *Le Journal des sçavans de l'an MDCLXVI*, Paris: Jean Cusson.

Sévigné, Madame de (1853) *Lettres de Madame de Sévigné avec les notes de tous les commentateurs*, Paris: Firmin Didot Frères.

Sombreval, sieur de (1665) *Advertissement du Ciel que Dieu donne aux chrestiens par la Comete*, Lyon: François Larchier.

Sorbière, Samuel (1665) *Discours de M. de Sorbière sur la comète*, [n.p.].

Tarteron, Jérôme (1665) *De cometa annorum 1664 & 1665 Observationes mathematicae propugnatae Parisiis, ab Hyeronymo Tarteron, in aula Collegi Claramontani soc. Jesu. Die Jovis 29. Januarii 1665*, Paris: Edmond Martin.

Vaissey, D. de (1665) *De novo cometa qui apparuit mense decembri anni 1664 carmen prognosticum illustrissimo D. de Vaissey*, [n.p.].

Secondary literature

Aricò, D. (1998) "'Res caelestes': Miracoli e osservazioni astronomiche in un carteggio inedito di Giovan Battista Riccioli con altri intellettuali del suo tempo," *Filologia e critica*, 23: 249–94.

—. (1999) "Les 'yeux d'Argos' et les 'étoiles d'Astrée' pour mesurer l'univers: Les Jésuites italiens et la science nouvelle," *Revue de synthèse*, 120: 285–303

Ariew, R. (1999a) *Descartes and the Last Scholastics*, Ithaca: Cornell University Press.

—. (1999b) "Scholastics and the New Astronomy on the substance of the heavens" in R. Ariew 1999a, pp. 97–116.

Atkinson, G. (1951) "Précurseurs de Bayle et de Fontenelle: la comète de 1664–1665 et l'incrédulité savante," *Revue de Littérature Comparée*, 25: 12–42

Barker, P. and Goldstein, B. R. (1988) "The Role of comets in the Copernican Revolution," *Studies in History and Philosophy of Science*, 19–3: 299–319.

Béguin, K. (1999) *Les Princes de Condé. Rebelles, courtisans et mécènes dans la France du Grand Siècle*. Seyssel: Champ Vallon.

Berger, S., Garber, D. and Grafton, A. eds. (forthcoming) *Teaching Philosophy in the Seventeenth Century*.

Boner, P. J. (2013) *Kepler's Cosmological Synthesis: Astrology, Mechanism and the Soul*. Boston: Brill.

Boschiero, L. (2009) “Giovanni Borelli and the comets of 1664–65,” *Journal of the History of Astronomy*, 40: 11–30.

Boudet, J.-P. (1990) “Simon de Phares et les rapports entre astrologie et prophétie à la fin du Moyen Age,” *Mélanges de l’École française de Rome. Moyen Age, Temps modernes*, 102–2: 617–648.

Brockliss, L. (1995) “Pierre Gautruche et l’enseignement de la philosophie,” in ed. L. Giard 1995, pp. 187–219.

Brown, H. (1934) *Scientific Organizations in Seventeenth century France*. New York: Russel and Russel.

—. (1938) “L’Académie des sciences de Caen d’après les lettres d’André de Graindorge (1666–1675),” *Mémoires de l’Académie nationale des sciences, arts et belles-lettres de Caen. Nouvelle série. Tome IX*, Caen: Charles Le Tendre, pp. 117–198.

Camerota, M. (2002) “*Sidera ex unis vorticibus in alios migrantia*. Note sulla teoria cometaria cartesiana,” in eds. M. T. Marcialis and F. M. Crasta 2002, pp. 91–105.

Campinoti, V. (2006) “Galileo contro Aristotele nello studio di Pisa: Resoconto di una ‘disputatio circularis’ di Alessandro Marchetti sulla natura delle comete,” *Galilaeana*, 3: 217–228.

Cassini, A. (2003) *Gio. Domenico Cassini, Uno Scienziato del Seicento*. Perinaldo: Comune di Perinaldo.

Chérot, H. (1896) *Trois éducations princières au dix-septième siècle*. Lille: Société de Saint-Augustin, Desclée, De Brouwer et Cie.

Collacciani, D. and Roux, S. (forthcoming) “The mathematical theses defended at *collège de Clermont* (1637–1682): How to guard a fortress in times of war” in eds. Berger, S. Garber D., and Grafton A. forthcoming.

Collas, G. (1912) *Jean Chapelain 1595–1674. Étude historique et littéraire d’après des documents inédits*. Paris: Perrin.

Dascal, M. and Boantza, V. D. eds. (2011) *Controversies Within the Scientific Revolution*. Amsterdam: John Benjamins Publishing.

Dobre, M. and Nyden, T. eds. (2014) *Cartesian Empiricisms*, Dordrecht: Springer.

Drévillon, H. (1996) *Lire et écrire l’avenir: l’astrologie dans la France du Grand Siècle, 1610–1715*. Seyssel: Champ Vallon.

d’Enfert, R. and Fonteneau, V. eds. (2011) *Espaces de l’enseignement scientifique et technique. Acteurs, savoirs, institutions, XVII^e–XX^e siècles*, Paris: Hermann.

Giard, L. ed. (1995) *Les Jésuites à la Renaissance. Système éducatif et production du savoir*, Paris: Presses universitaires de France.

Gal, O. and Chen-Morris, R. (2011) "Galileo, the Jesuits, and the controversy over the comets. What was The Assayer really about?" in eds. M. Dascal and V. D. Boantza 2011, pp. 33–52.

Garber, D. and Roux, S. eds. (2013) *The Mechanization of Natural Philosophy*, Dordrecht: Springer.

Gillispie, C. C., Holmes F. L. and Koertge, N. eds. (2008) *Complete Dictionary of Scientific Biography*, Vol. 1. Detroit: Charles Scribner's Sons.

Granada, M. A., Mosley, A. and Jardine, N. eds. (2014) *Christoph Rothmann's Discourse on the Comet of 1585: An Edition and Translation with Accompanying Essays*, Leiden: Brill.

Henry, J. and Hutton, S. eds. (1990) *New Perspectives on Renaissance Thought. Essays in the History of Science, Education and Philosophy*, London: Duckworth and Istituto italiano per gli studi filosofici.

Hetherington, N. S. (1972) "The Hevelius–Auzout controversy," *Notes and records of the Royal Society of London*, 27: 103–106.

Jensen, D. (2006) *The Science of the Stars in Danzig from Rheticus to Hevelius*, PhD Thesis, University of San Diego.

Kane, W. T. (1940) "Jean Garnier, Librarian," *Mid-America. An Historical Review*, 11–2: 75–95 and 11–3: 191–222.

Lerner, M.-P. (1995) "L'entrée de Tycho Brahe chez les Jésuites ou le chant du cycle de Clavius," in ed. L. Giard 1995, pp. 145–185.

—. (1996–1997) *Le monde des sphères*, 2 vols. Paris: Les Belles Lettres.

—. (2001) "La réception de la condamnation de Galilée en France au XVII^{e} siècle," in eds. Montesinos, J. and Solís, C. 2001, pp. 513–548.

Lugli, M. U. (2004) *Geminano Montanari*. Modena: Edizioni il Fiorino.

Lux, D. S. (1989) *Patronage and Royal Science in Seventeenth-Century France*. Ithaca, Cornell University Press.

Marcialis, M. T. and Crasta, F. M., eds. (2002) *Descartes e l'Eredità Cartesiana nell' Europa Sei-Settecentesca*, Lecce: Conte.

Matton, A. (1979) "L'œuvre méconnue et l'œuvre inconnue de Robert Luyt," *Bulletin de la Société d'archéologie et d'histoire du Tonnerrois*, 32: 30–42.

Montesinos, J. and Solís, C. eds. (2001) *Largo Campo di Filosofare. Eurosymposium Galileo 2001*, La Orotava: Fundación Canaria Orotava de Historia de la Ciencia.

Mormiche, P. (2011) "Les Condés et les sciences : entre l'académie Bourdelot et l'éducation de Monsieur le Duc (1670–1700)" in eds. R. d'Enfert and V. Fonteneau 2011, pp. 15–29.

Mosley, A. (2014) "The history and historiography of early modern comets" in eds. M. A. Granada, A. Mosley and N. Jardine 2014, pp. 282–325.

Nellen, H. J. M. (1994) *Ismaël Boulliau (1605–1694), astronome, épistolier, nouvelliste et intermédiaire scientifique*. Amsterdam: APA-Holland University Press.

Pumphrey, S. (1990) "Neo-Aristotelianism and the Magnetic Philosophy" in eds. J. Henry and S. Hutton 1990, pp. 177–189.

Romano, A. (1999) *La contre-réforme mathématique. Constitution et diffusion d'une culture mathématique jésuite à la Renaissance (1540–1640)*. Roma: École française de Rome.

Roux, S. (2013) "A French partition of the empire of natural philosophy (1670–1690)" in eds. D. Garber and S. Roux 2013, pp. 55–98.

—. (2014) "Was there a Cartesian experimentalism in seventeenth century France?" in eds. M. Dobre and T. Nyden 2014, pp. 47–88.

Ruffner, J. A. (1971) "The curved and the straight: cometary theory from Kepler to Hevelius," *Journal for the History of Astronomy*, 2: 178–194.

Sarasohn, L. T. (2004) "Who was then The Gentleman? Samuel Sorbière, Thomas Hobbes, and the Royal Society," *History of Science*, 42: 11–232.

Schechner, S. G. (1997) *Comets, Popular Culture and the Birth of Modern Cosmology*. Princeton: Princeton University Press.

Shapin, S. (1994) *A Social History of Truth: Civility and Science in Seventeenth-century England*. Chicago and London: University of Chicago Press.

Shelford, A. (2007) *Transforming the Republic of Letters: Pierre-Daniel Huet and European Intellectual Life 1650–1720*. Rochester: University Rochester Press.

Yeomans, D. K. (1991) *Comets: A Chronological History of Observation, Science, Myth, and Folklore*. New York: Wiley.

Ziggelaar, A., S.J. (1971) *Le physicien Ignace-Gaston Pardies S. J. (1636–1673)*. Odensee: Odensee University Press.