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Newtonianism and information control in Rome at the wake of the eighteenth century

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ABSTRACT

This paper offers an opportunity to ponder the way the Catholic Church and its methods of information control reshaped, and paradoxically even enabled, the dissemination and practice of science in early modern Italy. Focusing on the activities of Newtonian scholars operating in Rome in the First half of the eighteenth century – especially the Celestine monk Celestino Galiani (1681–1753) and prelate Francesco Bianchini (1662–1729) – I will argue that major contributions to the spread of Newtonianism in Italy came from individuals operating within the Church, acting more-or-less independently from the Church's oversight. These scholars realized they were witnessing an inexorable transition and that the medieval scholastic cosmology and physics could not survive. In order to rescue the Church – and to avoid further embarrassment, especially after the Galileo Affair – renewal was needed. Counterintuitively, the dissemination of Italian Newtonianism was largely a Catholic effort.

KEYWORDS

Catholic Church; Newtonianism; information control; Francesco Bianchini; Celestino Galiani

The city of Rome was one of the main gateways through which Newtonianism entered the Catholic world.[1] It was the formal seat of the Roman Inquisition as well as the base of a number of universities, cultural academies, and circles directly controlled by the Catholic Church. While essentially all of the major Italian urban and cultural centres responded to the spread of Newtonianism, Rome was especially remarkable as an international centre of study with journals and academies dedicated to the new ideas.[2] After the end of the Council of Trent and the close of the Thirty Years' War (1618–48), the Holy See aimed to enrich

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[1]The concept of Newtonianism is enormous in scope – encompassing, at least, cosmology, mathematics, optics, chronology, atomism, the social sciences, and natural theology, in addition to having meant different things to different people over the centuries. In this paper I will refer to Sir Isaac Newton (1642–1726/27) theory of light and colors, with an emphasis on the theory of attraction.

[2]This paper is a revised version of a chapter of my doctoral dissertation. One of the objectives of the current essay is to collect and discuss information on Newtonianism in Rome in the first decades of the eighteenth century that is scattered across studies written especially by authors such as Vincenzo Ferrone, Massimo Mazzotti, Silvia Mazzone, Clara Silvia Roero but also Enrica Baiada, Marta Cavazza, Franco Palladino, Luisa Simonutti, and Maria Laura Soppelsa. Portions of this paper had already published in Daniele Macuglia, 'The Work of the Roman Newtonians in the Italian Enlightenment', Viewpoint, Magazine of the British Society for the History of Science 108 (2015), 8–9.

its cultural system. It was increasingly open to modern ideas; yet, though this openness was a 'Machiavellian move', as the Church's interest was likely an attempt to modify and transform libertine ideas into versions more compatible with Catholic doctrine.[3]

1. Machiavellian move

The Church may have embarked a task of information control as early as the end of the seventeenth century by creating the *Giornale de' Letterati* and the *Accademia Fisico-matematica* (1677–1698). It was primarily thanks to the *Giornale* that Italian scientists knew about the most important scientific research going on beyond the Alps. On the other hand, the *Accademia Fisico-matematica* represented the most advanced Italian centre of scientific research at the close of the seventeenth century. Established by Cardinal Giovanni Giustino Ciampini (1633–98), at his residence near piazza Navona it operated under the protection of Christina, Queen of Sweden (1626–89).[4] The academicians focused on some of the most insidious threats to the Catholic orthodoxy – such as the Copernican system, the *horror vacui*, and the epistemological models connected to atomism and to the structure of matter – and studied the possibility of bringing them into alignment with the scholastic tradition.[5] This was their main occupation, as poet and critic Giovanni Crescimbeni (1663–1728) wrote in *Le Vite degli Arcadi Illustri* (Rome, 1710):

> All the eclipses and comets of those times were observed in the academy […], where people were focused on solving mathematical problems […]. There was no celestial or terrain discovery […] that was not carefully examined by its members.[6]

After Ciampini's death, when the *Accademia Fisico-matematica* ceased to operate, the prelate Francesco Bianchini (1662–1729) and the Celestine monk Celestino Galiani (1681–1753) took charge of the Roman scene. They created a circle where some of the most worrisome aspects of the new science could be analysed and discussed. From 1707–08, experiments on the nature of light took place in the Quirinal palace. Where members of the *Accademia degli Antiquari Alessandrini* met, a group supervised by Bianchini and that operated under the patronage of Alessandro Albani (1692–1779), nephew of Pope Clement XI (pontiff from 1700 to 1721). There Galiani, who was intellectually trained in the prestiguous monastery of *Sant'Eusebio* in Rome, carried out sophisticated

[3]Vincenzo Ferrone, *Scienza Natura Religione: Mondo Newtoniano e Cultura Italiana nel Primo Settecento* (Napoli: Jovene Editore, 1982), pp. 11–15.
[4]For more information about the *Accademia Fisico-matematica* please refer to William E. Knowles Middleton, 'Science in Rome, 1675–1700, and the Accademia Fisicomatematica of Giovanni Giustino Ciampini', *The British Journal for the History of Science* 8 (1975), 138–54.
[5]Vincenzo Ferrone, *The Intellectual Roots of the Italian Enlightenment: Newtonian Science, Religion, and Politics in the Early Eighteenth Century* (Atlantic Highlands, NJ: Humanities Press, 1995), p. 6. This volume is essentially the English translation of Ferrone's *Scienza Natura Religione*, with some differences in the footnotes.
[6]Ibid.

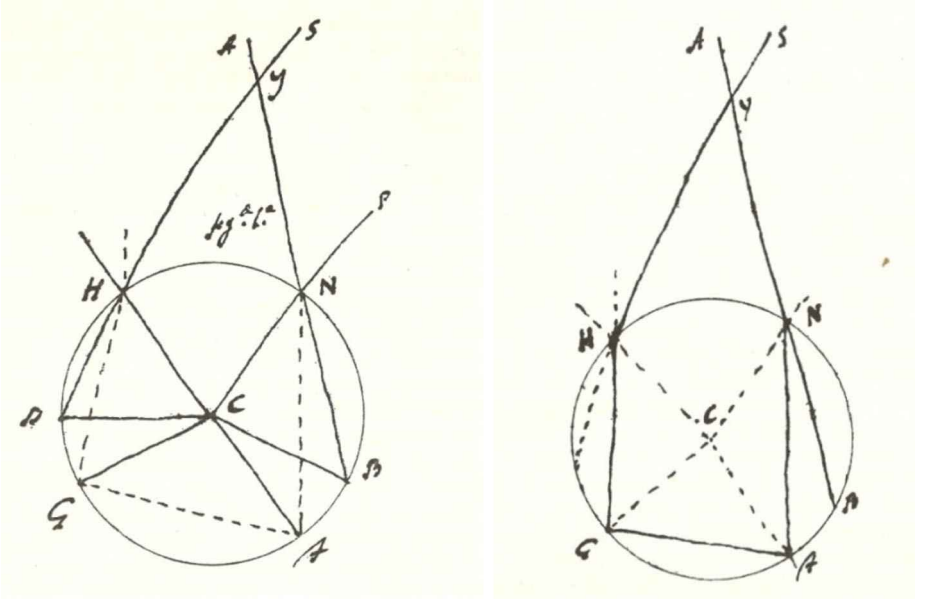

Figure 1. Galiani's optical studies as they appear in his correspondence with Guido Grandi.

optical experiments, commenting on Newtonian and Cartesian texts (Figure 1), and subsequently Newtonian cosmology.[7]

The new *Accademia* was among the first places on the continent – if not the first anywhere – where Sir Isaac Newton's (1642–1726/27) experiments on the nature of white light were discussed and reproduced.[8] The *Accademia* planned a revival of Italian sciences by establishing contact with some of the major European research centres and by promoting an effective spread of Newtonianism in the Italian peninsula. Galiani's studies culminated in two manuscripts: *Animadversiones Nonnullae Circa Opticem Isaaci Neutoni* (1708)[9] and *Differenze tra le Scoperte di Newton e l'Ipotesi Cartesiana* (1708).[10] It is interesting to note that in the *Animadversiones* Galiani reproduced the first seven propositions of Book 1 of the *Optice* and the first ten from Book II.[11] The same year, after he got a copy of Newton's *Principia* possibly through the diplomatic channels of the Holy See, Galiani produced a third manuscript entitled *Osservazioni Sopra il Libro di Newton, Intitolato Principia Mathematica* – a manuscript that proves that by that time, Galiani had also

[7]Figure 1 is an illustration referring to Biblioteca Universitaria di Pisa (BUP), Ms. 91, cc. 376r–378v; BUP, Ms. 91, cc. 379r–380v; Silvia Mazzone, Clara Silvia Roero, *Jacob Hermann and the Diffusion of the Leibnizian Calculus in Italy* (Florence: Olschki, 1997), p. 295; the two composing drawings of Figure 1 are taken from Franco Palladino and Luisa Simonutti, *Celestino Galiani – Guido Grandi, Carteggio* (Florence: Olschki, 1989), p. 58, p. 62.

[8]See John Heilbron, 'Bianchini and Natural Philosophy', in *Unicità del Sapere Molteplicità dei Saperi, Francesco Bianchini (1662–1729) tra Natura, Storia e Religione*, ed. by Luca Ciancio and Gian Paolo Romegnani (Verona: QuiEdit, 2010), pp. 63–4.

[9]Società Napoletana di Storia Patria (henceforth SNSP), MS XXX D 5.

[10]SNSP, MS XXX D 2.

[11]Mazzone, Roero, *Jacob Hermann*, p. 295, and note 642.

read David Gregory's (1661–1710) *Astronomiae physicae et geometricae elementa* (Oxford, 1702).[12] This output was significant considering that all of Rome was 'in arms against the mathematicians and physic–mathematicians […]' and the prisons of the inquisitorial tribunal were 'full of men to be questioned, and their number is always growing'.[13] Galiani, however, would never publish any of his writings or considerations.

The *Accademia* continued to connect Italy to the latest thinking in natural philosophy, especially when Bianchini travelled to England. Bianchini, a historian and astronomer operating in Rome, who was the pupil of Geminiano Montanari (1633–87), opened up a new chapter in the diffusion of Newtonianism through Italy. In Rome he was an established authority: he was renowned for his astronomical observations; he was a respected scholar of sacred and profane chronology; he was well known for the construction of the meridian at the church of Santa Maria degli Angeli e dei Martiri; and he was the papal Secretary of the Commission of the Calendar.[14] His trip to England put him in touch with Newton – who was also interested in some of Bianchini's own research – and with the environment of the Royal Society. Upon his return to Rome, Bianchini was able to share some invaluable information and experiences.

2. Connecting with Newton

Bianchini's trip started in May 1712 and brought him to France, Belgium, Holland, and England. He was supposed to carry out a diplomatic mission for the Holy See in order to bring the liturgical cardinal biretta to Armand de Rohan (1674–1749).[15] This was the official purpose. Unofficially, Bianchini's mission was to develop a better understanding of the positions of Louis XIV of France (1638–1715) and James Francis Edward Stuart (1688–1766), regarding the European political situation, and to become connected to the Catholic community living in the protestant lands to which he travelled.[16] Bianchini ended up meeting with some of the most renowned cultural personalities of that time, such as John Arbuthnot (1667–1735), John Flamsteed (1646–1719), Nicolaas

[12]Eugenio Di Rienzo, 'Celestino Galiani', *Dizionario Biografico degli Italiani* 51 (1998). Galiani originally had difficulties in comprehending the first propositions of the *Principia*, especially those passages employing the method of first and last ratios; Mazzone, Roero, *Jacob Hermann*, p. 295. The Philosophiae naturalis principia mathematica in Naples," Reading Newton in Early Modern Europe, ed. by Elizabethanne Boran, Mordechai Feingold (Leiden & Boston: Brill, 2017), pp. 23–63, on pp. 26–27.

[13]Gustavo Costa, 'Documenti per una Storia dei Rapporti Anglo–Romeni nel Settecento', *Saggi e Ricerche sul Settecento* (Naples: Istituto Italiano per gli Studi Storici, 1968), p. 427; Ferrone, *Scienza Natura Religione*, p. 11, p. 19; Ferrone, *The Intellectual Roots*, p. 4, p. 7.

[14]Casini, Paolo, 'Newton in Italia, 1700–1740: Note di Ricerca', *Newton e la Coscienza Europea* (Bologna: Il Mulino, 1983), p. 181.

[15]Francesco Bianchini, *Iter in Britanniam*, Biblioteca Civica di Verona (henceforth BCV), ms. CCCLXXIV; Biblioteca Valliceliana di Roma (henceforth BVR), ms. T.46.B; Ferrone, *Scienza Natura Religione*, pp. 57–64, on p. 58; See also Salvatore Rotta, *Francesco Bianchini in Inghilterra. Contributo ala storia del newtonianismo in Italia* (Brescia: Paideia, 1966).

[16]Ferrone, *Scienza Natura Religione*, p. 58.

Hartsoeker (1656–1725), John Keill (1671–1721), Bernard Le Bovier de Fontenelle (1657–1757), Jean Leclerc (1657–1736), and, more importantly, Newton who, by that time, was at the prominence of his career.

Bianchini arrived in London on January 16, 1713, and on January 21, he had the opportunity to meet with Newton at his house. His first opinion of England seemed to have been very high, and the Italian scholar was excited about what he saw and experienced. Interesting is the description of his arrival in London:

> The fact of having visited this country is among the most important results of my [whole] trip. The idea that I had about its magnificence was great, and great was also the idea of the friendly character of these people towards foreigners. By visiting it, I found both of them [the ideas] better than I imagined. As I entered London for the first time, I saw a long line of boats both on my right and leftside for six miles; I believe this was one of the most magnificent scenery I have seen. I was also impressed by the cohort of dames and gentlemen at the court of the Queen on the night I was received. I have never seen anything like that, especially the number of dames, who were more than two hundreds.[17]

Bianchini met with Newton on three different occasions; the first time on January 21, 1713 at Newton's house. There, he was accompanied by John Inghilis and by Keill, the latter of whom – who was at that time Savilian Professor of Astronomy at Oxford – seemed to have had a very positive relationship with the Roman scholar.[18] Bianchini had the opportunity to inform Newton of the intellectual environment in Rome and about the optical research carried out there by Galiani at the *Accademia Antiquari Alessandrini*. These were some of the most elementary experiments among those contained in the *Opticks*; however, they were sufficient enough to demonstrate some of the basic tenets of Newtonian optical research.

Newton was interested in Bianchini's studies. In fact two books by Bianchini, those on the reformation of the calendar, have been found in Newton's own library.[19] Together with Newton, Bianchini believed that astronomical observations may have played a role in furthering traditional studies on chronology.[20] Bianchini gave a very positive evaluation of Newton's *The chronology of ancient kingdoms amended* (published posthumously in London in 1728) and was convinced that the book had proven some of his own ideas on the matter.[21] A second meeting with Newton took place on February 2, 1713. On that occasion, Bianchini participated in an assembly of the Royal Society and attended

[17]Bianchini to Cardinal de Rohan, 1713, BCV, ms. CCCLXXXIV, c. 37r. See also Ferrone, *Scienza Natura Religione*, p. 60. Regarding the English translations of passages related to Ferrone that appear in this essay, the author has considered the English version of Ferrone's *Scienza Nature Religione*.

[18]See for example the letter that Bianchini wrote to Keill on 8 February 1713, BVR, ms. U. 21, c. 241rv; Ferrone, *Scienza Natura Religione*, p. 60.

[19]Casini, *Newton*, p. 181.

[20]Mazzotti, 'Il Newtonianesimo e la Scienza del Settecento', in *Il contributo italiano alla storia del pensiero. Appendice VIII della Enciclopedia Italiana di Scienze, Lettere ed Arti*, vol. 4, ed. by Antonio Clericuzio and Saverio Ricci (Rome: Istituto della Enciclopedia Italiana, 2013), p. 296.

[21]Mazzotti, 'Il Newtonianesimo', p. 296.

electrical experiments carried out by Francis Hauksbee (1660–1713). The Roman scholar joined another meeting of the Royal Society, which Newton also joined, and which was focused on optical and hydrodynamic experiments.

In those years, Newton was republishing his *Principia*. Additionally, at that time, the long-lasting feud between Newton and Gottfried Wilhelm von Leibniz (1646–1716) was particularly intense.[22] The first copies of the *Commercium epistolicum* had just been presented at the Royal Society. Newton gave Bianchini five copies, which the prelate presumably distributed among Galiani, the Camaldolese monk Guido Grandi (1671–1742), as well as brothers Eustachio (1674–1739) and Gabriele Manfredi (1681–1761).[23] This choice can be interpreted as an attempt by Newton to find influential allies in his fight against Leibniz:

> The day before yesterday I got from Lucca a small package with inside one of those books that the Royal Society printed out with the intent to defend Sir. Newton over the invention of infinitesimal calculus […] From this book it looks like […] since 1663 (and also in 1676) Newton had already invented his methods and had clearly communicated it to Leibniz, and also to other people.[24]

Unable to donate to Bianchini a copy of his *Principia*, Newton gave him two copies of the *Opticks* (one of which was a gift for the Vatican). He also promised that he would have a copy of Flamsteed's *Historia coelestis* sent to Grandi, Galiani, Eustachio Manfredi and Quarteroni:[25]

> Then he also added if I would give copies of the book to those friends of mine who were praised in Italy for flourishing in the mathematical disciplines. [To this extent] I named Manfredi, Grandi, Galiani, and Quarteroni.[26]

On January 30, Bianchini visited Greenwich where he met with Flamsteed, got updated on his research and learned about the scientific instruments composing the collection at the observatory.[27]

> Here in London I can enjoy people who deal with antiques, and Millord Pembrok and others let me see collections of drawings by Raphael and ancient medals. Other intellectuals let me observe all that is important for the sciences as I did yesterday at the Greenwich Observatory, where I met with the celebrated mathematician Flamsteed. Today I will meet Sir Newton, the most distinguished mathematician in all Europe. England is a country that is more affable than what we believe in Italy, and it deserves to be treated with closer attention.[28]

[22]As a general reference, see Domenico Bertoloni Meli, *Equivalence and Priority: Newton Versus Leibniz: Including Leibniz's Unpublished Manuscripts on the Principia* (Oxford: Oxford University Press, 1993).
[23]Ferrone, *Scienza Natura Religione*, p. 64; see also Casini, *Newton*, p. 182, and Salvatore Rotta, 'Francesco Bianchini', *Dizionario Biografico degli Italiani* 10 (1968).
[24]Grandi to Bianchini, Pisa, 14 August 1713, BVR, ms. U. 16, cc. 697r–699v; Ferrone, *Scienza Natura Religione*, pp. 64–5.
[25]Casini, *Newton*, p. 182.
[26]Bianchini, *Iter in Britanniam*, January 21; Ferrone, *Scienza Natura Religione*, p. 61.
[27]Bianchini, *Iter in Britanniam*, January 30; Ferrone, *Scienza Natura Religione*, p. 62.
[28]Bianchini to Paoloucci, 31 January 1713, BCV, ms. CCCLXXIV, c. 39r. See also Ferrone, *Scienza Natura Religione*, pp. 62–3.

He also visited the University of Oxford, where the vice-chancellor, Bernard Gardiner (1668–1726),

> In addition to offering a wonderful lunch with the most distinguished professors of the university, when he himself [Gardiner] could not personally join, by them [the professors] I was accompanied in visits to their colleagues, libraries and museums. That night he also made me enjoy a music concert.[29]

At Oxford, Bianchini met with John Hudson (1662–1719), Bodley's librarian, who gave his guest the precious opportunity to consult rare codices. Hudson asked Bianchini to help him strengthen connections with the Vatican Library.[30]

All in all, Bianchini's trip to England was an outstanding opportunity for him to get exposed to a completely new intellectual environment, learn how scientific research was carried out in England, and start a connection with the Royal Society. He also bought some of the major books on Newtonian physics available at that time in England: among them was Gregory's *Astronomiae*, a collection of books by Halley, and various works on infinitesimal analysis. These works may have helped him develop and interpret the physics of the *Principia*. When he went back home, Bianchini also made sure to bring some sophisticated prisms with which to carry out optical research.[31]

Once back in Italy, he sent Newton his own astronomical observations; Newton had them presented at the Royal Society and published, in September 1714, in the *Philosophical Transactions*.[32] Bianchini, who was elected as a fellow of the Royal Society, also took care to follow the developments of the Italian translation of Hauksbee's *Esperienze fisico-meccaniche sopra varj soggetti*, which was published in Florence in 1716. In a letter that same year, Cunningham wrote to Newton the following:

> Since I came hither have recd infinite numbers of compl[i]m[en]ts from all places in Italy, The learned seldom omit asking about you Sir and assure you of the high esteem they have for you, They are sorry you doe not write to them, I tell 'em of the multitude of your busines, and excuse you to them by a *Non si usa*, which tho it should be a good excuse evry where, I doe not find it more kindlie received any where, than here, Monsigr Bianchini kindly salutes you, I have sent to him lately the short state of the Commercium, and as soon as he has red it I expect his judgmnt of it […].[33]

Meanwhile, around 1713, Galiani had begun a correspondence with William Burnet (1688–1729), Willem's Gravesande (1688–1742), and Gregorio

[29]Bianchini to Cardinal Fabrizio Paolucci (1651–1726), London, 31 January 1713, BCV, ms. CCCLXXIV, c. 39r; Ferrone, *Scienza Natura Religione*, p. 62.
[30]BVR, ms. U. 21, c. 246r, c. 243rv; Ferrone, *Scienza Natura Religione*, pp. 62–3.
[31]Ferrone, *Scienza Natura Religione*, pp. 64–5, particularly note 16, p. 80.
[32]Celestino Galiani, *Epistola de gravitate et cartesianis vorticibus*, 1714, SNSP, MS XXX D2. See also Rotta, 'Francesco Bianchini'.
[33]Cunningham to Newton, Venice, 21 February 1716. Isaac Newton, *The Correspondence of Isaac Newton*, ed. by Herbert Westren Turnbull (Cambridge: Royal Society at University Press, 1967), Vol. IV, pp. 278–9.

Caloprese (1654–1715) with whom he discussed Newtonianism.[34] In March 1713, in a letter that Burnet wrote him, Galiani got a preview of Newton's *General Scholium* (which was about to be published) and in addition to presenting it to his Roman collaborators, Galiani debated it with Antonio Leprotti (1685–1746) in Rimini and with Giovanni Bottari (1689–1775) in Florence.[35] The Celestine monk was renowned for his mathematical ability, although little documentation is left regarding his own contributions to infinitesimal calculus.[36] Galiani had begun to study Leibnizian calculus under Gabriele Manfredi:

> […] and then subsequently to algebra and to integral and differential calculus, which at that time were beginning, amid lively opposition, to make headway in Italy, and which, later vigorously championed and defended by Galiani himself, he first learned from the *De constructione aequationum differentialium primi gradus*, which had not yet been published, and from the author of that little book in person, that is, from Gabriele Manfredi, who was the guest in Rome of the future Cardinal Filippo Maria Monti of Bologna and with whom our Celestino became very friendly.[37]

It is easy to understand that Galiani and other scholars had difficulties with the foundations of the *Principia* and other works related to Newtonianism. Scholars stemming from the old Italian geometrical school did not easily comprehend and deal with procedures involving the idea of approximation and the usage of differentials and higher differentials. This is also evident in Galiani's own correspondence with Giacinto De Cristofaro (1664–1725).[38] It was probably with the publication of Grandi's *De infinitis infinitorum* (Pisa, 1710) that a bit more conceptual order could have been put forward:

> Although Galiani does not linger at great length over these principles, he nevertheless seems still to hesitate over the degrees and orders of the differentials. But when your work is published, I hope that all Galiani's doubts, and the doubts of those two brilliant mathematicians and of others, will be totally resolved, to the great benefit and increase of mathematics and above all of the most advanced Geometry.[39]

And this was, in fact, what happened as Galiani, as of 1711, in a letter to Piergirolamo Barcellini would claim that he had no more doubts regarding the certainty of the principles of Leibnizian calculus.[40] The same stance seems to be indirectly confirmed by Grandi, who expressed his appreciation for the level reached by the Celestine monk in a 1711 letter to Piergirolamo Barcellini (XVII–XVIII centuries):

> When Your Honour writes to Father Galiani, give him my regards, assuring him that I was greatly pleased with his proof, and am very glad that he joins me in embracing the

[34]The connection between Galiani and Burnet started even earlier, when the English scientist was in Rome in 1709. Fausto Nicolini, *Un grande educatore italiano Celestino Galiani* (Naples: Giannini, 1951), p. 149.
[35]Casini, *Newton*, pp. 192–3.
[36]Mazzone, Roero, *Jacob Hermann*, p. 305.
[37]Mazzone, Roero, *Jacob Hermann*, pp. 294–5; Nicolini, *Un grande educatore italiano*, pp. 23–4.
[38]Mazzone, Roero, *Jacob Hermann*, pp. 297–98.
[39]Hermann to Grandi, Padua, 23 May 1710, Mazzone, Roero, *Jacob Hermann*, p. 304.
[40]Mazzone, Roero, *Jacob Hermann*, p. 304.

> very useful method of the infinitely small quantities, which if Giordani had been in possession of it, he would have not scoffed at, but would have solved the problem at once with a stroke of his pen, withouh making a fool of himself, as he has done with so many blunders.[41]

One of the few surviving evidences of Galiani's focus on Leibnizian calculus is his *Osservazioni intorno al calcolo integrale* (1709–11)[42] which underlines the Celestine monk's focus on Charles-René Reynaud's (1656–1728) *Analyse démontrée, ou la méthode de résoudre les problèmes de mathématiques* (Paris, 1708).

3. Galiani, the *Epistola*, and further developments

In 1714, Galiani produced the *Epistola de gravitate et cartesianis vorticibus*, in which he wrote against the Cartesian cosmology and motion of planets. The *Epistola* was a letter to the Cartesian Caloprese and was meant to be published in the *Giornale de' Letterati*, although this never happened.[43] In this writing, which circulated widely among various Italian scholars, Galiani focused more specifically on the ideas of vortices and gravity:

> It is more than one month that in order to please Mr. Gavina, one of the most celebrated men of letters in this city, I wrote a letter to one of his cousins, who is a very passionate of Descartes, with some difficulties against the two Cartesian hypotheses of the vortices and gravity.[44]

> In the first place, I wish you to know that in Cartesian philosophy there are many things I do not approve of at all, and while I reflected on it or read others' commentaries, these things seemed to me entirely uncertain, and even false. If I wished to expose all those things as they deserve, I would write a book rather than a letter. Thus in order not to go too far beyond the limits of a letter in this examination of Cartesian philosophy, I broach only two issues (i.e., that of the vortices spinning around the sun and the fixed stars, and that of gravity, which Descartes based on ether's pressure).[45]

The *Epistola* ended up being a very convincing means by which Italian scholars could develop an objective opinion about the superiority of the Newtonian perspective when compared to the Cartesian one:

> Based on Descartes' opinion (Princip., 3, num XXVIII and elsewhere), when the planets are relatively at rest in the celestial region in which they orbit, at the same

[41]Grandi to Barcellini, Pisa, 6 August 1711, Mazzone, Roero, *Jacob Hermann*, p. 305; Palladino, Simonitti, *Celestino Galiani*, p. 281.
[42]SNSP, MS XXX D 2, ff. 132r–139r; Mazzone, Roero, *Jacob Hermann*, p. 305, pp. 489–505.
[43]Galiani's letter seems to follow the general approach by Poleni in his *De Vorticibus*. However, the lack of originality was probably not the reason why the *Epistola* was not published. Ferrone, *Scienza Natura Religione*, p. 65, p. 73; Casini, *Newton*, p. 193.
[44]Galiani to Grandi, Rome, 21 April 1714, BUP, Carteggio Grandi, ms. 92, c. 363r. See also Celestino Galiani, *Epistola de Gravitate et Cartesianis Vorticibus*, SNSP, XXX D 2, c. 51r.
[45]Celestino Galiani, *Epistola de Gravitate et Cartesianis Vorticibus*, SNSP, XXX D 2, cc. 51v–52r; Ferrone, *Scienza Natura Religione*, p. 74; Ferrone, *Intellectual Roots*, p. 28.

> time they follow their orbits, and the nearby small spheres are carried around them. From this it stands that the periodic times of the planets are respective to the periodic times of the small spheres, this is to say (as in the thorem) as the squares of the distances from the center. And because Saturn's distance from the Sun is more than ninety times the earth's distance from the sun, [the ratio] of the earth's periodic time to Saturn's periodic time would therefore be 1 to 90. And when the earth completes its orbit in one year, Saturn ought to complete its about ninety times, while it makes only just thirty. Hence the Cartesian hypothesis is false to whomever reasonably finds such a consequence false.[46]

The way in which the *Epistola* was structured allowed Galani to produce some convincing arguments. This contributed to the supplanting of the Cartesian perspective within some of the most outdated scholarly environments of the peninsula. Whereas the Veneto area was already in good standing, the South needed fresh intellectual air. Naples was a stronghold of the Cartesian perspective, and Caloprese was a proponent of Neapolitan intellectual life. We can imagine how the *Epistola* may have been received by some of the more inflexible Cartesians:

> Therefore a new motion from the sun's rotation on its own axis is added to the small spheres near the sun. With that posited, it seems necessary that their motion accelerates without stopping. If in fact we suppose that the sun ceases to draw the nearby small spheres into its orbit, because of the laws of nature estabilished by Descartes, they would nevertheless continue in their runiform rotation with the very same velocity. For based on Descartes' opinion, what once is set in motion continues to move, and what moves without communicating anything to another mobile body loses none of its motion […]. But you, intelligent man, can already see what an absurdity this is: if Descartes' hypothesis were true, all the planets would have to follow their orbits in the approximately twenty-seven days in which the sun rotates on its axis, and there is nothing more false than this.[47]

In April 1714, a new academy was founded in Rome, the *Accademia Gualtieri*. It operated under the patronage of Cardinal Filippo Antonio Gualterio (1660–1728), and Bianchini and Galiani maintained their active roles. Scholars active in this circle focused on Newtonianism but also the optical theories advanced by Pierre Gassendi (1592–1655), René Descartes (1596–1650) and Christiaan Huygens (1629–1695). In a 1714 letter to Newton, Bianchini stressed:

> Your Excellence [Newton], I notified His Most Excellent Lord Alessandro Albani, the Pope's nephew, that as soon as possible he would receive a copy of the new edition of your works, which ever since they went to press as I was leaving, I intended to have them sent as soon as the typographer had published them. [Albani] says he is most obligated by your benevolence and generosity, which for quite some time he admired for the reputation that all scholars agree in expressing. Just recently it has been learned that this wonderful edition has been completed, and some friends have

[46]Celestino Galiani, *Epistola de Gravitate et Cartesianis Vorticibus*, SNSP, XXX D 2, c. 57r; Ferrone, *Scienza Natura Religione*, p. 75; Ferrone, *Intellectual Roots*, p. 29.
[47]Celestino Galiani, *Epistola de Gravitate et Cartesianis Vorticibus*, SNSP, XXX D 2, c. 58v–59r; Ferrone, *Scienza Natura Religione*, p. 76; Ferrone, *Intellectual Roots*, p. 29.

> said they saw the additions added, summarized by their headings in the brief, published list. I anxiously await this collection that all covet.[48]

What was truly remarkable about the academy were the considerable funds the Church provided it: in a 1714 letter to Grandi,[49] Galiani remarked that Cardinal Gualterio 'built a prodigious collection of instruments and gadgets, and he is ready to spend all that one may desire'.[50]

> We then arrived at the subject to be treated in the first gatherings, and His Excellency [Gualterio] commanded that we continue discussions about the things of Nature in the same order in which God created them, and therefore that we should begin with light; thus it was done … Monsignor Bianchini explained Gassendi's opinions about light, Mr. Resta those of Christian Huygens, and I those of Descartes and Newton. And we determined to continue in order, generating the experiments referred to by Newton himself in his book *De Luce et Coloribus*.[51]

In this way, Galiani and others delineated a clear programme of scientific research. For example, this was the place where Giambattista Resta built a modern version of the pneumatic machine that allowed for the establishment of the first Italian experiments on electricity, and where Galiani continued to carry on his optical experiments with the aid of the sophisticated prisms that Bianchini brought from England.[52] The new *Accademia* also tried to promote connections with other institutions in the peninsula, particularly with scholars in Naples, Pisa, and the cultural environment shaped by the *Accademia delle Scienze dell'Istituto di Bologna*.[53]

When Galiani was sent to Naples in 1731 to become *cappellano maggiore* (commissioner of education) of the Kingdom of Naples and Bishop of Taranto, the task of promoting Newtonianism was taken on by Roger Boscovich (1711–87) and also by the Minim monks, François Jacquier (1711–88), and by Thomas Le Seur (1703–70). The monks produced 'the best of all editions of the *Principia* in three richly annotated volumes' realised under the patronage of the Pope between 1739 and 1742.[54] With the election of Pope Benedict XIV in 1740, and with the arrival of Boscovich at the *Collegium Romanum* (Roman College), the city of Rome entered a new period of hope for the acceptance and spread of Newtonianism. 'A curious openness towards heliocentrism', was initiated inside the Roman College when Boscovich started to advocate for Newton and attacked the Cartesian metaphysics defended by his Jesuit brothers essentially everywhere in Europe.[55]

[48]Bianchini to Newton, Rome, 15 May 1714, BVR, ms. U. 21, c. 266rv; Ferrone, *Scienza Natura Religione*, p. 78; Ferrone, *Intellectual Roots*, p. 30.
[49]BUP, Carteggio Grandi, ms. 92.
[50]Ferrone, *Scienza Natura Religione*, p. 80; Ferrone, *Intellectual Roots*, p. 31.
[51]Galiani to Bottari, Rome, 5 May 1714, BCR, ms. 1581, 32.E.2, c. 1r; Ferrone, *Scienza Natura Religione*, p. 79; Ferrone, *Intellectual Roots*, p. 30.
[52]Ferrone, *Scienza Natura Religione*, p. 80.
[53]Ibid., pp. 81–4.
[54]Casini, *Newton*, p. 194; Heilbron, 'Bianchini', pp. 70–2.
[55]Ferrone, *Scienza Natura Religlione*, pp. 643–4.

It should also be noted that the Newtonian tradition in Naples had a slightly longer history. Before Galiani arrived there, Agostino Ariani (1672–1748) had already initiated a focus on Newtonian physics. Ariani had opened himself to the new ideas under a Flemmish scholar who gave him a solid background in geometry; later on, he taught himself texts by Philippe de La Hire (1640–1718), Guillaume de l'Hôpital (1661–1704), Gregory, Keill, and Newton.[56] Ariani was Professor of Astronomy and Geometry at Naples since 1675, and seemed to have taught about the 'discoveries of Sir Newton' in some of his lectures – his connection to Newtonianism is also documented in the *Elementa statices* (Naples, 1727) by Nicola De Martino (1701–69).[57] Also Nicola Cirillo (1671–1735) expressed favourable opinions about Newtonian science before the arrival of Galiani in Naples; similar openings were promoted by editor Lorenzo Ciccarelli, who had embarked on the risky task of republishing Galileo Galilei's (1564–1642) *Dialogue* (1710) and Jacques Rohault's (1618–72) *Tractatus physicus* (1713), and also editor Bernardino Gessari who took care of reproducing Bernhardus Varenius' (1622–50) *Geographia universalis* (1715).[58] However, it was only with Nicola and Pietro De Martino (1707–46), and later with Antonio Genovesi (1713–69), that the new cosmology and its mathematical foundations began to be more consistently accepted and supported by Neapolitan scholars.[59] Ariani, Cirillo, Nicola and Pietro De Martino were all influenced, in a way or the other, by Galiani, who put forward major contributions to the renewal of Neapolitan intellectual life. Although the Holy See was formally against the new cosmological ideas, Galiani, Bianchini and others created a surprisingly vibrant and culturally active community that affected the entire Italian cultural scene.

It is worth noting that none of Newton's publications appeared in the *Index Librorum Prohibitorum*. This is remarkable not only because of the sensitive topics dealt with in the *Principia*, but also because Newton was a Protestant in the repressive culture that followed the Counter-Reformation. Even more surprisingly, the edition of the *Principia* by Jacquier and Le Seur clearly stated that Newtonian cosmological ideas relied on heliocentrism and could not be valid without it:

> Newton assumes in the third book the hypothesis of the earth's motion. The propositions of that author could be explained except through the same hypothesis. We

[56]The exact name of such a Flemmish scholar doesn not seem to be known. Casini, *Newton*, p. 191.

[57]Federico Amodeo, *Vita matematica napoletana* (Naples: Mosca, 1727), p. 208; Vincenzo Ariani, *Memorie della vita e degli scritti di Agostino Ariani* (Naples: Catello Longobardo, 1778), p. 50, p. 81, p. 90; Casini, *Newton*, p. 191. See also Nicola De Martino, *Elementa statices in Tyronum gratiam tumultuario studio concinnata* (Naples: F. Mosca, 1727), p. LI, p. 560.

[58]Neapolitan editors also produced a new edition of Thomas Dereham's *Teologia astronomica* (1728) and William Derham's (1657–1735) *Principi filosofici di religione naturale* (1729); Casini, *Newton*, pp. 191–2.

[59]Pietro De Martino, *Philosophiae naturalis institutiones libri tres* (Naples: F. Mosca, 1738); Antonio Genovesi, 'Disputatio [later Dissertatio] Physico–Historica de Rerum Origine et Constitutione' in Pieter van Musschenbroek, *Elementa physicae conscripta in usus academicos* (Naples: typis Petri Palumbo, 1745); see also John Heilbron, *Elements of early modern physics* (Berkeley: University of California Press, 1982), p. 255.

have, therefore, been forced to act a character not our own. But we declare our submission to the decrees of the Roman pontiffs against the motion of the earth.[60]

4. The rise of Italian Newtonian texts

When Galiani left Rome in 1731, contributions to the spread of Newtonianism were already being seen in Naples – perhaps the last genuinely Cartesian city on the Italian scene. The profound intellectual renovation of Naples was evident in Nicola De Martino's treatise *Elementa statices* (Naples, 1727), a *manifesto* that helped renew the Neapolitan intellectual environment.[61] The book still had to cope with the general prohibition of the Copernican system, but Nicola was able to find a way out by summarizing the basics of Newtonian mechanics and astronomy, thus offering readers an introductory compendium to the principles of infinitesimal calculus and its application in the natural world. Nicola presented the *Principia* as a generalization of Galilean science; In this way, he highlighted the limits of the Galilean outlook without trapping himself in a theological or ideological impasse.[62] While focusing on the system of the world, the motion of projectiles, the foundation of celestial dynamics, he questioned basics tenets of the Newtonian perspective, such as the concept of the vacuum and the nature of gravity – ideas he was not willing to easily accept.

Slightly different was the case of Nicola's brother Pietro De Martino, author of the three-volume *Philosophiae naturalis institutiones* (Naples, 1738). Pietro was even more direct than his brother, paraphrasing sentences directly from the *Principia* and condemning as absurd the hypothesis of an immobile earth.[63] Pietro focused instead on the structure of matter, and on celestial and terrestrial dynamics, introducing the gravitational force as an intrinsic property of matter.[64] Like his brother, however, he avoided metaphysical discussions on the foundational concepts of the new science, especially those concerning absolute time and absolute space.[65] Pietro's publication aimed to confront those exponents of Neapolitan intellectual life who, as of 1738, maintained support for the Cartesian discourse or tried to give it new life. Pietro's results were not as successful as one might imagine. Both brothers, in fact, left their academic appointments to take up other professional paths, and failed to establish a consistent

[60]Samuel Wainwrigh, *The modern Avernus. the descent of England: how far? A question for Parliament and the constituencies* (London: Hatchards, Piccadillly, 1876), p. 286; Isaac Newton, *Philosophiae naturalis principia mathematica*, in François Jacquier, Thomas Le Seur, eds., *Philosophiae naturalis principia mathematica* (Geneva: Barillot et fils, 1739), John Heilbron, 'Censorship of astronomy in Italy after Galileo', in *The Church and Galileo* ed. by Ernan McMullin (Notre Dame: University of Notre Dame Press, 2005), pp. 279–322, on p. 307.
[61]Nicola De Martino, *Elementi statices* (Naples, 1727); Casini, *Newton*, pp. 208–12.
[62]Mazzotti, 'Il Newtonianesimo', p. 297.
[63]Pietro De Martino, *Philosophiae naturalis*, Vol. 2, p. 40.
[64]Mazzotti, 'Il Newtonianesimo', p. 297. Franco Arato, *Il secolo delle cose: scienza e storia in Francesco Algarotti* (Genova: Marietti, 1991), p. 48.
[65]Casini, *Newton*, pp. 212–15.

school to follow in their footsteps.[66] An exception, perhaps, was Genovesi, one of Nicola's students who began studying the *Principia* as a theologian. Genovesi's approach merged elements of natural theology with experimental philosophy, connecting these to the social sciences.[67]

There is then the case of the Venetian Somascan Father Giovanni Crivelli (1691–1743), who wrote his treatise in Italian and therefore potentially offered it up to a larger audience. His *Elementi di fisica* (Venice, 1731) is characterized by a relatively elementary mathematical approach; however, his precise and concise textbook provided a historical perspective that effectively framed the development of Newtonianism.[68] Crivelli delved into the three systems of the world: the Ptolemaic, the Tychonic, and the Copernican, which he openly referred to as the most plausible.[69] As of 1731, the Father would also claim that the Cartesian system was characterized by 'some remarkable shortcomings that were difficult to be overcome'.[70]

Worth mentioning, too, is Giovanni Maria Della Torre's (1710–82) *Scienza della natura generale* (Naples, 1748), and his *Scienza della natura particolare* (Naples, 1749), volumes written in Italian but later reprinted in a Latin expanded edition.[71] The work, however, lacks coherence and an effective plan. Of note are Della Torre's personal considerations in support of Newton:

> Among the moderns, the one who most precisely approached the correct method to study [the essence of] the bodies was Isaac Newton, born in Cambridge in 1642. After discarding all other possibilities, and those that are unlikely, he applied himself to the experiences and observations, deriving from them—with the aid of the most sublime geometry—the real essence of the matter composing bodies, and marvelously explaining its effects.[72]

And on the idea of gravitation:

> Together with his disciples, Newton was the first to demonstrate that bigger bodies gravitate the one towards the other; and in the natural phenomena, that all the parts of matter mutually attract each other; [in addition,] after having established a universal force law among the parts of the matters from which the gravitational law of the bigger bodies originate, he judged that this law is the fundamental source of natural phenomena […] [Newton] so gracefully attained his goal that there is nothing left to wonder.[73]

[66]Mazzotti, 'Il Newtonianesimo', p. 297.
[67]Antonio Genovesi, 'Disputatio [later Dissertatio] Physico-Historica de Rerum Origine et Constitutione' in Pieter van Musschenbroek, *Elementa physicae conscripta in usus academicos* (Naples: typis Petri Palumbo, 1745), Vol. 1, pp. 69–74.
[68]Giovanni Crivelli, *Elementi di fisica* (Venice, 1731); Casini, *Newton*, pp. 215–16.
[69]Giovanni Crivelli, *Elementi di fisica*, Vol. 2, pp. 215–36.
[70]Crivelli, *Elementi*, p. 235. See also Casini, *Newton*, pp. 216–19.
[71]Giovanni Maria Della Torre, *Scienza della natura generale* (Naples: Serafino Porsile, 1748); Giovanni Maria Della Torre, *Scienza della natura particolare* (Naples: Serafino Porsile, 1749); Giovanni Maria Della Torre, *Institutiones physicae* (Naples: Raimundianis, 1753), which is essentially the Latin version of the *Scienza della natura generale*, and finally Giovanni Maria Della Torre, *Elementa physicae* (Naples: Donati Campi, 1767–69), which is the Latin version, with revisions and expansions, of Della Torre's whole production.
[72]Giovanni Maria Della Torre, *Scienza della natura generale* (Venice: Recurti, 1750), p. XIII.
[73]Della Torre, *Scienza della natura generale*, p. 103.

The previous statement can be read in conjunction with Genovesi's own considerations of the problem, which he would eventually reveal in his posthumous *Elementa physicae experimentalis* (Naples, 1779): 'Musschenbroek is right, I believe, in stating that the cause of gravity is unknown. This [statement] should not create surprise because we ignore the essence of matter'.[74] This assertion, made at a more mature stage of the assimilation of Newtonianism in Italy, indicates that, even though the nature of gravitation remained unknown, this ignorance did not delegitimize the validity of the Newtonian outlook on gravitation; only a deep comprehension of the constitution of matter could lead to an understanding of gravity's essence.

To complete the picture are the *Istituzioni astronomiche* (Bologna, 1749) by Eustachio Manfredi, published ten years after his death. The treatise was written following 'the notes that Mr. Manfredi used to educate his own young students'[75] and constituted 'a simple and short treatise, which contains a summary of pure astronomy without depending on any physical system [doctrine]; [a treatise] on the status of this field after the discoveries that have been made by the moderns'.[76] The book, however, was not as illuminating as one might might expect:

> I am not sure if, among the physical hypotheses that have been introduced in astronomy, one should include the doctrine of universal gravity and empty space. […] The celebrated author of such a system, Sir Newton, and those distinguished men who followed his teachings, do not just consider this a hypothesis, but a physical truth on which it is not possible to doubt. Not only do some people doubt it, but many refuse even to accept it as a hypothesis. In any case, we can be sure of the fact that, among all the physical systems, this is the one which withstands all of the examinations that have been carried out, and is the one most in alignment with celestial phenomena, as one can realize by reading the excellent work of the elements of astronomy by Gregori […][77]

Manfredi's doubts about Newton's theory of gravitation were probably a way for the author to approach a sort of neutral ground. In his entire book, in fact, not only can we not find anything about the causal relationship between Newtonianism and Copernicanism, but only a small portion of the treatise focuses on Newtonian astronomy.[78] When introducing the universal gravitation law, Manfredi claims:

> If one is disgusted by the idea of taking as a physical truth the existence on the planets of such centripetal force towards the sun, then one may consider it a useful hypothesis that can help explain the phenomena governing celestial bodies.[79]

[74]Antonio Genovesi, *Elementi di fisica sperimentale* (Naples: Di Bisogno, 1786), vol. 1, p. 61.
[75]Eustachio Manfredi, *Istituzioni astronomiche, opera postuma del Dottor Eustachio Manfredi* (Bologna: Della Volpe, 1749), p. 1. Casini, *Newton*, pp. 216–19.
[76]Manfredi, *Istituzioni astronomiche*, p. XII.
[77]Manfredi, *Istituzioni astronomiche*, p. IX.
[78]Casini, *Newton*, p. 218.
[79]Manfredi, *Istituzioni astronomiche*, p. 383.

This sentence may well have seemed rather peculiar, as more openness would have been expected by such a prominent figure in the Veneto region. It may be, however, that the ideas recorded in the book were not truthful representations of Manfredi's real stances on Newtonianism. The author wrote what we may consider to be his genuine thoughts toward the end of the book:

> When it comes to Newtonian principles, I am willing to recognize their marvelous simplicity, and I admit I have never found so much ingenuity in any other astronomical system of the celestial bodies. In the same way, it is evident in this one [system] by this great philosopher [Newton].[80]

In 1739, Algarotti's *Il Newtonianismo per le dame* (Naples, 1737) was inserted into the *Index Librorum Prohibitorum*, and Manfredi had to be careful of what he wanted to express.[81] *Il Newtonianismo per le dame* was the result of extensive training undergone by Algarotti, study that found its origins in the contributions to the optical sciences the author had carried out while serving the *Accademia delle Scienze dell'Istituto di Bologna,* in collaboration with Francesco Maria Zanotti (1692–1777). As in the case of the Tuscan Giovanni De Soria (1707–67), Algarotti had produced a book that didn't directly confront the the foundational tenets of the scholastic tradition. The word God never appears in the entire publication, but the author was dangerously close to Galileo, John Locke (1632–1704), Jonathan Swift (1667–1745) and Alexander Pope (1688–1744), and embraced a sort of materialistic approach.[82] One year later, however, Maria Gaetana Agnesi (1718–99) embarked on a defense of Newtonianism in her *Propositiones Philosophicae* (Milan, 1738). Then, in 1742, on the occasion of the inaugural lecture at the Università di Pavia, Somascan Father Francesco Manara, professor of experimental physics, openly celebrated Newtonian experimentalism.[83]

Notwithstanding this eighteenth-century mixture of openness and fear, those years marked the completion of a deep intellectual change of the Italian cultural perspective: scholars from across the peninsula engaged in new debates and grew accustomed to a new way of carrying out investigations of the natural world. After an initial growth period, necessary to renew an outdated mathematical apparatus – revised mostly through the Leibnizian perspective – Italian scholars began to focus on the Newtonian approach, debating the nature of central forces, engaging in optical studies, and approaching a novel way of studying nature and the universe. From this perspective, the *Giornale de' Letterati d'Italia*

[80]Ibid., p. 389.
[81]Mazzotti, 'Newton for ladies'; Mazzotti, 'Il newtonianesimo', p. 295; Domenico Michelessi, *Memorie intorno alla vita ed agli scritti del conte Francesco Algarotti* (Venice: Pasquali, 1770).
[82]Mazzotti, 'Il newtonianesimo', p. 295.
[83]Maria Gaetana Agnesi, *Propositiones Philosophicae* (Milan: Joseph Richinum Malatestam, 1738); Massimo Mazzotti, *The world of Maria Gaetana Agnesi, mathematician of God* (Baltimore: The Johns Hopkins University Press, 2007), pp. 1–21; Mazzotti, 'Il newtonianesimo', p. 294; Francesco Manara, *Prolusio in Gymnasio Ticinensi habita a Francisco Maria Manara C.R.S. cum physicam experimentalem mechanicam profiteri ingrederetur anno MDCCXLII Kal. Decembris* (Pavia: Rovedino, 1742).

represented a unique opportunity for Italian scholarly debate. The *Giornale* gave rise to the intellectual terrain where Italian scholars could debate, connect with one another, and try out a standardized approach to the natural sciences and mathematics. The *Giornale* also gave Italian scholars a chance to reach out to the bigger *Res publica litteraria*, as copies of the journal travelled beyond the Alps. Since it also reproduced materials related to studies taking place abroad, the journal allowed Italian scholars to update their information regarding major European lines of research.

The *Giornale*, however, which first appeared in 1710 and continued to be published until 1740, after major contributions to the spread of calculus were already in place. Grandi was one of the most distinguished mathematicians to embark on the effort to modernize the older mathematical school. It took time for the Camaldolese monk to gain an appreciation for infinitesimal calculus, and he never made substantial contributions to the field. Even so, his interest in Leibnizian calculus engaged other scholars and promoted knowledge of the new methods. Grandi corresponded directly with Newton and enthusiastically shared his own perspectives on the physical science – especially those that, in his view, could further theological studies. He contributed to enlarging the Italian intellectual perspective, which, aided by the work of Jacob Hermann (1678–1733), had already begun a profound renovation. Although Hermann was keener on a mixed Leibnizian-Newtonian approach to mechanics, Grandi's approach to mathematics remained essentiallya Leibnizian. A peculiar case was presented by Jacopo Riccati (1676–1754), who favoured the Newtonian approach to mathematics, but whose enterprise repeatedly met with ill fortune.

Not only Grandi, but, as we have seen, also Bianchini and Galiani belonged to the religious substratum, and their influence spread across the peninsula. Bianchini's journey to England in turn shaped the Italian scientific scenario; books (and prisms) he brought back with him, together with the experience he gained, provided fuel to power the optical and cosmological aspects of Newtonian debate on the peninsula. Both Bianchini and Galiani made a wise use of the Holy See's network to connect with other scientific centres and to contribute to new research venues. Of particular interest is the copy of the *Principia* that Galiani obtained; furthermore, his own *Epistola* resonated throughout the peninsula and contributed to the dissolution of the Cartesian substratum. In addition, Galiani influenced the Neapolitan cultural environment, which Ariani had opened up. The Church also impacted secular institutions, as in the case of the *Accademia delle Scienze dell'Istituto di Bologna*. Zanotti and Algarotti solved their methodological impasse thanks to Modenese abbot Francesco Vandelli (1694–1771), who contributed high-quality prisms from England. And then, of course, we have to stress again the impact that Somascan father Francesco Manara had at the University of Pavia and the Barnabite Paolo Frisi (1728–84) who, in 1778, wrote his celebrated *Elogio* in support of Newton.

5. Conclusions

In this essay, I have provided a taste of what I believe was the essence of early Italian Newtonianism with special attention to the first two decades of the eighteenth century. The new ideas sparked a profound intellectual transformation, a change that was intimately connected with the Catholic Church; indeed, the Church provided the resources and energy necessary for the new ideas to flourish in the Italian background. Essential, too, were the funds the Church provided for the study of the new ideas coming from abroad – as we discussed in the cases of Cardinal Ciampini and Cardinal Gualterio. We certainly cannot assert that these contributions were made with the intent to promote the advancement of science or a broader public understanding of the sciences. This is why people like Bianchini and Galiani may be considered outliers, being positively engaged with and supporting ideas that were not exactly supported by the Church. In fact, we have discussed the possibility that the Church's intention in learning about Newtonianism was, at least in part, to maintain control over new libertine ideas.[84] Yet Newtonianism was never considered heretical, and Italian intellectual life opened further with the arrival of Boscovich in Rome and the election of Benedict XIV (pontiff from 1740 to 1758). The Geneva edition of the *Principia* by the Minim monks Jacquier and Le Seur – written in Rome under the patronage of the Pope – is one of the finest literary gifts of the European Enlightenment. Benedict XIV himself found ways to support the integration of science and religion; the contributions by Jacquier and Le Seur on one hand, and Boscovich on the other, clearly indicate the Pope's efforts.[85] Each of these scholars served on the Pope's committee to renovate St. Peter's Dome, and in 1746 Jacquier was appointed professor at the Roman College. In addition, Benedict XIV put forward fundamental reforms in promoting the role of women in the spread of new knowledge, and strongly advocated for a general cultural and social renewal of the Church in the middle of the eighteenth century.[86]

We can thus understand how Italian Newtonianism differed from what happened elsewhere in Europe, where the scientific and religious realms were not so deeply connected with each other. In other countries – notably in France – *philosophes* were attempting to free scientific research from religious influence. But

[84]Ferrone, *Scienza Natura Religione*, pp. 12–13.

[85]For a more precise focus on Benedict XIV the reader should consider Rebecca Messbarger, Christopher M.S. Johns, Philip Gavitt, eds., *Benedict XIV and the Enlightenment: art, science, and spirituality* (Toronto: University of Toronto Press, 2016).

[86]Messbarger, *Benedict XIV*, pp. xxix–xxx, pp. 17–90, pp. 177–252. See also Paula Findlen, 'Science as a Career in Enlightenment Italy: The Strategies of Laura Bassi (1711–1778)', *Isis* 83 (1993), 441–69; Paula Findlen, 'A forgotten Newtonian: women and science in the italian provinces', *The sciences in Enlightenment Europe*, ed. by William Clark, Jan Golinski and Simon Schaffer (The University of Chicago Press, 1999), pp. 313–49; Paula Findlen, 'The scientist's body: the nature of a woman philosopher in Enlightenment Italy', *The faces of nature in Enlightenment Europe*, ed. by Gianna Pomata and Lorraine Daston (Berlin: Berliner Wissenschafs–Verlag, 2003), pp. 211–36; Paula Findlen, 'Translating the new science: women and the circulation of knowledge in Enlightenment Italy', *Configurations* 2 (1995), 167–206.

on the Italian peninsula, notwithstanding the effects of the Galileo Affair and the general prohibitions on Copernicanism – major contributions to the spread of new mathematical and scientific ideas came from individuals within different factions of the Church, who acted more or less independently from the Church's oversight. It's true that proofs capable of demonstrating the Copernican system were still a long time coming, and that the Galileo Affair had embarrassed the Church and marked a scientific and cultural trauma for the entire *Res publica litteraria*. The Church well knew these facts.

Newtonianism had the effect or revitalizing Italian intellectual life, especially after the economic and cultural decline of the second half of the seventeenth century. The Church – some Enlightened Catholics within it – developed quite a strong interest in the new ideas coming from abroad, eventually comprehending and mastering them, and made significant contributions to their dissemination. From the analysis of some the earlier examples, it seems the Enlightened Catholics were unofficially trying to make up for the damages of the Galileo Affair (and the general scientific decline and intellectual closure that followed), while avoiding discrediting the Church's own official stances and thus openly contradicting its powerful authority. How can we explain the fact that many of the major agents in the Italian spread of the new science were part of the Church? Primary evidence suggests that people like Bianchini, Crivelli, Galiani, Grandi, Jacquier, Le Seur, Manara, Vandelli but also, in a sense, Albani, Ciampini, Gualterio, and later definitely Boscovich and Frisi, may have well realized that they were witnessing an inexorable transition that had already started to bring Western Civilization into the age of science. In such an era, the medieval scholastic approach could not survive. There is no doubt that Italian Newtonianism was, in large part, a Catholic effort. In order to rescue the Church – and to avoid further embarrassment – a renovation was needed. And Pope Benedict XIV may have realized it, too.

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