Franklinists in Naples in the second half of the 18th century

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Introduction

Around 1770 some works on electricity were published in Naples: two by Giuseppe Saverio Poli, *La formazione del tuono, della folgore e di varie altre meteore giuste le idee del signor Franklin* (1772), and *Riflessioni intorno agli effetti di alcuni fulmini* (1773); in the same year there was the respons of the scientist Gian Gaetano del Muscio, *Dissertazione con cui si risponde a varj dubbi promossi contro la teoria dell'elettricismo del Franklin del dott G.S. Poli.*

In spite that both authors claimed to be orthodox Franklinists, they gave conflicting interpretations to a series of phenomena regarding the nature of electric conductors.

It is well known that the 70's was a crucial period for the studies of electricity, since they marked the transition from a mostly experimental activity to a greater mathematization of this discipline.[1] So, it is extremely interesting to understand, what, in Italy and in particular in Naples, the debate was about the problems that mostly concerned the physicists of that time. One of these problems was the interpretation of some anomalies of electrized glass. [2]

The purpose of this paper is to highlight and discuss the state of studies on electricity in Naples in the second half of the 18th century, pausing in particular on the analysis of Poli's and del Muscio's detailed works, where they examined the very general problems regarding the theories on electric conductors and where they attempted to explain everything by applying the atmospheric theories of Franklin, even the behaviour anomalies exhibited during experiments with the Leyden jar.

The topics that will be discussed are as follows.

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[1] Cfr. J.L. Heilbron, Elements of Early Modern Physics, Berkeley 1982.

[2] In the 70's, most people that worked on electricity, supposed that glass was completely impermeable; Franklin was the first to sustain this supposition in 1751.

A short commentary on the state of scientific equipment and scientific research in Naples during the period of University reforms under the Ministery of Tanucci in the years from 1759 to 1776.

A discussion of the works on electricity which were published in Naples in the 18th century.

A brief demonstration, through the analysis of del Muscio and Poli's works. These writings raised and confronted some of the problems concerning atmospheric electricity as well as electrostatic electricity produced in the laboratory, the similarities but also the differences between them. Even though they both considered themselves to be Franklinists, they each gave different explanations to permeability of glass and secondary discharge in the Leida jar.

1. Scientific equipments under Ministery Tanucci (1759-1776)

It is important to point out that Naples was the capital of the largest Italian state, the Reign of the Two Sicilies, and in the second half of the 18th century it was the center of an intense push to promote and adapt an appropriate techno-scientific development such as enjoyed in other European capitals. In order to analyze and understand science, it is necessary to have proper scientific equipment. But what was the state of scientific equipment in Naples during the time of Enlightenment? On this point there is unanimous agreement: at the University of Naples, at that time, there was a very scant selection of scientific equipment and no physical laboratory in which to carry out experiments.[3]

The cultural policy of Bernardo Tanucci during the years 1759-1776 paid little attention to the reform programs initiated by Antonio Genovesi. The Genovesi policy called for economic, agriculture and scientific reforms for the Reign of the Two Sicilies. Tanucci did not understand the fact that the social and civil progress of a nation is measured by its technical and scientific accomplishments.[4]

An example of scientific disinterest on the part of Tanucci's Ministery, was the lack of interest shown to a request made in 1760 by the Newtonian Felice Sabatelli. Sabatelli wanted to institute an astronomic observatory; however, his request was repeatedly ignored and the observatory became a reality only at the beginning of the Nineteenth century. In fact, the experimental physics teaching at the University of Naples, established in 1735 by the Newtonian Celestino Caliani, was abandoned in the second half of the 18th century due to lack of teachers and a physics laboratory[5].

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[3] See A. Borrelli, *Istituzioni e attrezzature scientifiche a Napoli nell'età dei Lumi*, Società Napoletana di Storia Patria, 1996, 131-183.

[4] Ibidem, p.133.

[5] See E. Schettino, *L'insegnamento della fisica sperimentale a Napoli nella seconda metà del Settecento*, Studi Settecenteschi, 18 (1999), pp.367-376.

2. Works on electricity published in Naples in the 18th century

We can find some works on electricity published in Naples starting from 1747[6], when the translation appeared of the work of Georg Mathias Bose[7], *Commentario epistolare sopra l'eletricità,* followed, in the same year, by the work *Dell'elettricismo* - by anonymous - the first edition of which was published in Venice in 1746. Finally it appeared the work by Giovanni Windler[8], *Tentamina de causa electricitatis quibus Brevis Historia de nonnullis Auctoribus qui hanc praecipue excoluerunt materiam, premissa est.*

In 1748 we find the work of Niccolò Bammacaro, *Tentamen de vi electrica ejusque phaenomenis in quo aeris cum corporibus universi aequilibrium proponitur.*

In 1750 it was published the first edition of *Scienza della natura,* by Giovanni Maria della Torre. This work was used as a manual in the teaching of experimental physics, according the Newtonian approach [9]. Although it was a treatise on physics, elecricity was abundantly treated therein.

In 1761, it was translated - most likely by Maria Angela Ardinghelli - the work of the French scientist Jean Antoine Nollet[10], *Lettere intorno all'elettricità del signor Abate Nollet tradotte dal franzese.*

After the 1760's, no work on electricity was published in Naples. This scarcity of studies on electricity is in line with what happened in other scientific forums both in Italy and abroad. One needed to wait more than 10 years before some works appeared which closely examined the questions confronting the theories on electric conductors and the anomalies exhibited during experiments with the Leyden jar.

The authors, Gian Gaetano Del Muscio and Giuseppe Saverio Poli, cannot be considered true and proper electrical scientists.

Del Muscio was a refined mathematician who first introduced algebraic calculus in his teachings in Naples[11]. He was trained in Rome at the very prestigious "Collegio Nazzareno". His teacher was Father Urbano Tosetti, who was the first to

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[6] For a critical analisys, see P. Nastasi, *I primi studi sull'elettricità a Napoli*, fasc.2 (1982), pp.237-264-

[7] G.M. Bose, *Tentamine electrice*, Wittenberg, 1744.

[8] Windler, probably a student of Bose, was called to Naples by the Prince of Tarsia, Ferdinando Vincenzo Spinelli. Spinelli was an amateur of, and a dabbler in the electric sciences. Spinelli called Bose to be curator of his private physics studium.

[9] E. Schettino, ibidem, pp. 371-374.

[10] J.A. Nollet, *Lettere intorno all'elettricità del signor Abate Nollet, tradotte dal franzese*, presso Raimondi, Napoli, 1761.

[11] For a biography of Del Muscio, see P. Thoma Vinas, *Jannes Caietanus Del Muscio. A s. Iosepo, Index Bio-Bibliographicus scholarum piarum*, volumen tertium, Romae, 1911; and p. Leodegario Picanyol (a cura di), *Rassegna di Storia e Bibliografia Scolopia*, Roma 1942, pp.211-212

introduce an actual laboratory where his teaching of experimental physics according to the new empirical orientation could be conducted. While at the "Nazzareno", Del Muscio embraced the Newtonian ideas and in his doctoral thesis, *Propositiones ex Physica Selectae* (1765) [12], he demonstrated that he was already aware of the new electrical theories of Franklin, even going as far as to analyze them in a specific chapter entitled "De electricismo tum artificiali tum naturali".

Del Muscio taught in Naples from 1773 to 1778 at the Reale Collegio Ferdinandeo, a college designed for the education of nobility.

In complete contrast it was the background of Giuseppe Saverio Poli. He studied in Padova near Marco Antonio Caldani, specializing in medicine. In Naples, however, he became fascinated by physics and because of his scholarly teachings, he was called to teach at the "Reale Accademia della Nunziatella".

3. Theories of electric conductors in Del Muscio and Poli's works

We will begin with an analysis of Poli's book written in 1773[13] because in it a deeper examination can be found of other theories already raised in 1772, namely the divergent issues resulting from experiements with the Leida jar.

This work of Poli is divided in four chapters: in the first and in the third ones he discusses atmospheric electricity, the construction of lighting rods and their public usefulness, following the theories of Franklin.[14] The second and the fourth chapters are entirely dedicated to the electrostatic electricity produced with the Leida jar and the Franklin square. Poli described a series of experiments conducted by himself, which put into question one of the main theories of Franklin, i.e. the adiathermanousity of glass. Poli himself did not know the explanation because the discharge of the Leida jar was not immediate.

According to Poli, the secondary observed discharge was instead not justified by Franklin's dominant theory. An other issue in conflict with Franklin's theory was the possibility of charging a jar which also had a fissure in it.

His work finishes with an other series of experiments examining electrical and magnetical phenomena by witnessing the inside of a glass vase, containing a needle, fill with water and electrically charge. Again, this reaction could not be satisfactoraly explained by applying Franklin's theory, leaving Poli to realize that:

1st: there is no substance in nature which cannot spread electricity, that is, no isolating substance exists;

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[12] G.G. Del Muscio, *Propositiones ex Physica selectae,* Romae 1765.

[13] For a biography of Poli, see G. Nicolucci, *Sulla vita e sulle opere di Giuseppe Saverio Poli,* Memorie della Società Italiana delle Scienze, sez. III, (IV) 1881, pp.46-53.

[14] Incidentally, up to this point of time, no lightening rods of any type had been installed in Naples or the outlying regions of the Reign of the Two Sicilies.

2nd: no matter what its composition or form, glass - when electrified - distributes the electricity not only on its surface, as purported by Franklinists, but also on the inside of the surface of the glass.

Poli wrote: "Tali si è stato il risultato delle mie sperienze, replicate più volte, siccome ho già detto, con vetri, e cristalli non solamente di varia forma, e grandezza, ma eziandio fabbricati in vari Paesi, come sono quelli di Germania, di Boemia, d'Inghilterra, di Venezia, e di Napoli: e mi sembra di avere forte motivo di poter concludere, che il fuoco elettrico, oltre al diffondersi per la superfizie del vetro, si proccura eziandio in qualche modo di passaggio attraverso la sostanza del medesimo."[15]

Nevertheless, to explain with his model also the insulating effect that the glass at times displayed, Poli resorted to the existence of the two forms of electricity which he called "per origine e per comunicazione".

The work caused a great debate amoung the Neapolitan scholars of electricity. Among those, the mathematician and physicist Del Muscio was one of the major adversaries of Poli. Del Muscio thought that Poli explained the electrical phenomena by turning away from the new and returning to the old theory of Cartesio, even though partially modified. This prompted Del Muscio to caption it the "old semi-Cartesian theories". Obviously, Del Muscio was referring to the two forms of electricity which Poli introduced to explain the electrification of glass.

To reaffirm the theories of Franklin, Del Muscio wrote a pamphlet in 1773.[16] This book of 66 pages is divided into 4 chapters and it begins with an introduction on the significance of the experimental method. Every single experiment conducted by Poli was re-examined and reinterpreted in Del Muscio's booklet. Obviously, this could be done in a time when physics was as exact as mathematics, but above all it was possible to do because of the lack of precise instruments.

Del Muscio refuted Poli's positions not with proper experiments but by relying on points already stated by Cesare Baccaria, re-introducing entire passages of the works of this Turin scientist. [17] Del Muscio accused Poli of practicing bad experimentation, in which since he did know how to analyze the results of the experiments, he relied on external causes for the explanation. A case in point was glass, which when heated to a certain temperature becomes a conductor. Moreover, it was well-known to the Franklinists that the impermeability of glass depends on its hygrometric state too.

These were the considerations that pushed Del Muscio to write: "Che ve ne pare signor Poli? sono gli esperimenti che dimostrano false le leggi del Franklin, o sono

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[15] Poli, loc. cit., p.LXXXI.

[16] Gian Gaetano del Muscio, *Dissertazione con cui si risponde a varj dubbi promossi contro la teoria dell'elettricismo del Franklin del dott G.S. Poli.* Napoli 1773, previously cited in this article.

[17] G.B. Beccaria, *L'elettricismo artificiale*, Torino, 1772. Beccara came to be known as the great spreader of Franklinism in Italy.

le circostanze non avvertite, e lo spirito di contradire, che vi spingono a non riconoscerle per vere?"[18]

A year later, Poli responded to Del Muscio's pamphlet; a work[19] which seemed more an official defence of his Franklinian position than anything else. He had conducted no new experiment in 1774 and this volume seems to be merely a rehashing of his earlier works. However, he did insert a letter written to him by the elderly Della Torre, taking Poli's position in the quarrel between himself and Del Muscio. Poli apparently felt the need to get back in the good graces of Della Torre, who was certainly a great figure among prominent Neapolitans and among the advocates of Newtonianism in scientific teaching.

The elderly Father Della Torre not only shared Poli's ideas, but he considered them as his discoveries, so to write: "Così sono principalmente le due nuove scoperte da Voi fatte, e confermate con replicate esperienze, la prima delle quali è l'adesione della materia elettrica a tutti i corpi, e più ad alcuni, che ad altri; e la seconda è (benché questa in alcun riguardo fosse stata immaginata da altri), che per alcuni vetri, e cristalli non solo superficialmente, ma ancora per la loro solidità passa il fluido elettrico.[20]

Conclusion

An in-depth analysis of Neapolitan scientific production in these years, leads one to state that:

- in Naples, electrical experiments were repeated without originality;
- the electrical scientists explained anomalies raised by experimental practice only by applying the already tested theories. We justify Poli for applying two models of experimentation (Franklinist and Cartesian) to arrive at explanations regarding laboratory produced electricity. Del Muscio applied only one model - the Franklinist approach.

To reconfirm what is evident on the outline, one can see that after the year 1774, there were no further experiments on electricity. The interest about electricity was raised again only in the 1780's and then mainly with practical applications.

As for the main actors on the electricity stage in the 1770's, they dedicated themselves to other pursuits: Del Muscio became a bishop and was transferred to Puglia and Poli dedicated himself to his teaching and to the rewriting of his physics manual, which was not only widely praised but also adopted by Volta.

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[18] G.B. Del Muscio, op. cit., p.LIV.

[19] G.S. Poli, *Continuazione delle riflessioni intorno agli effetti di alcuni fulmini*, Napoli, 1774.

[20] See: *Lettera di risposta al Sig. D. Giuseppe Poli del P. D. Gio. Maria Della Torre,* in G.S. Poli, op. cit, p. CXLIV.