PIETRO COSSALI: A VERONESE ASTRONOMER

Massimo Tinazzi
Università di Padova

Abstract

Verona was the native town for some important astronomers between '500 and '800 and was a rich center for scientific activities and for the major Italian personalities, excelling in Veneto. Pietro Cossali was one of these citizens, completely devoted to scientific-mathematical research, he hold astronomy, meteorology and hydraulics desk in the royal university of Parma and then that one of sublime calculus at Padua university. His principal production was devoted to the astronomy, to the mathematics with the first history of mathematics published in Italy, to the hydraulics with original contributions. He didn't neglect even the passion for literature and he was man of letters and author.

Introduction

Retrieval of personality of Pietro Cossali becomes part of a historic research about sciences between '500 and '800 in Verona; in it are coming up again astronomers, physicists and all personalities in general who worked in different scientific fields, who were born and operating in Verona, city that had a patrimony of the best scientific brain(1). In Verona there were eminent characters who were interested in astronomy and who produced high level works. A historical research is in act to bring at large public knowledge, after centuries of oblivion, aiming at recovery and exploitation of these characters and of their contributions to the Italian astronomy. Here I propose the personage and the work of Theatine abbé Pietro Cossali (astronomy, meteorology and hydraulic professor at Parma royal university, and then sublime calculus at Padua university) who left a remarkable amount of publications at Episcopal seminary Library and at Agriculture, Science and Letters Academy; some unpublished writings and correspondence are kept in Verona Civic Library, where there are 37 portfolios(2) which I am filing and cataloguing to have a clear valuation,

I remember that the eighteenth century veronese tradition in astronomical sciences boasted already two other distinguished names: monsignor Francesco Bianchini(3), a priest that worked for many years also in Rome, and Antonio Cagnoli(4) president of Italian Society of Sciences. Verona was a city in which there were many scientific cultural incentives(5) and in fact 31 academies(6) were born here, some also with national fame.

It's necessary to remember that in Verona was founded the Italian Society of Sciences(7) in 1782 for will of Anton Maria Lorgna(8) who worked at this project for many years; in 1786 he published a catalogue of the first «quarantia» or the 40 names of Italian scientists called to subscribe the extraordinary institution that was the Academy of XL, which represented the best in national science of that time. Between members there were great names such as Alessandro Volta, Lazzaro Spallanzani, Ruggero Boscovich, Luigi Lagrange, Giovanni Arduino, Giuseppe Toaldo, Luigi Galvani, Barnaba Oriani, Giuseppe Calandrelli: it was the first nucleus chosen by Lorgna himself.

The experience of Italian Society of Sciences remains one of most interesting and fascinating of the Italian eighteenth century because it carried out the unitary soul of Italian scientists and realized an idea apparently utopian but, on the contrary which was really fretelling the following history and the ideas of intellectuals. The new idea was to

put together the forty most distinguished scientists of whole Italy in one only society which represented, at least in the sciences, united Italy, thus overcoming the frontiers which divided our peninsula. It was founded as a free association, politically and financially independent, at which a limited number of members were admitted; their members were democratically selected between high level personalities and the only title for admission was an acknowledged scientific capacity; the subjects treated were only about mathematics, physics and natural sciences and prizes or remunerations were not admitted for any reason, except for some "spoon of good chocolate"[9]. It was a new institution completely different from others, Italian and foreigners, which excited also Napoleon Bonaparte; because its members didn't meet between themselves (they voted by letter about President proposals) factions and fronts were prevented, so the unity of institution was not ruined.

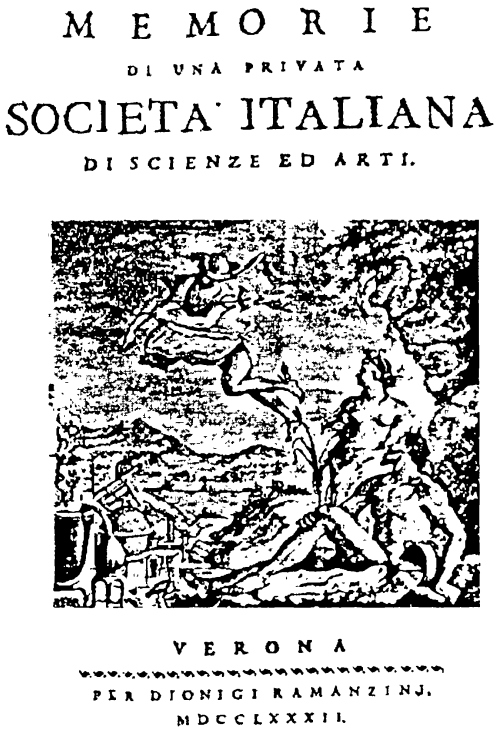


Fig. 1 Draft of the allegoric title-page projected by Lorgna in 1781 for the "Memorie di una privata Società Italiana di Scienze ed Arti" with mythological drawings and between them Mercury excels, with physics, chemical, astronomical instruments, mathematical formulas and elements of natural history.

We have to consider that in Italy an academic tradition in sciences was missing, and this fact hindered meetings, exchange of ideas and memories publication, that is a great limit for science development. On the contrary in England, French and Germany the great academies were born already in '600 and they became urging centres for research, very useful for editing publications which permitted the circulation of ideas and discoveries. Besides the academies announced rewarded competitions about the most interesting problems which had to be solved. As in Italy the eighteenth century scientific research was lacking in organization and diffusion possibility similar at others

European countries. The Academy of XL was the first possibility given at Italian scientists to go out the inferiority condition.

In the first catalogue of this institution there were ten Venetian scientists, therefore a quarter of the best Italian brains lived in the Serenissima, and we can conclude that Veneto had an important role in scientific Italian history at the end of '700, and the investigation of this environment give us interesting surprises.

Biographical outlines

Pietro Cossali was born in Verona july 29 1748 from Count Benassù and Countess Laura Malmignati[10]. His religious vocation coincides with studies development made in local Jesuitical college, with brilliant results and already in that period of his life showed a precise interest for philosophy and mathematical subjects. He was attracted by his Jesus Company and he entered in novitiate, but he didn't accomplish it, because of his impatience and perhaps of damage of his health due to the strict discipline of the Order. Notwithstanding this he carried on his studies privately, with a religious of Theatine order[11]: he studied Newton, Locke[12] and above all Wolff[13], whom he appreciated for his methodicalness and his attempt of close fusion of cosmology, metaphysics and calculus; at the end of this work, at only eighteen years old, according to epoch use, he kept in Verona a public discussion about different scientific and philosophical thesis with excellent results. Probably he was influenced by and he decided to enter the Theatine Order (Theatines were less severely anchored to metaphysical prejudicial in comparison with Jesuits) and in February 1768 he became regular cleric in Milan.

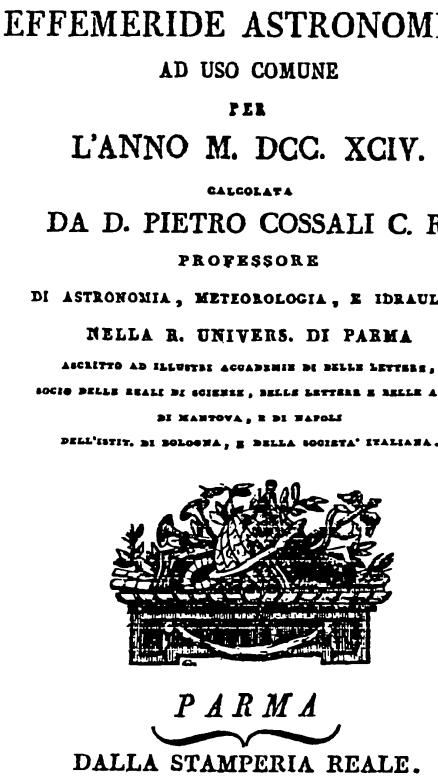
His capacities and his eclecticism were remarkable, in fact a lectureship of canon law at Padua University was offered around 1770, but he declined it to concentrate himself in scientific studies[14]. After his taking vows the Order send him in Padua as predicant.

Since 1778 he came back in Verona, where he was suitable mathematician and physicist, supporting the major scientific veronese character of that time, Anton Maria Lorgna, director of military school. His first writings underline his position in balance between religious and scientific themes, and the most representative works are the "Lettera... all'avv. L. Bramieri sulla quistione, se l'anno denominato 1800 sia l'ultimo dei secolo XVIII, o il primo del XIX"[15][16], or "Su la celebrazione della Pasqua del corrente anno 1802"[17], "Sul giorno... della Pasqua nell'anno venturo 1805", Parma 1804. The first scientific known article written by Cossali[18] is the reply at a question of 1781 from Padua Academy ("Dissertazione di una assoluta dimostrazione della irreducibilità del binomio cubico"[19], Verona, 1782) but the four "Lettere apologetiche critiche", printed in the quarterly "Progressi dello spirito umano nelle scienze e nelle arti"[20], were more famous because of the controversial with the well known analyst, G. B. Nicolai[21][22]; at this phase belongs also the assay "Limite comunemente non avvertito della consueta regola di doppia falsa posizione"[23] and the little volume "Su l'equilibrio esterno ed interno nelle macchine aerostatiche[24][25] (Verona, 1784): he was among the first experimenters of flying machines.

The latter is dedicated to the mathematician G. Riccati[26] of Treviso, with who Cossali was in correspondence for some years. If from historical point of view this writings is one of the many documents born from the immediate echo in Italy of the experiments of Montgolfier, on the technical point of view it is one of the best attempts of those years to set out scientifically the construction and manoeuvre of the air balloons. Cossali was one of the first in Italy to raise a balloon, without crew, covered with India rubber and inflated with hydrogen, experimenting publicly in the Arena of Verona between 1783 and 1784. In a pithy booklet he described all the characteristics

and the large number of the physical laws that must to be obeyed for the correct construction of a perfect aerostatical apparatus[27]; in this booklet with "external balance" he meant the ratio between the weight of air balloon and the weight of an equal air volume, and with "internal balance" the ratio between gas pressure and resistance of the involucre. He faced matters about physics and chemics of gases, considering Cavendish's researches and others about oxygen, he proved above all to have the curiosity of the real scientist, he showed all benefits that the scientific research would have obtained in the future from these apparatus, in the field of meteorology, physics, and medicine. The aerostatical ascension weren't booth phenomena but real undertaking of thought, and Cossali had clear the possibilities of the new means, particularly for physical and meteorological researches.

The notoriety of these publications induced duke Ferdinando of Borbone, in 1787, to offer him the professorship of theoretical physics in Parma university, changed in 1791 in astronomy, meteorology and hydraulic. The Parmese cultural flowering of the second '700 had interested also the university, but he was conscious of its instrumental limitation he potentiated the observatory begun by I. Belgrado[28]. His letter of 1791 sent to Oriani[29] shows the cares he had in this direction, and his researches took shape in seven annual astronomical ephemerides volumes, with introductions about themes of general astronomy[30]. He obtained from the government a financial help for observation about planets that he carried out in Milan, in the Brera observatory, and for the installation of a meteorological observatory in Theatine Parmese house, in which he



EFFEMERIDE ASTRONOMICA

AD USO COMUNE

PER

L'ANNO M. DCC. XCIV.

CALCOLATA

DA D. PIETRO COSSALI C. R.

PROFESSORE

DI ASTRONOMIA, METEOROLOGIA, E IDRAULICA

NELLA R. UNIVERS. DI PARMA

ASCRITTO AD ILLUSTRI ACCADEMIE DI BELLE LETTERE,

SOCIO DELLE REALI DI SCIENZE, BELLE LETTERE E BELLE ARTI

DI MANTOVA, E DI NAPOLI

DELL'ISTIT. DI BOLOGNA, E DELLA SOCIETA' ITALIANA.

PARMA

DALLA STAMPERIA REALE.

Fig. 2 Title-page of the ephemerides published by Cossali for year 1794 by Parma university.

effected pluriannual systematical recording that he never succeeded in publishing. His astronomical work had public recognition from colleagues, so that famous Cagnoli said that he "dominated the skies".

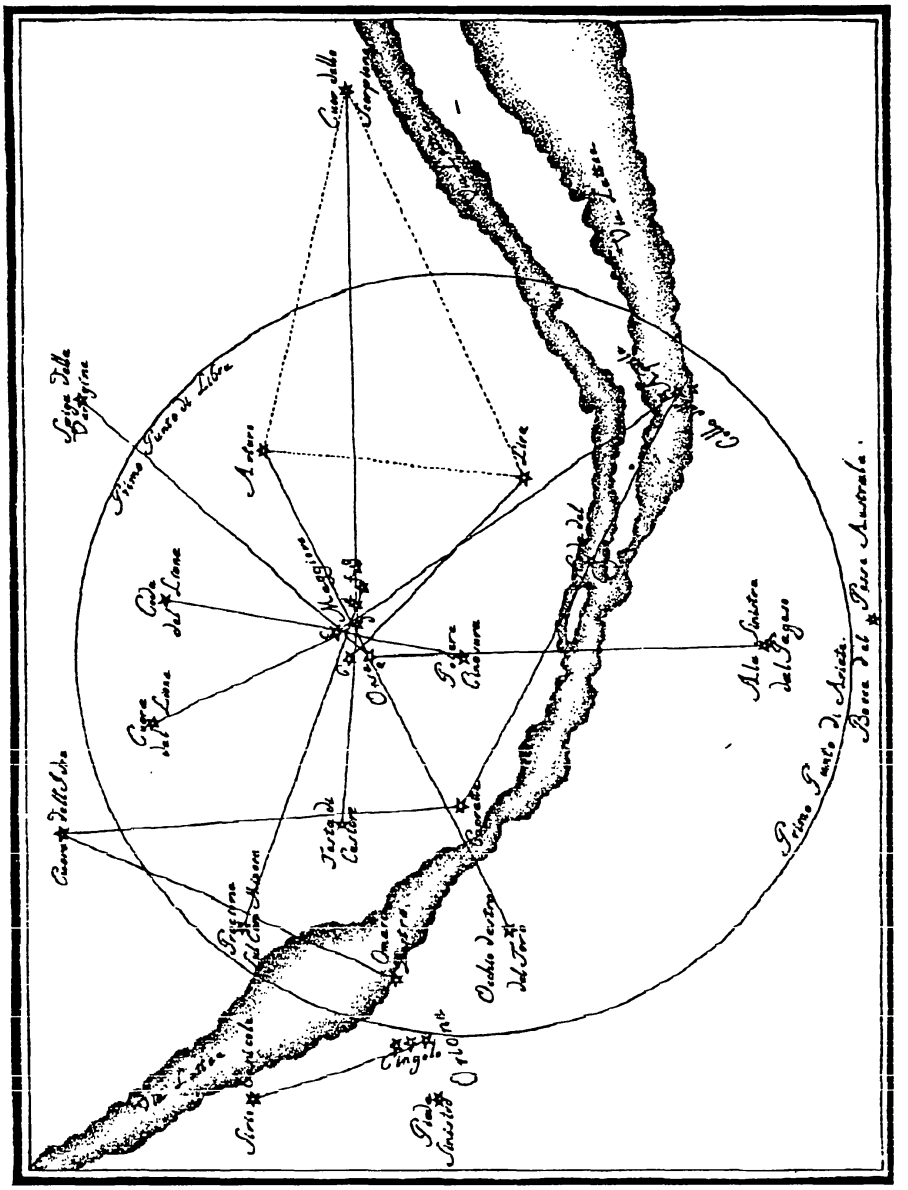


Fig. 3 A drawing of Milky Way and some constellations published by Cossali.

In published articles we can see the evident purpose of the author to be comprehensible by a public wider than the only specialist one that's to say it must "l'essere quinci più facile a ravvicinarvelo, ed il tenere ai sensi un più immediato rapporto". In conclusion we are in presence of a declared didactic aim so that everybody could understand the specific astronomical language and above all the informations that

this science could furnish. For these aspects the Theatine was ahead of his times, proposed himself an aim even popular which today is in vogue in great part of the modern scientific literature.

Cossali was also famous as historian of mathematics, as it emerges from his major work, "Storia critica di nuove disquisizioni analitiche e metafisiche arricchita"[31] and from the exacting re-examination of Euclidean mathematics[32]. An analysis of the themes and methodology of this work consents then to trace, if not a real intellectual biography of this author, at least some connections between his work, the themes circulating in scientific Emilian and Venetian ambience and some characters of European historiography and philosophy of mathematics of his time. A further aspect of his polyhedric interests was already realized in Parma where he became also government adviser about hydraulic problems, and arbiter in analogous quarrels between Parmese families.

In developing and keeping a wide network of relations, both direct and epistolary, he was facilitated by a certain pleasure for high society, linked also to his literary activity, which, far from being as secondary for quantity and diligence, was not only occasional but mostly dedicated to celebrative and laudatory occasions; however he attained a certain reputation as writer, by means of his poetical compositions, sonnets, panegyrics and celebrations. He was an Arcadian (in Veronese colony founded in 1705) named Uranofilo Parmisio, name with which he signed some poetic compositions devoted to the noblewoman Lodovica Ghirardini, and to another Arcadian[33][34], countess Silvia Curtoni Verza[35], and at his sister[36]. Contemporary sources remember also writings forgot today, as some observations about "Asolani" of Bembo and a letter to Pindemonte on artistic beauty. During the years he taught in Padua he was the unofficial orator of the academic body in occasion of commemoration of philosophical[37] and scientific illustrious personalities[38][39].

An aspect less easy of Cossali was his self-consciousness which contributed to render not always simple and brought at controversial irritation his character, perhaps due to the wish to see his own merits appreciated; all the witnesses agree on this trait of his personality as well as on his being basically humane and consistent. His inclination for controversy explains the different enmities aroused in the academic world; besides the quarrel already remembered with Nicolai we have also to mention the one with Lorgna, originated by his rough remarks on some analytical procedure used by Cossali.

Lorgna, promoter of the Italian Society of Sciences, called Academy of Forty, for long time opposed himself to admission of Cossali and this fact was probably the inner reason of the tension between them which manifested itself by means of publications and articles in which they blamed respective mathematical works. Cossali became member of the Academy of Forty only in 1783, when Lorgna had to recognize the importance of his "Storia critica": they became reconciled and Cossali published various contributions on "Memorie" of the society[40]. Cossali was also member of many important Italian academies such as the Academy of Sciences of Padua, Mantua, Turin, Naples, Academy of Agriculture Sciences and Letters of Verona, academy of catholic religion of Rome, and in Napoleonic period from 1811, pensioner of Italian Institute. His membership in scientific community procured him the esteem of his Order, of which he was provincial Superior.

In 1805 the wars in act pushed him to come back to Verona to continue the research, where he was offered the teaching post for introducing sublime calculus in local classical school, with superintendence of channels, bridges and roads, while Austrian government applied him for Hydraulic advices. These were very important in Veneto because the territory went through a serious hydrogeological ruin, specially around Verona, Vicenza and Padua, and this fact didn't allow an adequate development of agriculture because of the disastrous floods that followed one another.

The events of his life never seemed to suffer the political changes of Napoleonic age; before he served the Habsburg and, after annexation of Veneto in Italy kingdom, with a decree of 1806 he was designated teacher of sublime calculus in Padua university and then honorary inspector of waters and roads, member of the commission for arrangement of the Brenta. Without any doubt his not taking sides for a definite ideological choice and the ease with which he launched in commendations contributed at this persistent fortune, so that in writings of Paduan years we can read praises for Bonaparte that seem excessive and instrumental. We must nevertheless admit that notwithstanding the promises of large acknowledgement, he was able to resist the pressures on him in order to get a more direct pro-French involvement., and he remain faithful to his religious status and to Catholicism.

His astronomical production collected the ephemerides already cited, some observation about solar eclipses, some theoretical works original and curious enough about stones rains(41) coming from lunar volcanoes(42), about elliptic orbit parameter(43) determination of a planet when varying its position in relation to Earth.

Cossali died in Padua in 1815, on December 20, and further confirmation of his remarkable eclecticism comes from his testament(44) from which we learn the great extent and diversity of lectures that he had harboured. After defining monetary matters with his relatives and servants he nominates the heirs of his books: a library composed of mathematical, physical, chemical, natural history, agriculture, civil and military architecture, geographical and arts texts, encyclopedia of Lausanne, books of poems, of Greek, Latin, Tuscan and French proses, parchment codexes, on metaphysics and jurisprudence, Erasmus from Rotterdam works, books of Greek, Latin, Italian grammar, dictionaries, of rhetoric, of profane and holy history, anatomy and medicine, Pascal's Thoughts.

ACKNOWLEDGMENT

The author would like to acknowledge the help given by Chiara Zanin for translation and the advice and encouragement offered by prof. E. Proverbio.

REFERENCES

1) Orlandi A., La ricerca e la letteratura scientifica, in *Cultura e vita civile a Verona*, Verona, Banca Popolare di Verona, 1979.
2) Cossali left to his pupil Floriano Pasetti the scientific part of his library and some unpublished works, with charge to make copy of the best and to send at university of Padua library. But this disposition was not realized, and it is probably that those writings, with correspondence and other unpublished, became possession of his family. Between the paper Baldassarre Boncompagni selected some assays of mathematical history, part preparatories and part complementary the major work; Almost all material and important correspondence flowed together later on in Civic Library of Verona. Some Cossali's letters are in the correspondence with G.A. Slop preserved in university library of Pisa.
3) Francesco Bianchini (1662-1729), lived for forty years in Rome holding prestigious offices near Pontifical Curia and devoting himself to scientific research with astronomical, geographical, topographical, archaeological, architectural contributions.
4) Antonio Cagnoli (Zante 1743 - Verona 1816) acquired a notable juridical experience in a first time and when he was thirty years old he became secretary of Venetian ambassador in Madrid. In 1780 proceed to scientific study for which he devoted himself

entirely. He realized an observatory in Paris and then he moved to Verona in 1785 where he built an observatory in his home. His fame of astronomer and mathematician became high in consequence of his publications. In 1789 was elected president of Italian Society of Sciences for 18 years.

5) Biadego G., *Accademie veronesi: Accademia d'Agricoltura, Scienze, Lettere, Arte e Commercio*, Verona, Franchini, 1903.

6) Maylender M., *Storia delle Accademie d'Italia*, Bologna, Cappelli, 1926.

7) Penso G., *Scienziati italiani ed unità d'Italia. Storia della Accademia nazionale dei XL*, Acc. Naz. dei XL, Roma, 1978.

8) Anton Maria Lorgna (Verona, 1739-96) was an eclectic character who was interested mainly in chemics but also in mathematics, hydraulics, astronomy, physics, and particularly in series develop, in equations of superior degree, in infinitesimal calculus, in electrical fluid and in fluid mechanics developed by Bernoulli.

9) Curi E., Le idee scientifiche nel Veneto alla fine del settecento, in *Tra conservazione e novità: il mondo veneto innanzi alla rivoluzione del 1789*, 27, Accademia di Agricoltura Scienze e Lettere di Verona, 1991.

10) Baldini U., in *Dizionario biografico degli italiani*, Vol. 30, Istituto della Enciclopedia Italiana, Roma, 1984, p. 104.

11) Theatines war the order of "regular cleric of divine providence" founded in Rome (1524) by S. Gaetano da Thiene and G.P. Carafa (then become Paolo IV) to reform the life clergy.

12) The English philosophy John Locke (1632-17047) was one of the most important member of empiricism. Criticising innaticism he placed the ideas origin in experience.

13) The German philosophy Christian Wolff (1679-1754) was the most important member of Enlightenment in Germany. He asserted that every science has to appeal at not contradiction principle through analysis and deduction.

14) Zendrini A., *Biografia degli italiani illustri nelle scienze, lettere ed arti* (E. De Tipaldo), vol 7, Venezia, Alvisopoli, 1840, p. 407.

15) In *Lettere sopra vario argomento utile e dilettevole*, s. l. né a. (ma Parma 1801), pp. 14-22.

16) AA.VV., *Lettere inedite d'illustri italiani*, Milano, 1835, pp. 148.

17) Parma without author, reprinted in Florence in 18O4.

18) It was preceded by a little brochure about treatment of Cardano about third degree equation, "Particularis methodi de cubicarum aequationum solutione...", appeared in Venice in 1779 with dedication at admiral A. Emo.

19) Cossali P., *Dissertazione di una assoluta dimostrazione della irreducibilità del binomio cubico in risposta al quesito analitico proposto dall'accademia di Padova nel 1781*, Verona, 1782.

20) IV , 1783, pp. 113-116, 160-163, 172-176, 429-432.

21) Giovan Battista Nicolai (Venice 1726-Schio 1793) was professor of mathematics at Padua University (Memorie sopra una nuova genesi delle curve).

22) Cossali P., Quattro Lettere apologetiche dell'analisi algebriche contro il Nicolai, in *Progressi dello spirito umano nelle scienze e nelle arti*, IV, pp. 113-116, 160-I63, 172-176, 429-432, 1783.

23) Negli *Opuscoli scelti sulle scienze e sulle arti*, VIII, Milano 1785, pp. 73-87.

24) Boffito G., *Il volo in Italia*, Firenze, 1921, pp. 196, 242.

25) Boffito G., *Biblioteca aeronautica italiana illustrata*, Firenze, Olscki, 1929, I, p. 132.

26) Giordano Riccati (Treviso 1709-90) was mathematician and architect, son of Iacopo Francesco mathematician and sanitary engineer that proposed differential equation that has his name.

27) Cossali P., *Sull'equilibrio esterno ed interno delle macchine aerostatiche*, Verona, Moroni, 1784.
28) Iacopo Belgrado, Jesuit, performed mathematical studies in Bologna and theological studies in Parma. In 1738 assumed the title of confessor and theologian of Filippo di Borbone, and mathematician of the Royal House. The protection of Borbone allowed him, in 1757, to prepare an astronomical observatory in Jesuitic college of Parma and he could devote himself to scientific studies (Observatio defectus Lunae habita and Parma in novo observatorio patrum Societatis Iesu die 30 iulii 1757) and become member of different Italian scientific academies and of Academy of Paris. In 1763 had a blunt leave by Ferdinando di Borbone inspired by Theatine Paolo Maria Paciaudi, opponent of the Jesuits and the first sign of the religious politics that later on the Bourbon minister Du Tillot would have carried out. (cfr. Cappelletti, *Dizionario biografico degli italiani*, Vol. 7 Istituto della Enciclopedia Italiana, Roma, 1965, p. 578)
29) Barnaba Oriani (Garegnano 1752 - Milan 1832) astronomer and geodesist, director of Brera observatory.
30) Cossali P., Effemeride astronomica ad uso comune per l'anno 1794, Parma, Stamperia Reale, 1794; Ibid. per l'anno 1795; Ibid. per l'anno 1796; Ibid. per l'anno 1797; Ibid. per l'anno 1798; Ibid. per l'anno 1799; Ibid. per l'anno 1800; Ibid. per l'anno 1801; Ibid. per l'anno 1802; Ibid. per l'anno 1803; Ibid. per l'anno 1805.
31) Cossali P., *Origine, trasporto in Italia, primi progressi in essa dell'algebra. Storia critica di nuove disquisizioni analitiche e metafisiche*, 2 Voll., Parma, Stamperia Reale, 1797.
32) Cossali P., *Degli elementi di Euclide libri 8*, Verona, Moroni, 1805.
33) Cossali P., Ritratti d'alcuni illustri amici di S. Curtoni Verza, in *Arcadia Flaminda Caritea*, Verona 1807, pp. 27-30.
34) Cossali P., *Sonetti dedicati alla nobil signora contessa Curtoni Verza*, Padova, 1811.
35) Uglietti F., *Una gentildonna veronese tra rivoluzione e restaurazione. Silvia Curtoni Verza (1751-1835)*, Archivio Storico Curia Vescovile, Verona, 1983.
36) Cossali P., *Sonetti VII ad Anna Cecilia sua sorella monaca*, s. l. né d.
37) Cossali P., *Elogio di F. Stellini professore d'etica nella Univ. di Padova*, Padova, 1811.
38) Cossali P., *Elogio di G. Poleni*, Padova, 1813.
39) Cossali P., *Elogio di L. Lagrange*, Padova, 1813.
40) About determinate types of equations; about stress of ropes; about hypotesis of lunar origin of meteoritic stones; about properties and construction of barometer; about rule of double false position in calculus; about mathematics in commercial compound.
41) Poggendorff J.C., *Biographisch-Literarisches Handwörterbuch zur Geschichte der exakten Wissenschaften*, Lipsia, 1863.
42) Cossali P., Sull'opinione delle piogge de' sassi dei vulcani lunari. Disquisizione matematica, Modena, Soc. Tipografica, 1806, in *Mem. Soc. Ital. delle Sci.*, Tomo XIII, 1807.
43) Cossali P., *Lettera al sig. Antonio Cagnoli sul problema di determinare un'orbita ellittica in un orbita ad un tempo dato qualunque piccolo cangiamento geocentrico di un pianeta con emendazione di una formula del Frisi*, Modena, Soc. Tipografica, 1817.
44) Boncompagni B., *Scritti inediti del p. P. Cossali chierico regol. teatino*, Roma, Tip. Belle Arti, 1857.