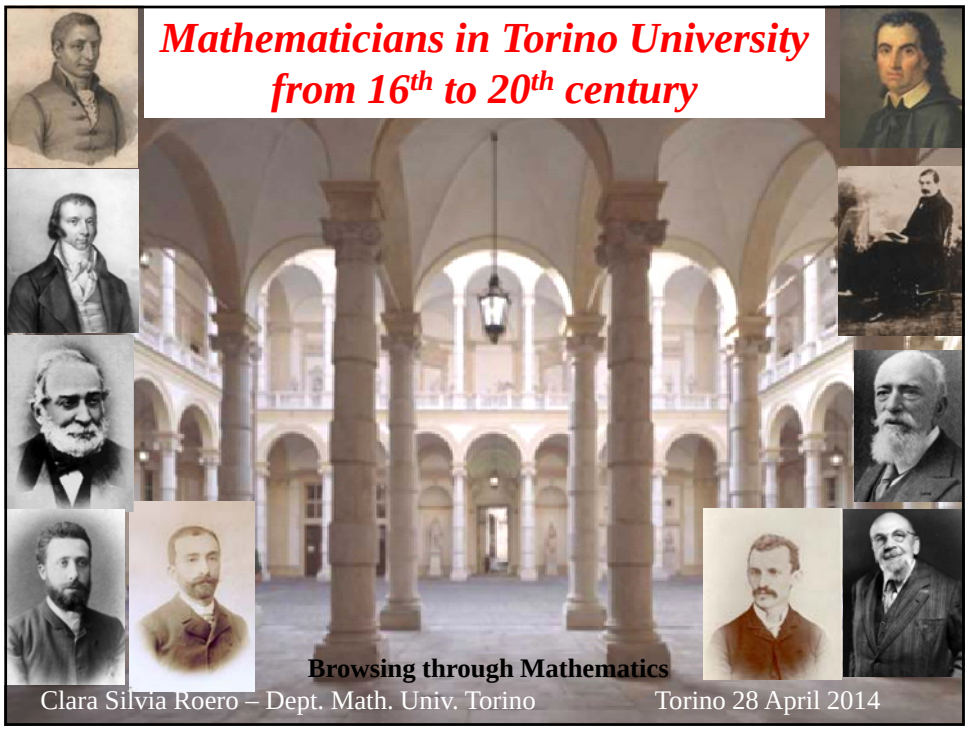


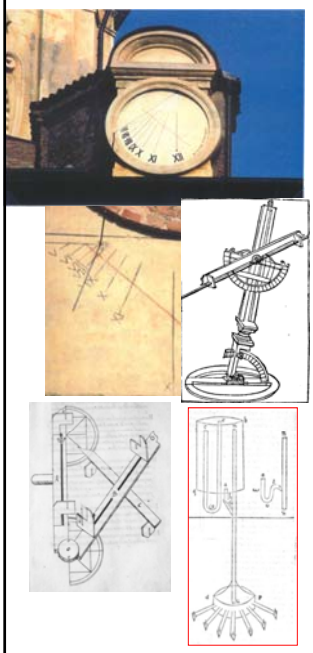
The Duchy of Savoy in the Late Renaissance
Giovanni Battista Benedetti 1530-1590

- Venetian mathematician, from 1558 to 1566 was at the court of Ottavio Farnese in Parma.
- Benedetti was invited by **Duke Emanuele Filiberto** who had great plans to raise the cultural level of the Duchy and the **scientific culture** at the University, transferred by him in Torino in 1567. His aim was also to establish a museum-library called ***Theater of all sciences*** [*Teatro di tutte le scienze*]
- He reached Savoy at the end of **1566** or beginning of 1567 and remained until his death (Jan. 20, **1590**).
- His activity covered a range of interests: classical geometry, mechanics, physics, metereology, music, acoustics, optics, hydrostatics, astronomy, astrology, etc.

Diversarum speculationum mathematicarum et physicarum Liber 1585

Collection of letters to mathematicians, scientists, philosophers, musicians and scholars of all Europe

Giambattista Benedetti 1530-1590



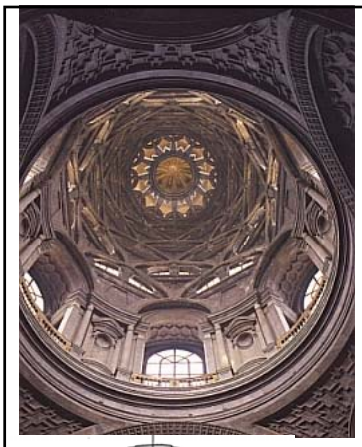
- *Resolutio omnium Euclidis problematum una tantummodo circini data apertura* 1553
- *Demonstratio proportionum motuum localium contra Aristotilem et omnes philosophos* 1554
- *De gnomonum* 1574
- *Diversarum speculationum mathematicarum et physicarum Liber* 1585

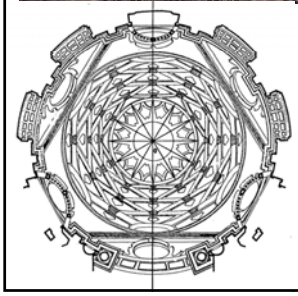
He performed the duties of a '**court mathematician**', employed **to plan and construct sundials** and other scientific **instruments** (oil lamp, mechanical clocks, tools for surveying and mensuration), to **advise** on engineering and the architecture of public works (fortifications, fountains) and on university affairs, to **interpret astronomical** events and to **provide** astrological **forecasts,** to give lectures on mathematics and science to the Duke and the princes of the house of Savoy, like Carlo Emanuele I, etc.

Guarino Guarini 1624-1683

A cosmopolitan artist, born in Modena, studied theology, philosophy, mathematics and architecture. During his travels to Rome, Vicenza, Prague, Parma, Messina, Lisbon, Paris, Nice, Torino and Milan he came into contact with scholars and artists. The fruit of these exchanges ripened during Guarini's **period in Torino**, from **1666** until his death (March 6, **1683)**.
In 1668 became **Royal Engineer** and **Mathematician of Savoy**

- *Placita **philosophica***, 1665
- ***Euclides adauctus et methodicus***, 1671, 1676
- *Modo di misurare le fabbriche*, 1674
- *Compendio della **sfera celeste***, 1675
- *Trattato di **fortificazioni***, 1676
- ***Leges temporum et planetarum***, 1678
- ***Caelestis matematicae***, 1683
- Plates in *Novum Theatrum Sabaudiae*, 1675
- *Disegni di **architettura civile ed ecclesiastica***, 1686
- *L'architettura civile*, 1737



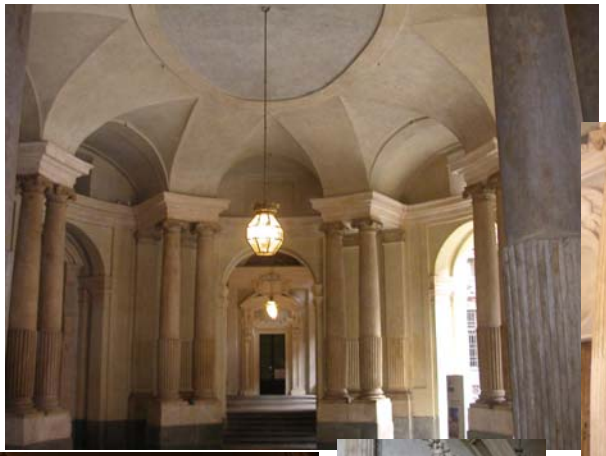


Guarini, *Euclides adauctus ...* 1671

Thaumaturga Mathematicorum miraculorum insigni vereque regali architectura coruscat

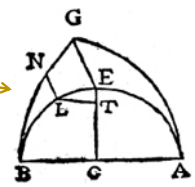
underlines the **miraculous power** that **mathematics exerts on architecture**, declaring that it is possible to **draw on mathematics' most sublime ideas**, a science that he sought to enrich with the fruits of his labour

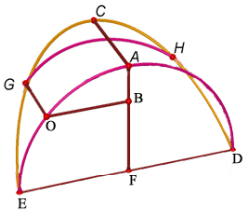
Carignano Palace



Carignano Palace

Carignano Palace

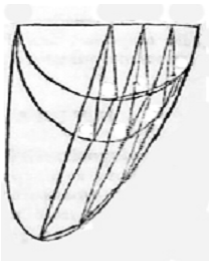


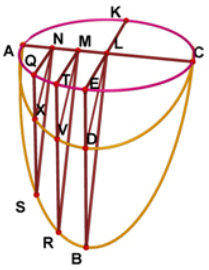


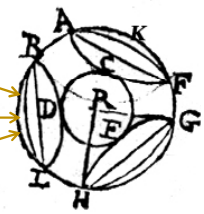

EVCLIDES ADAVCTVS
ET METHODICVS
MATHEMATICAQVE VNIVERSALIS
CAROLO EMANVELI II.
SABAVDIAE DVCI PEDEMONTIVM PRINCIPI
REGI CYPRI, &c.
DICATA,
AVCTORE
D GVARINO GVARINO
MVTINENSI C.R. THEATINO.
AVGVSTÆ TAVRINORVM, M DC LXXI.

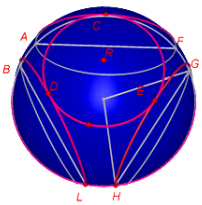
Guarini conceived **new curves**, new **surfaces** and new **solids** which could be used in the construction of buildings, churches, noble palaces, gardens, staircases, columns, vaults, lunettes, and more.

Saint Lawrence





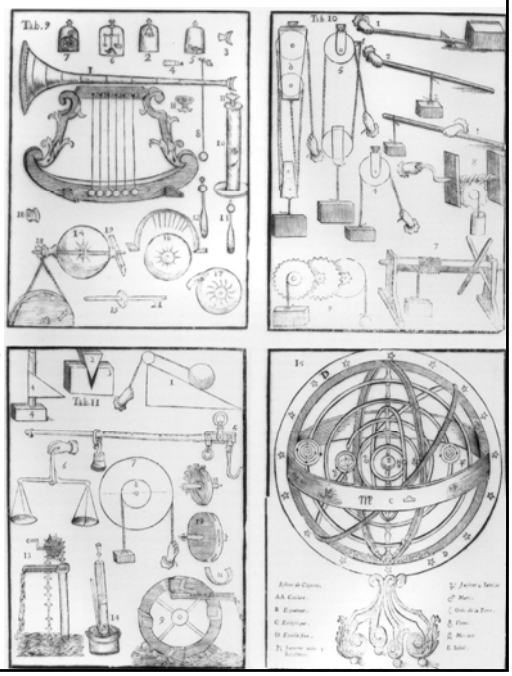




Duchy of Savoy

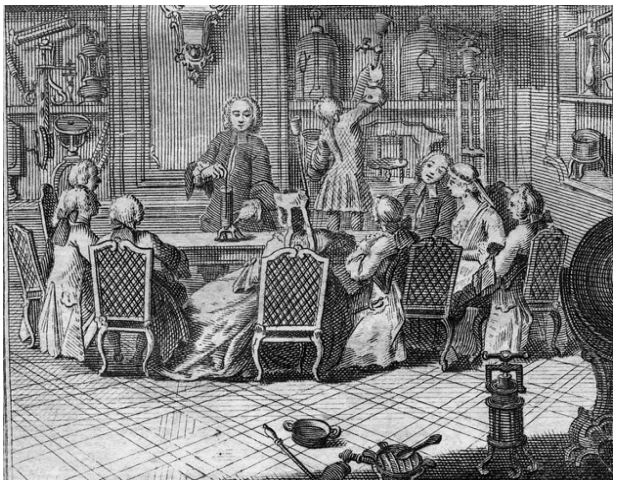
1739 Scientific Museum

- Chamber of **Experimental Physics**
- Chamber of **Mathematics**
- Chamber of **Botany** and **Zoology**
- Chamber of **Anatomy**
- Chamber of **Marvels** *Wunderkammer*



1700-1770

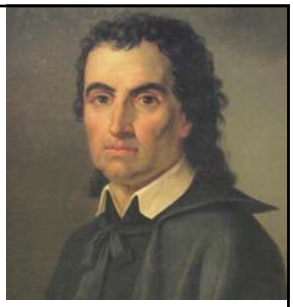
The soujourn of Jean Antoine Nollet in Torino 1739-1740



French clergyman and physicist Nollet spent 6 months in Torino, invited by the Duke to teach **Physics** to prince Vittorio Amedeo III.

He conducted physical **experiments** in the face of court and **sold instruments** to the Duke for his Museum.

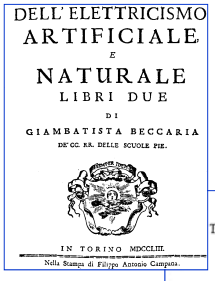
Giambattista Beccaria 1716-1781

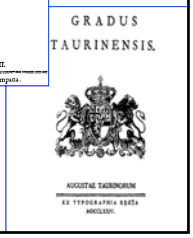


- **1748-1781 Torino University Professor of Experimental Physics – lectures on**
  - Galileo's and Newton's theories
  - results of scientists

    Kepler, Descartes, Huygens, Newton, Leibniz, Boyle, Musschenbroek, Johann Bernoulli, Daniel Bernoulli, … B. Franklin
  - Among his students at the university:

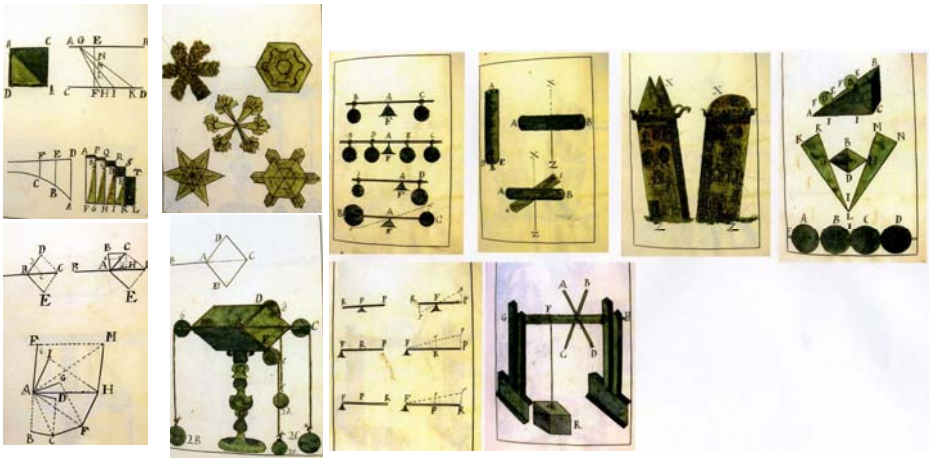
    mathematician Joseph Louis **Lagrange** and his friend the physician Gian Francesco **Cigna** , two of the founders of the Turin Academy of Sciences.


DELL' ELETTRICISMO
ARTIFICIALE
E
NATURALE
LIBRI DUE
DI
GIAMBATISTA BECCARIA
DE' CC. RR. DELLE SCUOLE PIE.
IN TORINO MDCCLIII.
Nella Stampa di Filippo Antonio Campana.

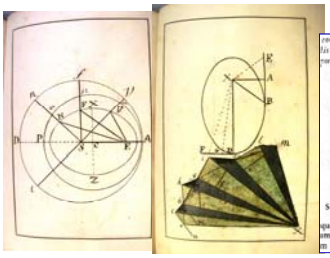

GRADUS
TAURINENSIS.

Torino 1748-1781

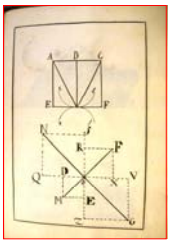
Institutio I ***De Physica et de optima Physicae excolendae via***
Institutio II ***De corpore, et corporum affectionibus***
Institutio III ***De affectionibus actuosis praesertim de motu universe***
Institutio IV ***De vi inertiae, deque tribus legibus Newtonianis***
Institutio V ***De motuum differentiis, de aestimatione motus uniformis***
Institutio VI ***De pressione et compositione motuum, resolutione, aequilibrio***
Institutio VII ***De pressionibus diffusis, earum aequilibrio, et centro communi***



Torino 1748-1781

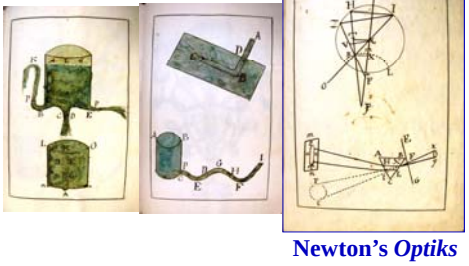


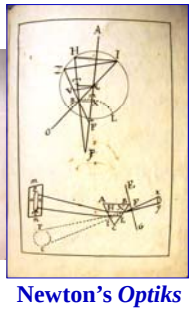
Kepler's Laws in Newton's *Principia*



Leibniz mv^2

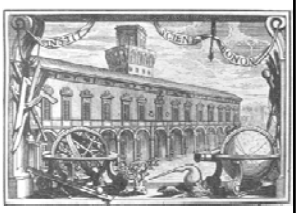
Institutio X ***De gravitate coelesti***
Institutio XI ***De motu qui fit ex percussione***
Institutio XII ***De Liquidis***
Institutio XIII ***De Aere***
Institutio XIV ***De Lumine***
Institutio XV ***De re electrica …***





Newton's *Optiks*

➢Follower of B. Franklin, Beccaria published works on **electrical phenomena** and erected the first iron rod on his house in Turin and hailed its usefulness in providing protection against lightning.



Dell'Elettricismo artificiale e naturale **1753**

(*Lettere a G. B. Beccari*) ***Dell'elettricismo*** **1758**

De electricitate vindice (to **B. Franklin**) **1767**

Elettricismo artificiale **1772** (English transl. 1774)

➢ member of Royal Society and Bologna's Institute of Sciences

Torino 1736-1766

Kingdom of Carlo Emanuele III 1730-1773

25 January 1736 in Torino

Reform of University by Vittorio Amedeo II 1680-1730

Faculties

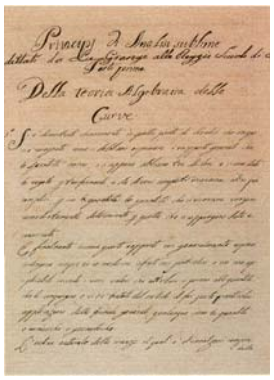
- ➢ Theology
- ➢ Jurisprudence
- ➢ Medicine, Arts and Philosophy

June 1752 Lagrange obtained the title of ***maître-es-art pour le Droit*** and follow the lectures of Physics, Mathematics and Logic
Studied at the Public Library and wrote letters to the Italian mathematician Giulio Carlo Fagnani and then to Leonhard Euler in Berlin

J. L. Lagrange Turin **1755-1766**
"substitute of the teacher of Mathematics"
Military Schools courses of **Analysis** and **Mechanics**

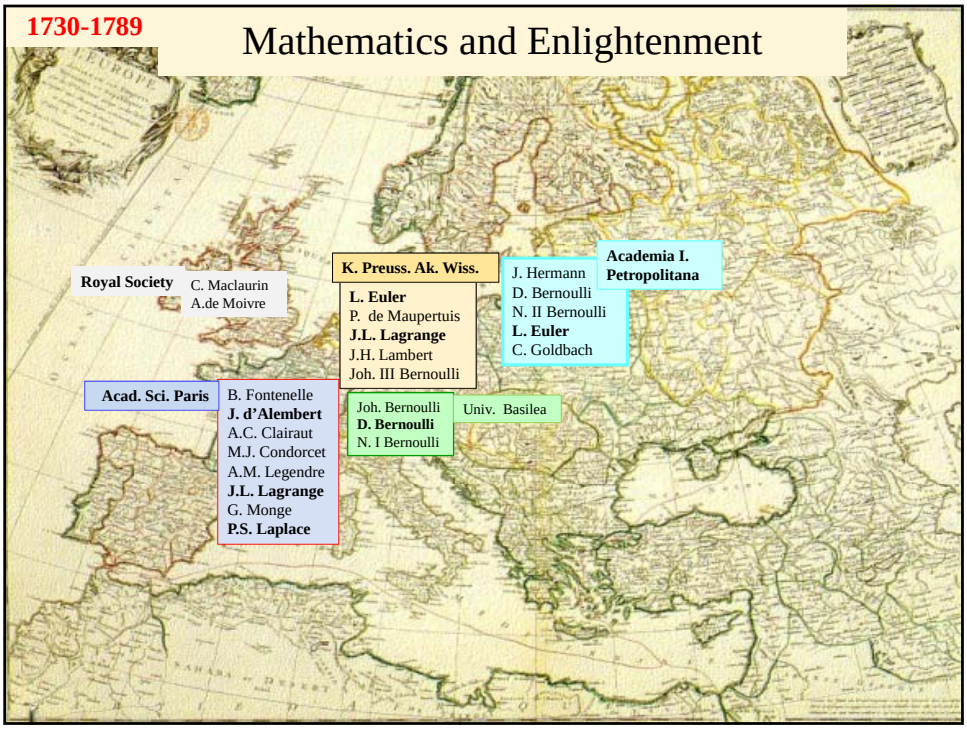
1754-1759 from Lagrange's correspondence to G.C. Fagnani and the quotation in his lessons *Principi d'Analisi sublime* of treatises on Calculus we know that he studied

M.G. **Agnesi** *Instituzioni Analitiche ad uso della gioventù italiana*, 1748,
L. **Euler** l'*Introductio in analysin infinitorum*, 1748; *Institutiones calculi differentialis*, 1755; il *Commercium Epistolicum* fra **Leibniz** e **Johann Bernoulli** (1742); **Jac. Bernoulli** *Opera omnia* 1744; **Joh. Bernoulli** *Opera* 1742; **L. Euler** *Mechanica, sive motus scientia analytice exposita* 1734, 1736; *Methodus inveniendi lineas curvas maximi minimive proprietate gaudentes* 1744.



1730-1789

Mathematics and Enlightenment



Berlino 1740-1766

Académie Royale des Sciences et de Belles Lettres

Federico II *il Grande*
1712-1786

Voltaire

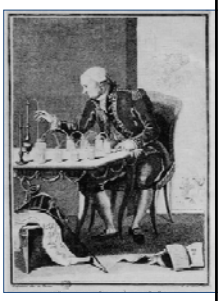
Sans-Souci

Pierre L. M. de Maupertuis
1740-1759

Leonhard Euler
1744-1766

1756 Discussions with G. Beccaria who threw Lagrange, Saluzzo and Cigna out of his Laboratory of Physics. **1757** The three young men met weekly in Saluzzo's home and founded a ***Private Scientific Society***

Giuseppe Angelo SALUZZO
1734 – 1810 chemist



1747 Military carrer - R. Scuola di Artiglieria Lagrange

1757-1788 **President** of the ***Private Scientific Society***

1759 *Sur la nature du Fluide Elastique qui se développe de la Poudre à Canon*

1794 General of Artillery

Gianfrancesco CIGNA
1734-1790 physician

1750 Studied Physics under Beccaria's guide

1755 **degree** in Medicine

1757 **Secretary** of the ***Private Scientific Society***

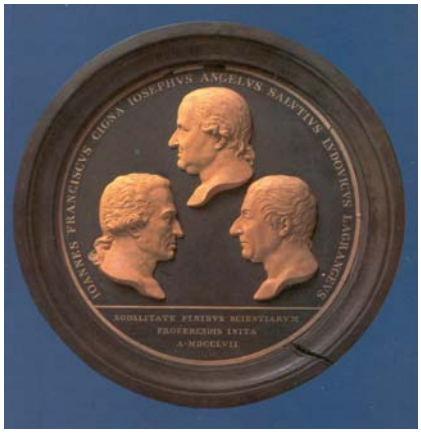
1757-1765 research on breathing and electricity

1770 Lecturer at hospital (San Giovanni)

1775 **Professor of Anatomy at Torino University**

SOCIETAS PRIVATA TAURINENSIS

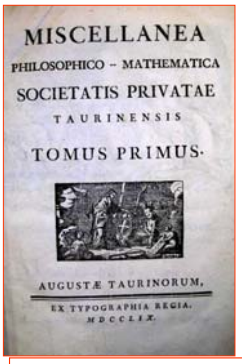
1757



"Esclusivamente si adoprava nel promuovere i progressi delle scienze positive e sperimentali: **matematica, fisica, chimica, anatomia, fisiologia**."

J.L. Lagrange, G. Cigna and A. Saluzzo founded the ***Private Scientific Society*** the nucleus of the **Torino Academy of Sciences**

Veritas et Utilitas



1759

Miscellanea Philosophico-Mathematica Societatis Privatae Taurinensis

Lagrange J.L. *Recherches sur la méthode* de maximis et minimis, I^2, p. 18-32

Lagrange J.L. *Sur l'intégration d'une équation différentielle à différences finies, qui contient la théorie des suites récurrentes*, I^2, p. 33-42

Lagrange J.L. *Recherches sur la nature et la propagation du son*, I^3, p. 1-112 vibrating strings

J.L. Lagrange to **L. Euler**, September 1759
Il y a quelques jours, je vous ai envoyé un exemplaire de l'ouvrage qu'une Société privée de Turin a fait paraître sous le titre ***Miscellanea Philosophico-Mathematica***.

L. Euler to J.L. **Lagrang**e, 23 October 1759
... tout le monde doit convenir que ce premier Volume de vos travaux est un vray **chef d'œuvre**, et renferme bien plus de profondeur que tant d'autres volumes des Académies établies et **jamais societé particulière n'a plus mérité d'être soutenue par son souverain**."

Vittorio Amedeo III

1760

Società Reale di Torino

MISCELLANEA 1759

Lagrange J.L. *Recherches sur la nature et la propagation du son*, Misc. Taur. 1759, p. 1-112

"Je tire de mes formules la même construction du problème ***de chordis vibrantibus*** que M. **Euler** a donné, et qui a été si fort contestée par M. **D'Alembert**. Je donne de plus à cette construction toute la **généralité** dont elle est capable..."

- estabilished the conditions for the initial configuration of the string
- substitute to the elastic string an oscillatory system formed by *n* points and found $n \to \infty$ for the elongation of the string at point *x* and time *t*, the espression

$$y(x,t)=\frac{2}{l}\int_0^l Y(\xi)\sum_{r=1}^{+\infty}\sin\frac{r\pi\xi}{l}d\xi\sin\frac{r\pi x}{l}\cos\frac{rc\pi t}{l}+\frac{2}{c\pi}\int_0^l V(\xi)\sum_{r=1}^{+\infty}\frac{1}{r}\sin\frac{r\pi\xi}{l}d\xi\sin\frac{r\pi x}{l}\sin\frac{rc\pi t}{l}$$

where ***Y*** and ***V*** represent the initial position and velocity.

MÉLANGES II, 1760-1761

Euler member of Turin Society **1 January 1760**

Lagrange foreign member of Berlin Academy **September 1756**

Euler L., *Lettre à M.r De La Grange. Recherches sur la propagation des ébranlements dans un milieu élastique*, II[2], p. 1-10

Lagrange J.L., *Nouvelles recherches sur la nature er la propagation du son*, II[1], p. 11-172.

de Foncenex D., *Sur les principes fondamentaux de la méchanique*

Lagrange J.L., *Addition à la première partie des recherches sur la nature et la propagation du son*, II[2], p. 323-336

- Convergence of research and results
- General Formulation of the theory of **acoustic waves**
- First foundations of the theory of **finite deformations of continuous media**
- Studies of **differential equations**
- Calculus of variations

Euler L., *Methodus inveniendi lineas curvas maximi minimive proprietate gaudentes*, 1744

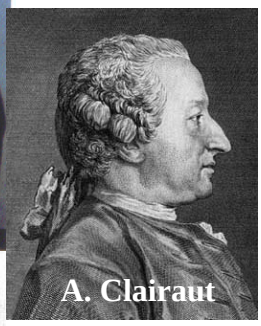
MÉLANGES II, 1760-1761

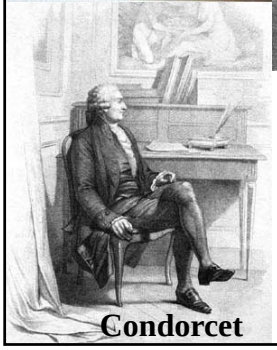
Lagrange J. L., *Essai d'une nouvelle méthode pour déterminer les* maxima *et les* minima *des formules intégrales indéfinies*, II[2], p. 173-195.
Lagrange J.L., *Application de la méthode précédent à la solution de différens problèmes de Dynamique*, II[2], p. 196-298.

Lagrange a Euler, 28.10.1762 "Ayant appris, par une de vos lettres de 1759, que vous aviez fait assez de cas de ma méthode *de maximis et minimis* pour l'**étendre** et la **perfectionner** dans un **Traité** particulier, **j'ai cru devoir supprimer** entièrement celui que j'avais presque déjà achevé sur ce sujet, et je me suis borné à en exposer simplement les principes dans un **Mémoire** que j'ai tâché de rendre **le plus court** qu'il m'a été **possible**; je ne me suis même déterminé à composer ce Mémoire que parce que vous m'avez fait l'honneur de me mander dans la même lettre que vous ne vouliez point publier votre travail avant le mien."

Euler a Lagrange, 2.10.1759 "Analytica tua solutio problematis isoperimetrici continet, ut video, **quicquid in hac quaestione desiderari potest** et ego maxime gaudeo hoc argumentum a te potissimum **ad summum perfectionis fastigium** esse evectum. Rei dignitas me excitavit, ut tuis luminibus adiutus, ipse solutionem analyticam conscripserim, quam autem celare statui donec ipse tuas meditationes publici iuris feceris, ne ullam partem gloriae tibi debitae praeripiam."

Lagrange's travel to Paris 1763-1764


A. Clairaut


Condorcet

Lagrange to Condorcet 19.10.**1773**

Il y a bientôt dix ans que j'ai eu le bonheur de faire votre connaissance à **Paris**, et que j'ai conçu pour vous le plus tendre attachement. Je regarde toujours **cette époque** comme **la plus heureuse** de ma vie. »

The strategies by D'Alembert with Frederick the Great in 1765-66

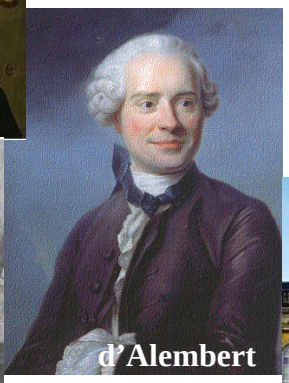
"un homme du plus **rare talent dans la Géométrie**, fort au dessus de **tout ce que l'Italie renferme** en ce genre, et **à côté** pour le moins de **tout ce qu'il y a de meilleur** dans le reste de l'**Europe**".

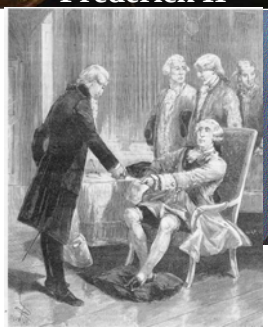

Frederick II

Berlin 1766-1787

"Philosophe sans crier"

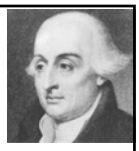
Philosopher without clamour


d'Alembert




Sans-Souci

Paris 1787 - 10 aprile 1813



1788 ***Méchanique analytique*** M. Marie, A.M. Legendre
- Bailly, Lavoisier, Lemonnier, Guyton-Morveau, …

1794 professor at École Normale

1795-1799 taught mechanic and analysis at the Ecole Centrale des Travaux Publics - Ecole Polytechnique

1797 ***Théorie des fonctions analytiques*** 2 ed. 1813

1798 ***Traité de la résolution des équations numériques***

1806 ***Leçons sur le calcul des fonctions***

1811 ***Mécanique analytique*** 2 ed. 2 vol. 1811, 1815; 3 ed. 1853-55

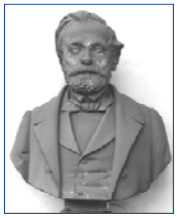
University of Turin — Mathematicians and politicians

Risorgimento **1848-1860 and the Unification of Italy 1861**

Carlo Ignazio Giulio
1803-1859

Giovanni Plana
1781-1864

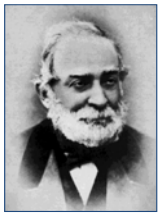
Luigi F. Menabrea
1809-1896



Felice Chió
1813-1871

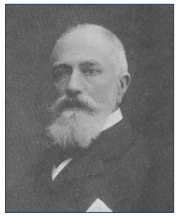
Quintino Sella
1827-1884

F. Faà di Bruno
1825-1888



Angelo Genocchi
1817-1889

Francesco Siacci
1839-1907



Enrico D'Ovidio
1843-1933

➢ **Context** – Risorgimento and Unification of Italy **1840-1880**

❑ political and social background (Math. research, teaching and education)

❑ Scientific journals in Piedmont before Unification (Kingdom of Savoy)

➢ **strategies** to overcome the cultural backwardness

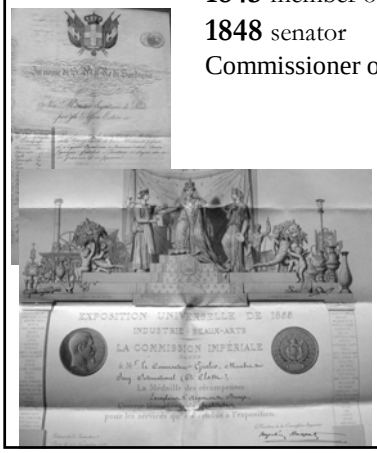
❑ (**International**) travels, visits and stays for making reports on scientific institutions, factories, manufacturing, technical instruction, sojourns of study, legislations & decrees, congresses, Universal Exhibitions, international relationships with foreign Institutions, Scientific National Societies, ...

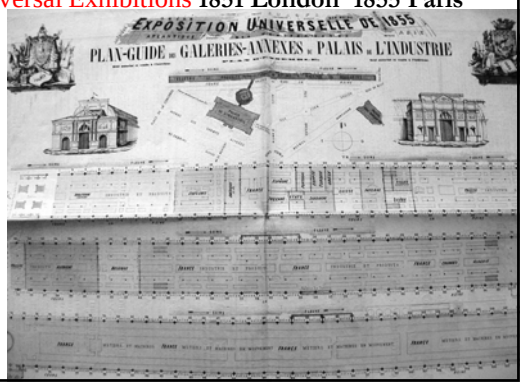
❑ (**National**) congresses, legislations & decrees on public instruction, technical courses (then Polytechnic), Italian translations of papers by foreign mathematicians, periodicals (Math. research, teaching and education)

19th century

Carlo Ignazio Giulio
1803-1859

1840 member of the Statistic Commission **TURIN**
1841 dean of Faculty (Mathematical, Physical and Natural Sciences)
1844 rector of University; Commissioner of the Universal Exhibition in Turin
1845 member of Public Education Ministry
1848 senator
Commissioner of Universal Exhibitions **1851 London 1855 Paris**





Carlo Ignazio Giulio
1803-1859

1847 He travelled for 3 months in Switzerland, France, Germany, Belgium, Great Britain and returned with as many new ideas on **scientific and technical instructions**. From these visits and stays he brought back **scientific journals**, books, **treatises**, catalogues, diaries, now in his Archives with his own Library (BSCP Turin). Geneva, Lausanne, Neuchâtel, Basel, Colmar, Strasbourg, Heidelberg, Frankfurt, Cologne, Aacken, Bruxelles, Antwerp, Gand, Bruges, London, Oxford, Gloucester, Leicester, Birminghan, Manchester, Liverpool, Sheffield, Dover, Folkestone, Boulogne-sur-Mer, Abbeville, Amiens, Paris, Orleans, Lyon, Chambery.

Detailed reports in Letters to his wife

École Polytechnique: D. Poisson's *Traité des mécanique* 1811, 1833; J. N. Hachette *Traité élémentaire des machines* 1811; L. B. Francoeur *Traité de mécanique élémentaire, à l'usage des élèves de l'École polytechnique* 1801; C. Navier *Résumé des leçons données à l'École des ponts et chaussées sur l'application de la mécanique à l'Établissement des constructions et des machines* 1826

1845-1859 *Regio Istituto tecnico* (1852) *Scuola di applicazione per gli ingegneri* (1859)
Technical Institut - Polytechnic School

Translations

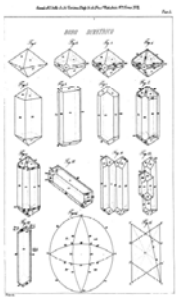
- C.I. GIULIO (ed.) ***Elementi di geometria*** *di* ***Clairaut****, nuova traduzione italiana con note. Approvata dal Consiglio superiore di Pubblica Istruzione per uso delle scuole secondarie e speciali*, Torino, Stamperia Reale, 1850.
- C.I. GIULIO (ed.), *Teoria matematica dei* ***ponti pensili*** *con tavole per agevolarne la costruzione del Signor* ***Davies Gilbert****, vice-presidente della Società R. di Londra tradotta dall'inglese con note ed aggiunte*, Torino, Stamperia Reale, 1851.
- C.I. GIULIO (ed.) ***Elementi di meccanica*** *del capitano Enrico* ***Kater*** *e del dottore* ***Lardner****, prima versione italiana con note ed aggiunte*, Torino, Cugini Pomba e compagni, 1851.

Travels, visits and stays for study of young graduated

from **Turin** to France, Switzerland, Germany, Great-Britain, Russia, ...

1847-1851 **Quintino Sella** was invited to continue his studies at the École des Mines in **Paris**, on behalf of Savoy Kingdom and he spent 2 months, travelling in Germany (in **Berlin** met Jacobi), and **Great-Britain** (11-25 June 1851 and April-September 1852). Then he became prof. Mathematics in Turin Technical Institute and University.

1857-1859 Berlin – St. Petersbourg **Giovanni Virginio Schiaparelli** sojourns for study at the **Berlin University** and **Pulcovo Observatory** (from 1860 he became the astronomer in Brera, Milan)



Sella *Geometria applicata alle arti* **1852** Techn. Institute Torino
Mathematical Cristallography

1860 Professor of Mineralogy

1861 Politician, Ministry, President of the Accademia Nazionale dei Lincei, devoted to the development of Research and Italian Scientific Culture

Memberships in Turin Academy of Sciences

Among the consequences of the relationships of European mathematicians and scientists with Italians colleagues became corresponding members of the Turin Academy

1841 Poncelet, Babbage, Coriolis, Hamilton, the 2 **Jacobi** (phys. and mathem);

1845 Bélanger, Liebig, **1853 Faraday**

1870 H. von Helmholtz, 1878 Hermite, 1880 F. Klein, 1881 K. Weierstrass

and also became members the Italian mathematicians, engineers, chemists, physicists, astronomers, … **who took active part to the Unification of Italy**:

1856 Sella, **1857** Piria, **22.1.1861** Matteucci, Carlini, Amici;

25.1.1862 Genocchi, Brioschi, **1863** Govi; **1865** B. S. Robert; **1868** M. Lessona, G. Codazza, **1870** Lombroso, G.V. Schiaparelli, A. Dorna, A. Secchi

1878 L. Bellardi, G. Basso, **1879** G. Bizzozero, E. D'Ovidio

Giovanni Plana
1781-1864

Ecole centrale – Grenoble Ecole polytechnique - Paris

Mathematician and astronomer, Prof. Infinitesimal Calculus – Turin University, Director of Observatory, President of Academy of Sciences

Prize Lalande Académie Sciences Parigi

Iron Crown Austria Emperor

Gold Medal Copley Royal Astronomical Society

F. Faà di Bruno
1825-1888

1849-51 Paris
1854-56 PhD thesis A.L. Cauchy
1860-1888 Prof. Higher Analysis - Turin University
Théorie générale de l'élimination (1859), *Traité élémentaire du calcul des erreurs* (1869), *Théorie des formes binaires* (1876)

Angelo Genocchi
1817-1889

Note sur la théorie des résidus quadratiques, Mém. couronnés et mém. des savants étrangers, Académie royale des sciences, des lettres et des beaux-arts de Belgique, 25, **1852**, pp. 1-54

1884 *Calcolo differenziale e principii di calcolo integrale* con aggiunte dal Dr. G. Peano **1899, 1903, 1922** German and Russian translations

1858-1932

1880-1900 Mathematical Schools in Turin

Relationships with the international scientific community

Giuseppe Peano

Analysis, Logic

1863-1924

Corrado Segre

Algebraic Geometry

1860-1940

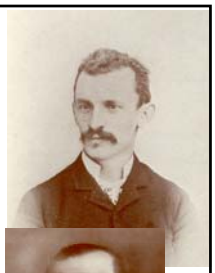
Vito Volterra

Analysis, Physical Mathematics

From the manuscripts of courses and the hundreds of letters and postcards (1879-1923) can emerge the mechanisms by which the most recent styles of scientific research circulated between Italy and Germany, as well as some of their relapses on the cultural and academic life, and the publishing policies of the two countries.

Göttingen

Giuseppe Peano



27 August 1858 **Spinetta (CN)**

16 July 1880 **degree in Mathematics** Univ. Torino

1880 Assistent of E. D'Ovidio

1881-1890 Assistent of A.Genocchi

1884 Supplied him course of Infin. Calculus

1890 winner of a competition for the **chair of Analysis** and obtained the full professorship in 1895

1908/09-1909/10 Course of Higher Analysis

1925/26- Course of Mathematics for teachers

20 April 1932 death

Main contributions: Analysis, Vector Calculus, Foundations of Maths (Arithmetic, Geometry, Analysis), Mathematical Logic, Education, Linguistic

Drafting the **lectures of Genocchi**, the young assistant soon earned international renown with the publication of Genocchi's treatise ***Calcolo differenziale e principii di calcolo integrale***, in 1884.

Peano with his refined critical sense discovered the **defects**, **errors** and **imprecisions** of the principal treatises of **infinitesimal calculus** then in use in **France, Germany and Italy**, and **retouched** definitions, statements, theorems and proofs. A feature that distinguishes this book from the mathematical literature of the times are the **examples** (now called '**counterexamples**'), **so simple and well chosen** that Peano contrived to show the **fallaciousness of the results** presented up to that time in even the best books of analysis.

The *Enzyklopädie der Mathematischen Wissenschaften* reported among the **most authoritative books of analysis** not only this 1884 treatise, but also his 1887 *Applicazioni geometriche del calcolo infinitesimale*, and his 1893 two-volume *Lezioni di analisi infinitesimale* for the Military Academy.

Among the noteworthy '**Peano's additions**' are

- the theorems and observations on the limits of indeterminate expressions;
- the generalisation to the functions with several variables of Weierstrass' theorem on maxima and minima;
- the example of functions with two variables continuous along every straight line in the plane but not continuous in the whole plane;
- the theorem of uniform continuity of the functions with several variables;
- the generalisation of the theorem of mean value;
- the properties of existence and derivability of implicit functions;
- the integration of peculiar rational functions;
- the analytic expression of the function of Dirichlet;
- the definition of the definite integral as the upper and lower extreme of finite sums.

Moreover there are sections on **avant-garde results** derived from the **study of**

G. Cantor, Dini, Dedekind, Harnack, Lipschitz, Du-Bois-Reymond, Darboux, Heine and Schwarz.

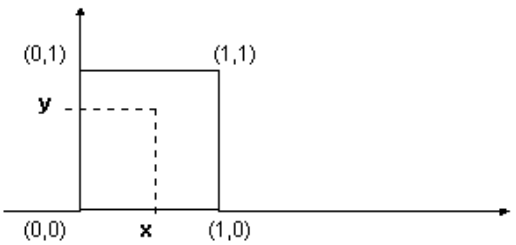
January 1890 Peano's famous curve that fills an area

Taking as a point of departure a famous work by **Georg Cantor**, in which the correspondence between a segment and a square is established, in just a few pages Peano defines the parametric equations of a continuous curve that passes through all points in a square.

0 ——————— **1**

P **segment (0,1)**
$t = 0, a_1b_1a_2b_2a_3b_3...$

Q square
$x = 0, a_1a_2a_3...$
$y = 0, b_1b_2b_3...$



The astonishment of contemporaries about this event, which marks a significant fundamental step in studies of analysis, topology, set theory and measure theory, is evident from both the comments made by many as well as by the multitude of papers that follow the path opened by Peano:
D. Hilbert in 1891, E. H. Moore in 1900, H. von Koch in 1904, E. Cesàro in 1897 and 1905, H. Lebesgue and È. Picard in 1904, W. Sierpinski in 1912, followed by A. Schönflies, E. Jürgens, W. Killing, G. Polya, ….


David Hilbert
1891

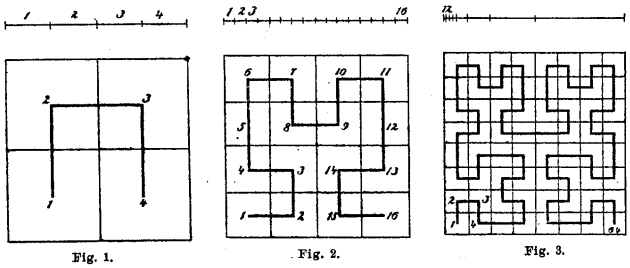
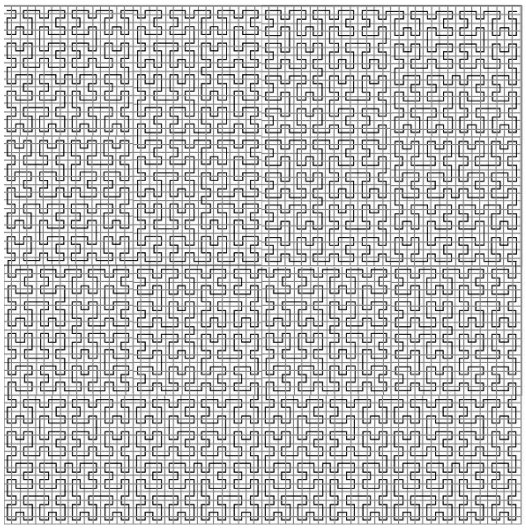


Fig. 1.

Fig. 2.

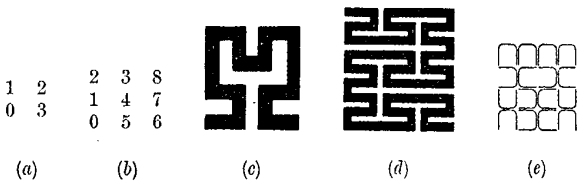
Fig. 3.



Peano – Hilbert

Cavoretto (hill of Torino) 1891

In the last edition of 1908 of the *Formulario Mathematico*, Peano, with the use of symbols, illustrates and comments on the principle on which the construction of his curve is based and offers the visualisation of some steps.



In the meantime he had in fact ordered the construction of a reproduction, in black tiles on a white background, on the **balcony of his house** in **Cavoretto**, which he bought in 1891.

Formulaire de Mathématiques 1895

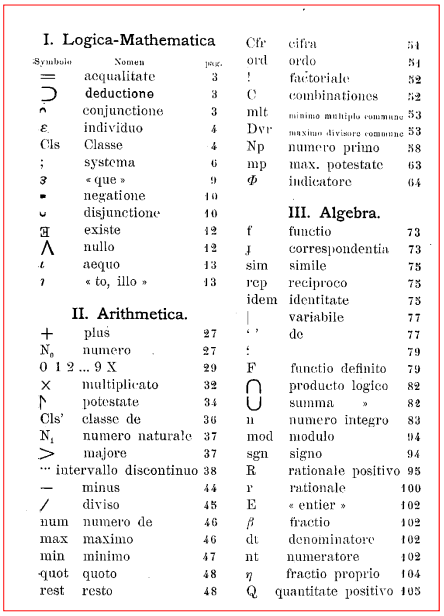
144 p.

I. **Logique mathématique Peano, G. Vailati**
II. **Opérations algébriques Peano, F. Castellano**
III. **Arithmétique Peano, C. Burali-Forti**
IV. **Théorie des grandeurs C. Burali-Forti**
V. **Classes de nombres Peano**
VI. **Théorie des ensembles G. Vivanti**
VII. **Limites R. Bettazzi**
VIII. **Séries F. Giudice**
IX. **Théorie des nombres algébriques G. Fano**

Chaque partie du **Formulaire**, *bien que commencée par* ***un Auteur***, *sera en définitive le* ***résultat*** *du travail de* ***tous les collaborateurs***.

Addictions et Corrections

Otto Stolz, C. Ciamberlini, A. Ramorino, G. Morera, A. Arbicone, E. Cantoni, **Buhl, Louis Couturat**, **Gustav Enestrom**, A. Borio, W. Beman, F. D'Arcais, **J. Rius y Casas**, F. Severi, F. Invrea, **A. Korselt**, I. Zignago



I. Logica-Mathematica

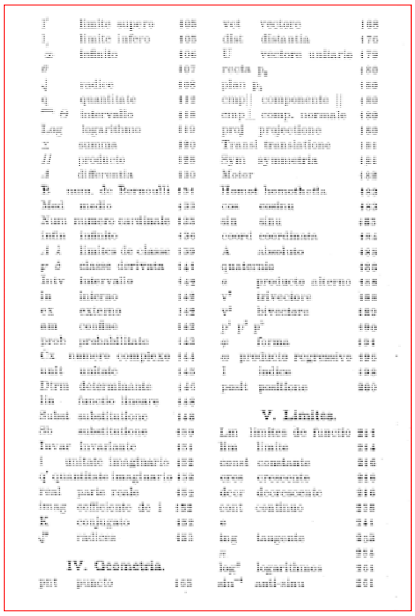
Symbolo	Nomen	pag.
=	acqualitate	3
⊃	deductione	3
^	conjunctione	3
ε	individuo	4
Cls	Classe	4
;	systema	6
ɜ	« que »	9
-	negatione	10
∪	disjunctione	10
∃	existe	12
Λ	nullo	12
ι	aequo	13
ι	« to, illo »	13

II. Arithmetica.

+	plus	27
N_0	numero	27
0 1 2 ... 9 X		29
×	multiplicato	32
⁄	potestate	34
Cls'	classe de	36
N_1	numero naturale	37
>	majore	37
⋯	intervallo discontinuo	38
−	minus	44
/	diviso	45
num	numero de	46
max	maximo	46
min	minimo	47
quot	quoto	48
rest	resto	48
Cfr	cifra	51
ord	ordo	51
!	factoriale	52
C	combinationes	52
mlt	minimo multiplo commune	53
Dvr	maximo divisore commune	53
Np	numero primo	58
mp	max. potestate	63
Φ	indicatore	64

III. Algebra.

f	functio	73
ɟ	correspondentia	73
sim	simile	75
rcp	reciproco	75
idem	identitate	75
|	variabile	77
' '	de	77
:		79
F	functio definito	79
⋂	producto logico	82
⋃	summa »	82
n	numero integro	83
mod	modulo	94
sgn	signo	94
R	rationale positivo	95
r	rationale	100
E	« entier »	102
β	fractio	102
dt	denominatore	102
nt	numeratore	102
η	fractio proprio	104
Q	quantitate positivo	105



Strategies to promote the *Formulario* asking for collaboration

- Journals
- International Conferences (Math., Phil.)
- Societies of teachers (Ass. Franç. Avan. Sciences, Mathesis)
- Contacts with colleagues, teachers, editors of journals, historians of mathematics, philosophers, assistants, students (Klein, Mittag-Leffler, Jordan, Frege, Cantor, …, Cesàro, Vitali, Levi-Civita, Marcolongo, Pincherle, …, R. de Montessus, …)
- Editorial Announces in RdM, other periodicals (for mathematicians, teachers, …), meetings
- 'Payment' consisted in the annual subscription to his *Rivista di Matematica*

27. Et pour les en récompenser en quelque façon, nous offrons l'abonnement annuel à la *Rivista di Matematica* à tous ceux qui contribueront au développement du Formulaire, en ajoutant de nouvelles parties, ou en corrigeant les parties publiées, et les notes historiques.

International congresses: Logic and *Formulaire*

1897 in Zurich ICM plenary lecture by G. PEANO *Logica matematica*

1900 At the second ICM held in Paris there were Peano, Padoa, Vacca and Vailati. Among those in the *Comité de patronage* of the congress of philosophy that had taken place the week before that of the mathematicians, also in Paris, were the Germans G. Cantor, R. Dedekind, G. Frege and F. Klein, while among the Italians was Peano. Through him were presented at the congress, in addition to his own, communications by Burali-Forti, Padoa, Pieri and Vailati.

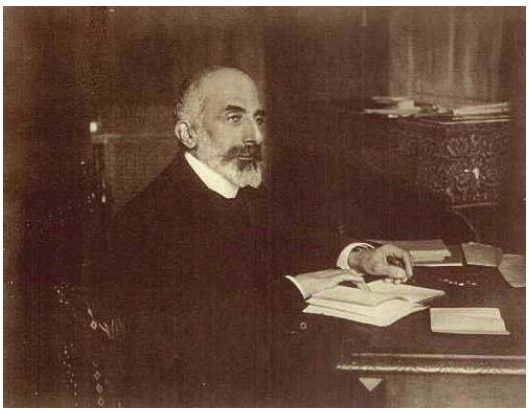
On that occasion Peano, Vailati, M. Calderoni and C. Cantoni were elected as referees for Italy.

1903 At the second international congress of historical sciences, which took place in Rome in April 1903, during which E. Lampe, F. Müller, S. Günther and G. Itelson were present, Vacca illustrated the fourth edition of Peano's *Formulaire* (1902-03).

1904 In August 1904 Peano, Vacca and Vailati were in Heidelberg for the third ICM, where Vailati made a communication, as he also did in September 1904 in Geneva at the second I C Phil.

1908 Rome 1911 Bologna 1912 Cambridge …. 1924 Toronto

Corrado Segre (1863-1924)



1883 He took his degree in mathematics at the University of Turin with Enrico D'Ovidio

1888 he obtained the chair of higher geometry at the University of Turin

1904-1924 Co-director of *Annali di matematica pura ed applicata*

From 1887-88 to 1890-91 and from 1907-08 to 1920-21 he taught a course for future teachers in the Scuola di Magistero (Teacher Training School)

1887 – 1912 - "Turin's geometric orgies"

C. Segre (1863-1924)

G. Fano (1892)

A. Tanturri (1899)

B. Levi (1896)

F. Severi (1900)

G. Z. Giambelli (1901)

A. Terracini (1911)

E. Togliatti (1912)

G. Castelnuovo (1887-1891)

F. Enriques (11.1893-1.1894)

G. Scorza (1899-1900)

M. Pieri (1885-1901)

F. Amodeo (1890-1891)

W.H. Young & Grace Chisholm (1898-1899)

J. Coolidge (1903-1904)

The model of Göttingen

1849-1925

F. Klein **1872-1875** Erlangen; **1875-1880** Munich; **1880-1886** Leipzig; **1886-1925** **Göttingen**

1895 -1920 **D. Hilbert**

Klein adopted an **innovative style of teaching**, initiating a tradition of teaching that was essentially **oral**, based on a system of **seminar**s and **colloquia** on topics of **advanced research.**

F. Klein, *The Evanston colloquium … 1893 … in Chicago…* 1894

He was joined by **David Hilbert** in **1895**, that he would carry out his plan to create a School of mathematics, exerting from 1895 to 1920

a profound impact on mathematics and physics throughout the world. Many factors contributed to the creation of a special atmosphere that ***served as a model*** *for several other important* ***centres for mathematical research***. *Göttingen exemplified a dynamic new way of doing mathematics within a* ***highly competitive*** *community in which* ***the spoken word*** *often carried* ***more weight*** *than did information conveyed in* ***written texts***.

[Rowe 2004, p. 85]

Felix Klein as Segre's '*Maestro a distanza*'

1878-1879 through Luigi Cremona, **Enrico D'Ovidio** (rector of Torino University) came into contact with **Klein** (Munich) with the aim to promote the **internationalisation of mathematical knowledge.** He asked Klein for news about recent publications printed abroad and, for example, begged to be kept informed about the publication of the *Vorlesungen über Geometrie* by Clebsch and Lindemann.

1880 **F. Klein** corresponding member of the Torino Academy of Sciences
16 August 1883 **C. Segre** and G. Loria sent Klein the paper which arose out of research carried out in their **degree dissertations**, written under D'Ovidio's advisement, *Sur les espèces diverses de complexes du 2e degré des droites qui coupent harmoniquement deux surfaces du second ordre.* This memoir was influenced, in both its contents and the method used, by the works of the **German School** (articles by **A. Weiler**, **T. Hirst** and **F. Schur**, as well as those of **Klein** himself).
1883-1923 onset of an intense, on-going **dialogue** between Klein and Segre
For Segre Klein become -and remain ever after- a ***Maestro***, first **indirectly** through the **reading** of his **works** and exchanges of **letters**, and **later directly** through **personal meetings** in Göttingen in **1891** and in Italy in **1899**.

Felix Klein as Segre's '*Maestro*'

*C'est que, sans le savoir … vous êtes, Monsieur, pour nous non seulement un **maître** mais aussi un **ami**, dont nous étudions les travaux avec passion, car **c'est par eux que nous avons commencé à vous connaître et à vous aimer**.*

[**C. Segre to F. Klein**, 7 Sept. 1883, Luciano-Roero 2012, p.83]
Segre to Klein: 22 September 1883, 3 January 1884, 8 February 1884, 27 March 1884

- **1883-1888** the dialogue was essentially '**asymmetrical**'.

Segre discussed the **topics** he intended to tackle, in order to sound out Klein's opinions on **originality**, usefulness and **importance**, presented his **difficulties**, … **Klein** suggested **strategies** to him for addressing them, he was able above all to open Segre's eyes to **new horizons in cutting-edge mathematical knowledge**, he recommended him with indications of **new papers**.

It was by following the advice of Klein that Segre studied in depth the **memoirs** of A. Weiler, A. Cayley, L. Schläfli, G. Darboux, T. Hirst, F. Schur, J. Sylvester, R. Ball, K. Weierstrass, A. Ameseder, M. Nöther and B. Riemann.

These would have an **impact on Segre's courses in Higher Geometry** in Turin, the topics of which, changed each year, would **become the legacy inherited** by his first disciples, **G. Castelnuovo** and **G. Fano**.

- **1883-1886** Klein invited Segre to contribute to the *Math. Annalen* not only as an author but also as a **reviewer** and **reviser** of the works in geometry and analysis


(after 1888) Dialogues between equals

1888 after winning the chair in **Higher Geometry**, the relationship between *Maestro* and disciple was transformed into a dialogue between equals, between two '**leaders**' of mathematical **Schools** engaged in promoting and advancing their respective traditions. The new dynamics between Segre and Klein are evident in both the changes in the stylistic forms of the letters and in the subjects discussed.

- (new responsibilities) specific topics are alternated with **comments** on **lecture**s and **students**, on their training, on **publishing policies**, and on the **most suitable means** for favouring the **internationalisation** of mathematical knowledge with **sojourns for study** and **translations**.
- 1890 Segre assumed the role of **promoter** and spokesman with **Klein** and **Hurwitz** for **the results** of his friend **Castelnuovo** and of **his student Fano.**

*Siccome nel prossimo anno scolastico io farò un **corso** di geometria **sulle curve algebriche** di genere* p *nel quale svilupperò alcuni dei **risultati da Lei ottenuti** sulle corrispondenze in generale, e particolarmente su quelle univoche, avrei piacere che Ella mi **suggerisse**, se ne conosce, quei **miglioramenti,** quelle **generalizzazioni** che Ella credesse opportuno di introdurre nei Suoi due importanti lavori.*

[**C. Segre to F. Klein**, 29 July 1890, Luciano-Roero 2012, p. 156]

1886-1890 Publishing Initiatives promoted by Segre


MarioPieri

Up to the 1880s, the desire to give an **European dimension** to his **teaching** led Segre to overcome the 'problem of language', by becoming the promoter of the **Italian translations** of several **memoirs** and **treatises written in German**.
1886 Segre expressed for the first time to Klein his interest in *Beiträge zur Geometrie der Lage* and in **1887** he proposed that **Mario Pieri** carry out the Italian translation of **von Staudt's book**, asking Klein for his help in finding information regarding his life and to ask authorisation.

- **1889** Italian version of the ***Geometrie der Lage***, Mario Pieri ed., (Torino, Bocca) accompanied by a valuable Segre's essay on von Staudt's biography and his contributions.



Gino Fano

- **1889** November Segre urged Klein to reprint his famous ***Erlangen Program***, of which he appreciated the 'substantial identity between various mathematical disciplines (in particular between analytical and geometrical disciplines). The text, although held to be of capital importance, was **not yet well-known in Italy** at the time.
- **1890** Segre entrusted the work to **Gino Fano**, at that time still a student. Carried out under Segre's meticulous supervision, the Italian version of the *Program* was compiled from a print copy in parallel with a manuscript draft by F. Gerbaldi made available by E. D'Ovidio.

Annali di Matematica (2) 17, 1890, p. 307-343

Segre's reasons to suggest Italian version of the *Erlangen Program*

The reasons for my proposing this work … do not consist for me only in the ***historic*** *interest, which this essay assumes from the multitude of research, especially those of Mr Klein and his School, which were inspired to a greater or lesser extent by almost twenty years of panoramic insights and to the profound concepts that it contained. … Many general and ingenious ideas are to be found in these pages, such as* ***the substantial identity*** *between* ***different mathematical disciplines*** *(and in particular between* ***analytical*** *and* ***geometrical*** *disciplines!) each of which represents the other when account is taken of the* ***transformations groups*** *that underlie them; the various considerations about these* ***groups****; many correct observations that shed the truest light on and specify in the best possible way the character of many topics and doctrines, and especially of some of those most discussed, such as that of* ***generalised varieties****, and* ***non-Euclidean geometry****. All of these are things that* ***are not sufficiently known*** *and* ***studied by young people****, or are* ***known only by indirect*** *ways. Let me draw the full attention to these matters*.

- **1896** **Francesco Giudice** translated Klein's *Vortrage über ausgewahlte Fragen der Elementargeometrie*, Leipzig, Teubner, 1895.

F. Klein, Conferenze sopra alcune questioni di Geometria elementare (Torino Rosenberg-Sellier)

[**G. Loria to F. Klein**, 22 July 1895, Luciano-Roero 2012, p.183]

Italian versions of Klein's writings in university teaching

- **C. Segre**'s forty handwritten *Quaderni* (1888-1924) regarding his courses in Higher Geometry

  [Terracini 1953; Giacardi 2001, 2002, Conte-Giacardi 2013]
- **G. Castelnuovo**'s forty-nine notebooks (1903-1923) in Rome univ.
- the thirty-five *Taccuini* by **A. Terracini** related to courses in Higher Geometry, Complementary Mathematics, Higher Mathematics and Probability Theory. Through the considerable number of quotations from works by Klein they show the breadth of dissemination of his results and 'views'.
- **G. Fano**'s and other assistents' handwritten *Quaderni* regarding courses in Higher Geometry (Torino univ.)

- In Italian Universities began to be requests the **lithographs** of the **lectures of Klein and Hilbert**. A large collection of Klein's lithograph courses were either brought back to Italy by Fano or sent by Klein to the professors. *Nicht-Euklidische Geometrie I, Vorlesung … 1889-90 von F. Klein Ausgearbeitet von Fr. Schilling*, Göttingen, 1893; *N.-E. Geometrie II, Vorlesung …*, Göttingen, 1893 (Fano G 95); F. KLEIN, *Einleitung in die höhere Geometrie I, Vorlesung gehalten im Wintersemester 1892-93 von F. Klein Ausgearbeitet von Fr. Schilling*, Göttingen, 1893 (Fano G 36)

1891 Segre's Travels to Germany and stay in Göttingen

1891 June-August **Segre** visited Frankfurt am Main, Berlin, Nuremberg, Dresden, Munich, Leipzig and Göttingen, where he met **T. Reye**, **M. Cantor**, K. Rohn, **M. Nöther**, **F. Klein** and **W. Von Dyck**.
The trip offered him both the opportunity to visit scientific institutions (observatories) and to keep him up to date with the most recent publications (new ed. of T. Reye's *Geometrie der Lage*, the 2nd vol. of M. Cantor's *Vorlesungen über Geschichte der Mathematik* and Hurwitz's writings on Riemann surfaces and on the theory of ideals.
He also seized the opportunity to **promote Italian studies in algebraic geometry outside** of Italy. In particular, with Klein, Nöther and Rohn.

Chi non è stato qui, non può immaginare che razza d'uomo è Klein e che specie di organizzazione egli ha saputo, con un'abilità che nessun altro può avere, imporre agli studi matematici in quest'Università. È una cosa che m'ha fatto un'impressione straordinaria. E sì che di impressioni vivissime da parte degli scienziati ne ho già avute parecchie in questo viaggio!'

[**C. Segre to G. Castelnuovo**, 30 June 1891]

1893-94 Gino Fano in Göttingen and Erlangen

Fano arrived in **Göttingen** in October 1893 to spend the winter semester. He attended **Klein's lectures** on **functions and hypergeometric series**, as well as a course by **Weber** on the **theory of algebraic numbers**.
He also **gave** some **talks** himself at the ***Mathematische Gesellschaft,*** in which he illustrated the **results** of the **Italian School** of geometry, contributing to their diffusion.

*Il soggiorno a Göttingen favorì in lui il **pieno maturarsi di certi modi di pensare** già **appresi alla scuola dei Maestri italiani**; anzitutto la tendenza alla **valorizzazione di quei procedimenti di scoperta** che si sogliono sintetizzare col termine alquanto vago di **intuizione**.'*

[**A. Terracini**, *Commemorazione*, 1953, p. 704]

Erlangen summer of **1894** Fano met **Max Nöther**, with whom he discussed **Enriques's discovery** of the existence of non-rational surfaces of genre 0.

[F. Enriques to G. Castelnuovo, 29.8.1894, Conte 1994, p. 106]

1899 Klein's proposal to Gino Fano - chair in Göttingen

Klein so highly esteemed his capacities that he offered Fano a teaching position in Göttingen.

Prof. ***Schönflies*** *has been called to Königsberg as full professor and will move there by 1 April. His teaching here by us regarded the initial required courses and in particular he had to teach the classes in* ***Descriptive Geometry.*** *Further, he had time to occupy himself with more advanced classes. I conceive the* ***chair*** *essentially as* ***a geometric chair****, that is, I wish the* ***new occupant*** *to emphasise* ***geometric representation*** *and cultivate* ***geometric studies in all directions****. Now however you know the decline of the geometry in the new generation of Germans. I have therefore come to think that* ***you might be the right man for us****!*

[**F. Klein to G. Fano**, 5 Febr. 1899, Luciano-Roero 2012, 195-196]
G. Fano to F. Klein, 10 Feb. 1899, Luciano-Roero 2012, 197-198

Circulation of textes

➢ Circulation of textes, papers, litographies from his disciplines to foreign scholars (correspondences with Nöther, Zeuthen, Schur, Hurwitz, …)

Je me suis mis en correspondance, par l'intermédiaire de Segre, de Turin, avec M. Beppo Levi *dont je t'ai emprunté deux notes. Il m'écrit: Je dois avouer que j'ai trouvé dans mes démonstrations quelques lacunes, etc; d'autres occupations m'ont détourné provisoirement de ces recherches, etc.*

[**R. Baire to E. Borel**, 16.12.1903, Dugac 1990, p. 65]

Mes théorèmes invoqués par Fatou sont mis en doute actuellement par ***Beppo Levi*** *dans les Rendiconti dei Lincei. Beppo Levi n'a pas su rétablir quelques raisonnements intermédiaires simples et il s'est cassé le nez sur une faute de rédaction grave que Montel m'a jadis signalée et qu'il est facile de réparer.* ***Naturellement j'ai commencé par rédiger une note ou je l'attrapais comme du poisson pourri puis, sur une lettre de Segre, et parce que ce n'est pas le moyen d'acquérir une réputation mondiale que d'attraper ceux qui s'occupent de mes histoires, j'ai été moins dur.***

[**H. Lebesgue to E. Borel**, 1.6.1906, Bru-Dugac 1991, p. 148-149]

Scientific and human relationships: 1904 in Heidelberg

Tutta una scuola di geometri italiani riconosce nella Memoria di Brill e Noether il suo punto di partenza! *Più fecondi ancora divennero quei concetti, quando,* ***per opera appunto di questa scuola****, essi acquistarono un carattere più astratto e più generale, venendo riferiti a curve iperspaziali …*

[**C. Segre**, *La Geometria d'oggidì e i suoi legami coll'Analisi*, ICM Heidelberg, 1904, p. 115]

La Geometria d' oggidì e i suoi legami coll' Analisi.

Vortrag, gehalten in der 3. allgemeinen Sitzung am 13. August

von

C. Segre aus Turin.

Voi conoscete il volumetto che l' Università di Kolozsvár ha pubblicato due anni sono, pel centenario dalla nascita di Giovanni Bolyai.*) Ne sono parte precipua una memoria di L. Schlesinger sulle applicazioni della geometria assoluta alla teoria delle funzioni di variabile complessa, ed un' altra di P. Stäckel sulla meccanica analitica in relazione colle varietà di più dimensioni.**) Così alla glorificazione del grande geometra ungherese prenderanno parte l' Analisi e la Meccanica!

A me parve di vedere in ciò un nuovo indizio dei sentimenti fraterni che vanno sempre più legando fra loro i vari rami della Matematica!

Per quel che riguarda la Meccanica, non occorre che io dica quanta parte abbia e debba avere in essa la Geometria! Solo mi permetterò di ricordarvi, a proposito della Geometria moderna, una rappresentazione, di grande importanza suggestiva, a cui ormai, dopo l' esempio dato da Hertz, tutti i cultori della Meccanica ricorrono liberamente. Voglio dire la rappresentazione di un sistema mobile con n gradi di libertà per mezzo di un punto dello spazio ad n o a $2n$ dimensioni. Indicando la forza viva con $\frac{ds^2}{dt^2}$, il problema del moto equivale a quello geometrico delle geodetiche di uno spazio ad n dimensioni, in cui ds sia l'elemento lineare!

Quanto ai legami che stringono la Geometria e l' Analisi, si può dire che essi derivano principalmente da ciò che in molta parte gli oggetti di cui esse si occupano sono gli stessi, almeno in un

*) Joannis Bolyai in memoriam.

**) V. anche Stäckel, Bericht über die Mechanik mehrfacher Mannigfaltigkeiten, Jahresb. d. Deutschen Math.-Vereins. 12, 1903, p. 449.

C. Segre, *On Some Tendencies in Geometric Investigations*, Bulletin of the American Mathematical Society, 11, 1904, p. 442-468; **J. Coolidge**, *The opportunities for mathematical study in Italy*, Bull. AMS, 11, 1904, p. 9-17; **E.B. Stouffer**, *Mathematics in Italian Universities, the 12th annual meeting of the Rocky Mountain Section*, Colorado, 1928.

A first student (not Italian): J. Coolidge

In the academic year 1903-04 Coolidge attended to the lessons of Higher Geometry held in Turin University by C. Segre on *Applications of Abelian Integrals to Geometry*.

Then he went to Germany to work with E. Study. To both (Segre and Study) Coolidge owed his deep interests in the geometrical interpretation of complex numbers and their functions, a subject which always fascinated him.

Every student in complex domain will find that he is forced to refer continually to the work of two admirable contemporary geometers, Professor Corrado Segre of Turin, and Professor Eduard Study of Bonn. The names of both appear throughout this book; the author had the rare privilege to be the pupil of each of these masters. Geographical separation has cut him off from the one, the inexorable logic of history has impeded his communion with the other. But his sense of obligation has never wavered, and he begs to offer the present work as a small token of admiration and esteem.

Papers of Coolidge influenced by Segre

Some of the principal papers written by Coolidge under the influence of Segre and Study:

- *Die dual-projektive Geometrie im elliptischen und spharischen Raume. Dissertation*, 1904.
- Les congruences isotropes qui servent à representer les fonctions d'une variable complexe, *Atti Acc. Sci. Torino*, 1904.
- *The elements of non euclidean geometry*, Clarendon, 1908.
- A study of the circle cross, *Trans. of the AMS*, 1913.
- *A treatise on the circle and sphere*, Clarendon, 1916.
- The characteristic numbers of a real algebraic plane curve, *Rend. Circ. Palermo*, 1917
- *The geometry of the complex domain*, Oxford, OUP, 1924
- Questioni di geometria nel campo complesso, *Rend Roma*, 1928.
- *A Treatise on algebraic plane curves*, Clarendon, 1931.

The interruption of international exchanges

La formation des professeurs des écoles moyennes supérieures a certainement une grande importance *…. J'espère que mon ami* ***Loria*** *voudra accepter la tâche que vous désirez lui confier.* ***A Stockolm il faudra présenter une vue d'ensemble de notre enquête****. ...* ***J'ai préparé, en suivant vos instructions, le discours (assez courte) que je dois prononcer à Paris en votre lieu***.

Je comprends et j'apprécie les motifs qui vous ont inspiré. *Mais, d'accord avec M. Smith, et dans l'intérêt de notre Commission,* ***je vous prie de vouloir bien renoncer pour le moment à mettre à effet votre propos.*** *… D'ailleurs le moment grave que traversent toutes les* ***institutions internationales*** *conseille de n'introduire aucun changement dans leur organisation de crainte que ces faibles organismes ne doivent succomber.* ***Il faut au contraire s'effacer de les faire survivre jusqu'à la conclusion de la paix****, à fin qu'elles puissent faciliter la reprise des relations normales entre les peuples, dès que la guère sera terminée.*

[**G. Castelnuovo to F. Klein**, 3.3.1914 and 10.3.1915, Luciano-Roero 2012, p. 208-209, 212-213]

The *Encyklopädie der Mathematischen Wissenshaften* (1912-1920)

Above all we will try, even though we are not directly involved in the actual circumstances, to assure the survival of our scientific undertakings. This refers especially to the work on the mathematical encyclopaedia. I am happy to hear from Mohrmann that the completion of ***the essays written by you and Enriques on algebraic curves are coming to a good end****. Having already taken charge of the chapter on correspondences, Mohrmann first of all approached* ***Berzolari****, whose previous careful work had earned him the special sympathy of the editorial team of the third volume.* ***The article by Loria is a good as finished, the very detailed and extremely carefully crafted article by Segre is in the phase of being translated by Mohrmann****. I hope that you are well in this critical period. We are all involved in these immense events, when not personally, then through the involvement of members of our family, but this is not the place to comment on that.*

[**F. Klein to G. Castelnuovo**, 4.3.1915, Luciano-Roero 2012, p. 209-211]

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