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The Lorenzoni-Tacchini Correspondence at Padova Observatory Archives: the “True” History of Italian Astronomy of the Second Half of the Nineteenth Century

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ABSTRACT

The correspondence between Giuseppe Lorenzoni and Pietro Tacchini covers the period from 1870 to 1905. Two hundred and ninety original letters written by Tacchini to Lorenzoni and 177 rough copies of letters by Lorenzoni to Tacchini are preserved at the Padova Observatory Archives. Their friendship, which started in 1870 during the expedition to the total solar eclipse in Sicily, as well as their astronomical ability, were of great importance for many events in Italian astronomy during the second half of the 19th century. We are able to gather from this correspondence the following things: 1) the hard work that was put into the founding of the ‘Società degli Spettroscopisti Italiani’ which succeeded in 1871 mainly thanks to the willingness of three astronomers, Secchi, Tacchini and Lorenzoni; 2) important details about the preparation for the Italian party to India to observe the transit of Venus in 1874; 3) the role of both Lorenzoni and the workshop of the Observatory of Padova in successfully making two large equatorial mountings for the new Catania Observatory and the Bellini Observatory on Mount Etna, and later those for the Italian Observatories of Turin, ‘Collegio Romano’ in Rome, and Arcetri in Florence.

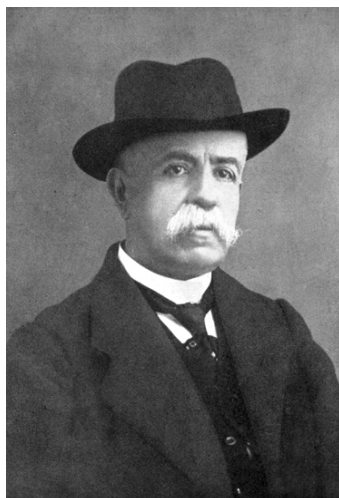


Figure 1. Gregorio Ricci-Curbastro (Padova Observatory Archives).

1. Introduction

Nobody knows why Gregorio Ricci-Curbastro (1853–1925) – better known as Ricci – the famous mathematics professor at the Padova University (Fig. 1), kept the letters that Giuseppe Lorenzoni (1843–1914) had received from Italian astronomers, especially from Pietro Tacchini (1838–1905) and Giovanni Virgilio Schiaparelli (1835–1910), and his rough copies of letters to them.

At the end of the World War II, Giorgio Ricci-Curbastro, Gregorio's son, who lived in Faenza, sent a thick parcel of these letters to Giovanni Silva (1882–1957), sixth director of the Padova Astronomical Observatory. It seems that a great part of these letters was destroyed during the war. Silva's opinion was that Ricci, before his unexpected death in 1925, took part in a commission together with Tullio Levi-Civita (1873–1941), Antonio Maria Antoniazzi (1872–1926) and others, with the task of publishing the most important papers and a detailed biography of Lorenzoni, beloved director of the Padova Observatory. Ricci had been Lorenzoni's colleague at Padova University, Levi-Civita and Antoniazzi had been pupils and later colleagues of both of them, while Silva had been a pupil and colleague of the latter ones. It is worth mentioning that Ricci and Levi-Civita are the two famous mathematicians of whom Einstein wrote: *“The mathematical tools necessary for*

the Theory of General Relativity were already prepared in the ‘absolute differential calculus’ established as a system by Ricci and Levi-Civita.”



Figure 2. From left to right: I. Galmozzi, G. Legrenzi and Tullio Levi-Civita (Padova Astronomical Observatory Historical Archives).

Documents preserved at the Observatory Archives prove the strong relationship between all the above-mentioned people: the funny picture which Levi-Civita gave to Lorenzoni when he got his degree in mathematics in 1894 (Fig. 2), for example, and all the papers published by Levi-Civita with autograph dedications to Lorenzoni (Fig. 3), then to Antoniazzi (Fig. 4), and finally to Silva (Fig. 5), all of them subsequent directors of the Astronomical Observatory of Padova.

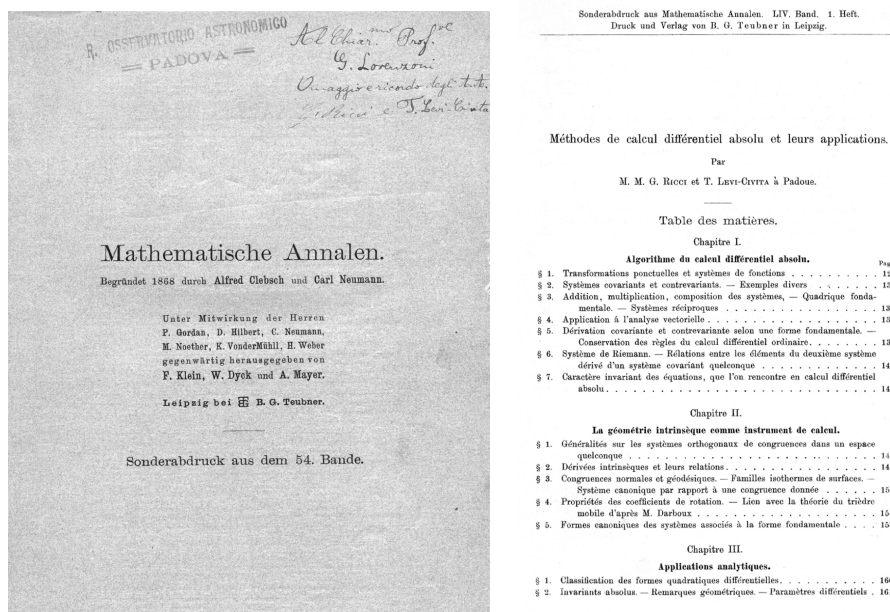


Figure 3. *Left:* Cover with Ricci's and Levi-Civita's autograph dedication to Lorenzoni. *Right:* summary of their paper on differential calculus.

The correspondence between Giuseppe Lorenzoni, astronomer at the Padova Observatory, and Pietro Tacchini from Modena (Fig. 6), covers the period from 1870 to 1905. The friendship between the two astronomers began during the party to observe the total solar eclipse of 1870. It “suffered from some unfeeling periods [as Lorenzoni wrote at Tacchini's unexpected death in 1905] but it never failed”.

Two hundred and ninety original letters written by Tacchini to Lorenzoni and 177 rough copies of letters by Lorenzoni to Tacchini, are preserved at the Padova Observatory Archives. These letters focus on three important events: the first one concerns the total solar eclipse of December 22, 1870, the second one the 1874 transit of Venus, the last one, the construction of large equatorial mountings for Italian telescopes.

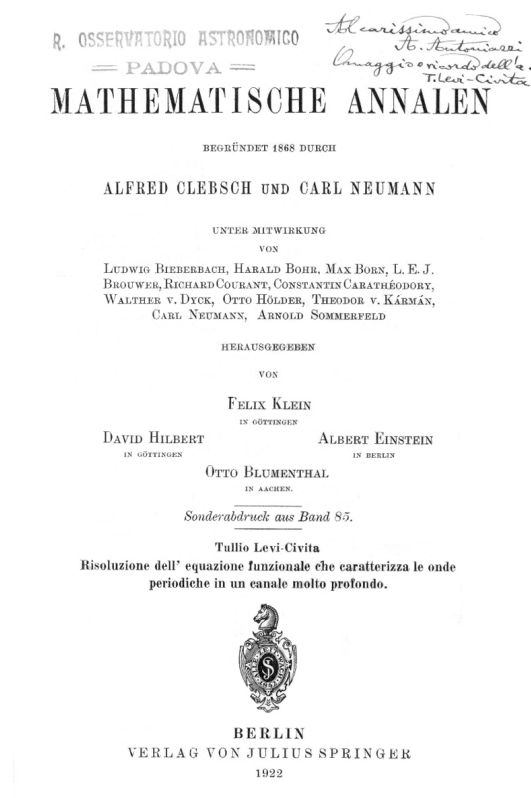


Figure 4. Levi-Civita's autograph dedication to Antoniazzi (Padova Astronomical Observatory Historical Archives).

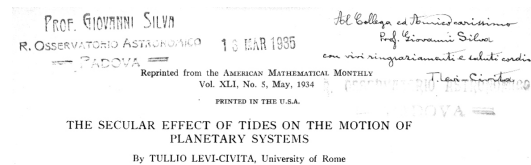


Figure 5. Levi-Civita's autograph dedication to Silva (Padova Astronomical Observatory Historical Archives).

2. The Total Solar Eclipse of December 22, 1870

The phenomenon was observable in its totality in Spain, Sicily, Africa and along the Mediterranean coast. On July 1, 1869, the King of Italy, Vittorio Emanuele II, issued a decree to nominate a commission with



Figure 6. Portraits of Giuseppe Lorenzoni (left) and Pietro Tacchini (Padova Astronomical Observatory Historical Archives).

the task of carrying out studies of the eclipse. All directors of the Italian observatories (Gaetano Cacciatore of Palermo, Annibale De Gasparis of Naples, Giambattista Donati of Florence, Giovanni Santini of Padova, Giovanni Schiaparelli of Milan) took part in the commission. The 82-year-old Giovanni Santini (1787–1877) was appointed president of the Commission by the Minister of Education. In this way, the Commission planned the first scientific mission of the new Kingdom of Italy (Pigatto 1998). Six fundamental objectives had to be pursued:

1. determine height, colour, luminous intensity and spectrum of the chromosphere;
2. examine the structure of the prominences and their spectrum;
3. examine the spectrum of the corona and the polarisation of its light;
4. observe the bright plumes, their size, spectrum and relation to the position of prominences;
5. observe the first and last contact of the Moon with the Sun;
6. take photographs of the Sun during eclipse.

This ambitious program demonstrates the high level in astrophysical studies of the Sun in Italy, thanks in particular to Angelo Secchi (1818–1878), a very pioneer of modern astrophysics. Because of his old age,

Santini entrusted Cacciatore with the task of investigating the best places where to observe the phenomenon. Tacchini, at that time astronomer at the Palermo Observatory, accompanied Cacciatore on his journey to eastern Sicily, then he was charged with the task of getting ready lodgings for astronomers, as well as huts and supports for instruments, in the two chosen observing locations – Terranova and Augusta.

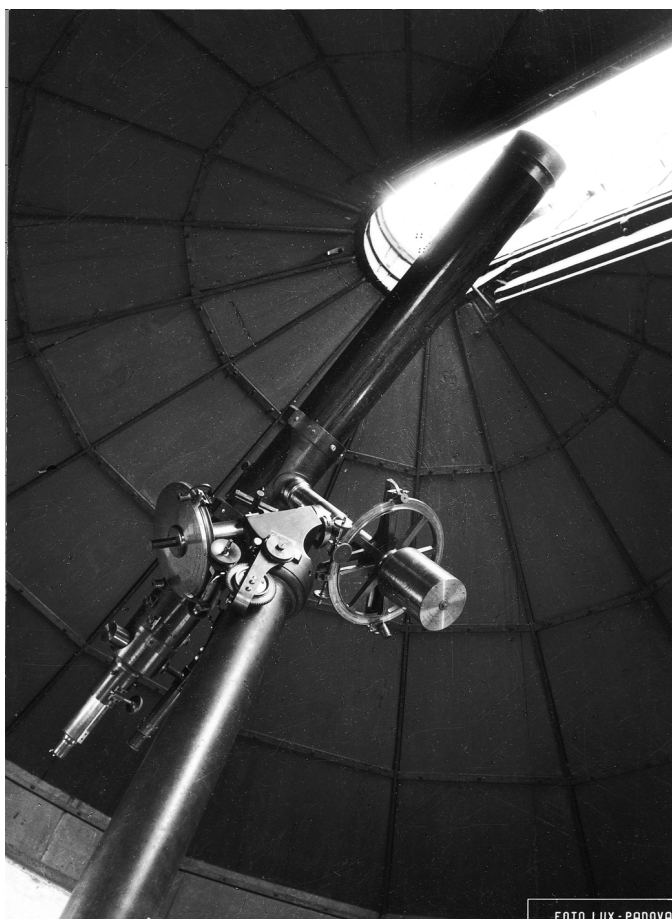


Figure 7. The Starke-Merz equatorial refractor (117-mm aperture) in its small dome at Padova Observatory (Padova Observatory Archives).

Tacchini's and Lorenzoni's first letters deal with the instruments that Padova Observatory had to send to Sicily for the eclipse, i.e. the

Starke-Merz equatorial refractor (117-mm aperture, 1.65-m focal length) (Fig. 7), the Hofmann spectroscope and the Repsold universal instrument (Tacchini 1870; Lorenzoni 1870). The two astronomers had to use in collaboration the equatorial with the spectroscope mounted on it to observe the solar prominences and their spectrum.

The observations of the total eclipse yielded poor results because of the variable weather. In addition, unpleasant misunderstandings about the reliability of mutual scientific results arose among the astronomers of the two stations. As is apparent from the 1871 letters between the two friends, this is one of the reasons why the report (Santini 1872) of the Italian Commission was published only more than one year after the eclipse. Anyway, the eclipse gave the two friends the opportunity of practising with the spectroscopic observations of the solar prominences. In 1871 Tacchini suggested to Lorenzoni to make and draw simultaneous spectroscopic observations of the solar prominences in order to compare the results of their different spectroscopes (Tacchini 1871a). As a matter of fact, since 1868 Pierre J.C. Janssen (1824–1907) and Norman J. Lockyer (1836–1920) had invented a method to observe the prominences outside eclipse, it was possible to perform such observations on a daily basis. Tacchini suggested to Father Angelo Secchi to do the same; the Jesuit adhered immediately to these observations (Tacchini 1871b), at the same time he proposed to found a society in order to co-ordinate the spectroscopic solar observations among all Italian observatories. Tacchini wrote immediately to Lorenzoni:

“Secchi... suggests to found a society in order to observe the Sun: It seems to me a good idea, and I hope you will take part in it. To this aim, a meeting should be organized in Rome next October in order to plan what to do.” (Tacchini 1871c).

Tacchini took care of contacting Italian astronomers, but Secchi’s idea didn’t move them to enthusiasm. On September 13, Tacchini (1871d) wrote to Lorenzoni:

“Our Society is shaky. Even if you are not coming [to Rome], you promised to be ready to work. Those of Naples say that they can’t be involved at this moment, but Nobile is willing to take action when it will be established... Donati is against this project, for he states to be not convinced that everybody has to study prominences... Respighi didn’t reply, so I think he wouldn’t dare to take part in the Society.

From Milan no reply. So we are three of us, me, you and Secchi.”

Lorenzoni (1871) replied:

“I’m sorry but not surprised to hear the negative results of your doings about the foundation of the Italian Society to study the solar prominences. I explain this fact to myself with the irreducible repugnance that many people have to play the role of satellites when they believe to be able to play, with or without reason, that of the main star.”

Nonetheless, thanks to the willingness of the three astronomers – Secchi, Tacchini and Lorenzoni – the ‘Società degli Spettroscopisti Italiani’ was founded in November. In 1872, the first issue of the “Memorie” of the new Society, the first astrophysical journal in the world, was published. The first papers were by Lorenzoni, Secchi and Tacchini, obviously.

3. Preparing the Transit of Venus Party

Tacchini is to be considered the true promotor of the Italian party to India (Pigatto & Zanini 2001). However, this expedition succeeded also thanks to Lorenzoni, to his advanced knowledge of astronomical instruments that Santini, his teacher, had transferred to him, and the traditional skill of the mechanics at the Padova Observatory workshop. All the telescopes to be used for the observations were prepared, improved, modified at the Padova Observatory workshop under Lorenzoni’s supervision. Before the packing and shipping to India, all telescopes were mounted in the “Sala delle Figure” at the top of the Observatory, in order to make and send a picture to the Italian ministers. Antonio Abetti, the young astronomer assistant to Lorenzoni at the Padova Observatory, took part in the Venus party. The letters he wrote to Lorenzoni during the expedition are included among the Lorenzoni-Tacchini correspondence. These letters give an interesting and amusing report about the long and adventurous journey from Venice to Alessandria in Egypt, from Alessandria to Suez by train, from Suez to Bombay, from Bombay to Muddapur by train, where our astronomers observed the transit of Venus.

The history started when the French astronomer Janssen wrote to Tacchini asking him about an eventual support of the Italian government to a transit expedition. This fact spurred Tacchini to write a

report to the Minister of Public Education, who gave him a positive answer after two months, when the Minister had learned that the Russians had asked Tacchini, or Secchi and Lorenzoni, to join them in a transit expedition to Egypt (Tacchini 1873a). In August 1873, Tacchini wrote letters to all the Italian astronomers asking them to agree to an Italian transit expedition. Only Secchi and Alessandro Dorna, director of Turin Observatory, agreed to take part in the Venus party. Lorenzoni couldn't take part in it for he had to provide all the duties of direction because of Santini's old age. He wrote to Tacchini that Antonio Abetti would take part in the mission, and the equatorial refractor, already used in Sicily, could be prepared for observations (Lorenzoni 1873). On December 25, 1873, Tacchini (1873b) sent Lorenzoni a telegram informing him that the Italian government had awarded to him 50,000 liras for the transit expedition.

Almost all the correspondence of 1874 (51 letters of Tacchini and 32 of Lorenzoni) concerns the organisation of the transit party. In January 1874, a frenetic activity started at the Padova Observatory workshop to collect instruments from other observatories, to improve and modify them, in order to make them ready for the mission. Lorenzoni (1874) sent Tacchini a note signed by Giuseppe Cavignato, mechanic of the Padova Observatory workshop, with the description of the works to be done and their cost, after a verbal agreement with Tacchini (Table 1).

Thanks to his competence in astronomical instruments, Lorenzoni was the scientific supervisor for new mountings, supports, for checking chronometers, chronographs, and for ordering new eyepieces and micrometers from Italian and foreign workshops.

Five telescopes were prepared and improved for the mission (see Fig. 3 in Pigatto & Zanini 2001) – a Starke equatorial refractor of the Observatory of Padova (117-mm aperture, 1.65-m focal length), a Steinheil refractor of the Observatory of Bologna (162-mm aperture, 2.60-m focal length), a Fraunhofer refractor of the Observatory of Turin, (117-mm aperture, 1.95-m focal length), a Starke altazimuth of the Observatory of Padova (117-mm aperture, 1.95-m focal length) and a 95-mm Dollond refractor of the Nautical College of Palermo. Other instruments, such as a Repsold universal instrument, three spectroscopes, chronometers, chronographs, thermometers, barometers, micrometers, other accessories and four pavilions to shelter the main instruments were prepared for the party. Two methods of observing the transit had to be used: the ordinary way, with telescopes equipped with heliometric micrometer or by projection, and with telescopes on which a spectroscope was mounted. Only the Italian astronomers planned to use this



Figure 8. The Catania Observatory Merz refractor (340-mm aperture) on its equatorial mounting made by Giuseppe Cavignato at the Padova Observatory workshop (Padova Astronomical Observatory Historical Archives).

new device so fundamental for modern astrophysics. As a matter of fact, Tacchini (1874a) wrote to Lorenzoni:

“Meanwhile, neither the Russians, nor the Germans, nor the English will use the spectroscope; this is a shame, bearing in mind that these governments planned a lot of luxury

expeditions. It seems to me that they could try to use it without changing their general program. Lockyer wrote me that he is disconcerted by Airy's refusal of this instrument which, I think, never has done anyone any harm."

Table 1. Works for the transit party and cost in Italian liras.

Radical modification and repair of the equatorial refractor of the Bologna Observatory, graduation of the circles, construction of a mechanism in order to adapt the instrument to whatever latitude from 0° to 50° ; all has to be done so that the instrument can be improved at its best taking into account its present state	700
Very hard walnut 2.70-m high support for the previous instrument	300
Mechanism to adapt the Padova equatorial refractor to whatever latitude from 0° to 50°	200
Very hard walnut support of convenient height for the Padova equatorial refractor	200
Construction of a mounting completely like that of the Padova equatorial refractor for the Turin Fraunhofer refractor	2000

In July our friends started to organize the trip to Calcutta, in whose neighbourhood they planned to observe the transit. On 16 October 1876, the party left Venice on board of the *Sumatra*, a steamer of the "Peninsular & Oriental Steam Navigation Company".

4. Constructing Equatorial Mountings

Tacchini was very satisfied because of the instruments' perfect working order at the Venus transit in India; for this reason he thought that the Padova workshop was able to make large mountings for telescopes. In 1876, he was successful in convincing the Authorities to have new observatories built, one in Catania and one on Mount Etna. "I hope [Tacchini wrote to Lorenzoni] that this affair will be able to show that in Italy we have tools, that is mechanics, able to make large mountings without asking eternally abroad" (Tacchini 1876a). On 20 October, Tacchini (1876b) wrote to Lorenzoni about this new project:

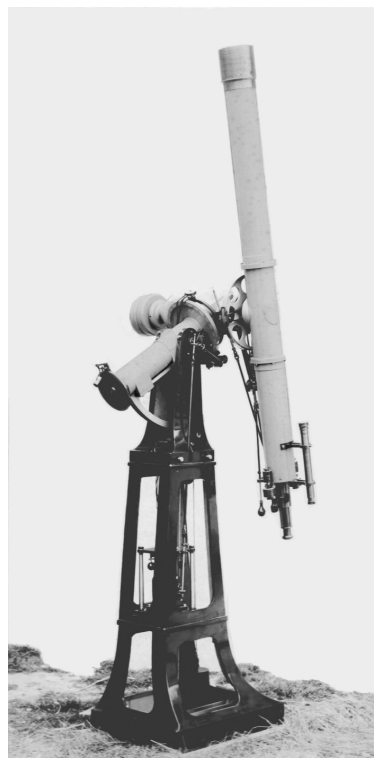
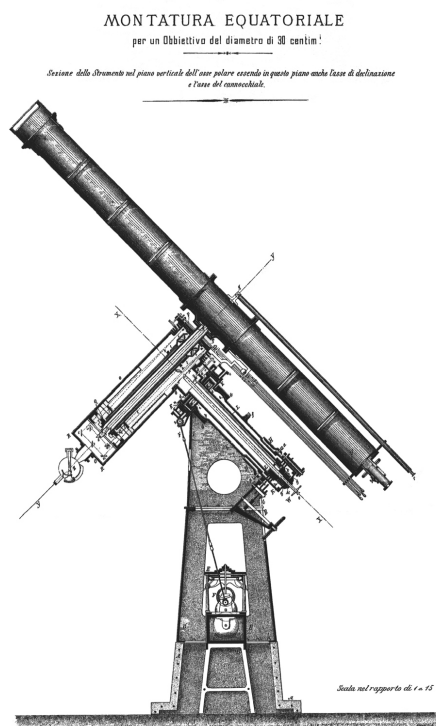


Figure 9. *Left:* Equatorial mounting for the 300-mm refractor of Turin Observatory: vertical section along the polar axis. *Right:* Equatorial mounting for the small Merz refractor of the *Collegio Romano* Observatory. Padova Observatory Archives.

“I’m almost sure that the work will be done: I will have a great pleasure if your mechanics should be in charge of it, under your precious direction. You always encouraged me in this project, and now that it is achieving a serious aspect, I will be also more happy.”

Many letters in the period 1876–1882 concern ideas, schemes, projects and costs for the two equatorial mountings. Some delay was due to the bureaucracy and to the difficulties because of political instability – change in government and ministers – in the new Reign.

Finally, Tacchini got a 340-mm objective lens, two tubes and the eyepiece lenses from Merz in Munich, and two equatorial mountings made by Giuseppe Cavignato, mechanic at the Padova Observatory

workshop, for the two Sicilian observatories; in this way the Merz objective could move from Catania to Mount Etna during the good season. The first mounting was completed in the second half of 1881, the second one in 1882. The Catania equatorial telescope (Fig. 8) was mounted in the ‘Sala delle Figure’ at the Padova observatory, and Lorenzoni tested all the telescope’s movements, and their influence on the stellar images’ precision. Lorenzoni made this last test by observing artificial stellar images of different sizes put on top of the bell tower in the Santa Giustina Church. “The result of such an examination has been very satisfying – Lorenzoni (1881) wrote – so that the telescope can be dismounted and packed, and sent to Catania”.

On June 25, 1882, Lorenzoni (1882a) wrote an official letter to Tacchini informing him that he had “examined, together with the astronomer doctor Antonio Abetti, the Merz Refractor equatorial mounting made by the mechanic Giuseppe Cavignato”. The second mounting, for the Etna observatory, was completed.

In this same year 1882, Alessandro Dorna, director of the Turin Astronomical Observatory, asked the mechanic Giuseppe Cavignato for a new equatorial mounting for a 300-mm refractor. Cavignato’s workshop suffered from financial difficulties, thus the astronomer Antonio Abetti, supported by Lorenzoni, started to deal with Vincenzo Stefano Breda, president of the “Società Veneta per Imprese e Costruzioni Pubbliche”, which made iron bridges, railways and aqueducts throughout Italy. The factory was located in close proximity to the Padova Observatory, and it would be able to help the small workshop with large constructions.

In November 1882, Lorenzoni (1882b) wrote to Tacchini that an agreement was signed among the Società Veneta, the Astronomical Observatory of Padova and the mechanic Giuseppe Cavignato. A new workshop was instituted of which Cavignato became workman in-chief. The workshop should be directed and administrated by the Società Veneta, the Observatory should only be scientific consultant. Shortly after, the Società Veneta sent the mechanic Cavignato with the astronomer Abetti to visit the Observatories of Vienna and Strasbourg in order to study their equatorial mountings, before starting new constructions.

The ambitious project of our two friends to make Italian industry able to construct telescope mountings for Italian astronomy, appeared to be achieved. However, many difficulties arose during the following years, due to envy and misunderstandings among Italian astronomers. Nevertheless, equatorial mountings were made by the Società Veneta for

the Turin Observatory (Fig. 9), for the “Collegio Romano” Observatory (Fig. 9), for the Arcetri Observatory in Florence, and for Naples.

5. Conclusion

This paper shows the main scientific events of which Lorenzoni and Tacchini were protagonists, as it appears from their correspondence. Many details not mentioned here give a clear view of Italian astronomy, of relations among astronomers (not always in good terms). The correspondence also demonstrates the different scientific paths of our two friends. Lorenzoni was appointed director of the Padova Observatory in 1877, and then member of the Italian Geodetic Commission; Tacchini was appointed director of the ‘Collegio Romano’ Observatory in Rome in 1879 and then of the new Central Meteorological Institute. The new Kingdom of Italy used its clever astronomers for national necessities, thereby stopping the advance of the newborn Italian astrophysics.

Tacchini wrote his last letter to Lorenzoni – a card with wishes for the day-name (St. Giuseppe) – without signature – seven days before his death.

A comment should be added about correspondence in general: history is known through official documents and reports, which are important because they ratify the events. Private letters throw light on many details which are very useful in order to know the ‘truth’ behind these events. The complete Lorenzoni-Tacchini correspondence will soon be published in Italian.

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