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# **Old documents, new technologies: the preservation and valorization of the Italian astronomical archives**

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## ABSTRACT

The historical archives of the Italian astronomical Observatories are a source of incredible treasures. They contain records of observations, sketches of astronomical objects (nebulae, comets, and planets), letters, diaries, journey logbooks, meteorological data, maps, astronomical calculations, etc. Over 3 million documents, 122 series containing the funds of various astronomers are preserved in 12 historical archives. Rearranging these records is a long and hard task comparable to solving a puzzle not knowing how the finished picture will turn out, but we certainly know that the reorganization will constitute a fundamental resource for the study of the history of astronomy. The web portal “Polvere di stelle [Stardust]: the cultural heritage of Italian astronomy” ([www.beniculturali.inaf.it](http://www.beniculturali.inaf.it)) contains a specific section dedicated to the historical archives. It provides a brief description of each archive and the possibility to consult the tree structure of the inventories and to make a search in all database fields. In 2018, a digitization project of selected archival documents began. The 18th century meteorological registers from Padua and the solar observations made by Pietro Tacchini and Angelo Secchi in 19th century are now available on “Polvere di stelle”. This contribution will show benefits and problems encountered in dealing this particular aspect of preservation and valorization of the astronomical heritage.

## Introduction

The National Institute for Astrophysics (INAF) is the main Italian research institute in the field of astronomy. INAF has multiple locations, most of which are the twelve Italian astronomical Observatories, the oldest scientific institutions in the Country. All the Observatories own an historical archive, which preserve sketches of astronomical objects like nebulae, comets, and planets, made during the long nights spent by astronomers to observe the sky, letters and diaries revealing the mind paths leading to extraordinary scientific discoveries, journey logbooks, meteorological data, maps, astronomical calculations... and so on. Not only a collection of records providing written evidence of the scientific activities carried out by the institution, but also a collection of incredible treasures. All together, INAF archives preserve over 3 million documents, organized in 122 series containing also the funds of various astronomers.

Due to the role played by astronomers in past centuries, the archival materials preserved in the Observatories are a source of primary importance not only for studies in the history of science, but also for researches covering a broad range of subjects in other humanities fields. Indeed, the astronomical phenomena had crucial outcomes in

the civil and political life at the time. We have documents related to the construction of great sundials in the cathedrals of Palermo, Milan, and Bologna; original manuscript calculations for compiling ephemeris and nautical almanacs; correspondence with engineers for drawing up detailed maps and regulating public clocks; and collaborations with the judicial authorities.

In order to valorize and share all this historical heritage to the largest audiences, including scientists, historians, students, and general public, INAF created “Polvere di Stelle” (Stardust; [www.beniculturali.inaf.it](http://www.beniculturali.inaf.it)), the web portal of the Italian astronomical cultural heritage, which has been discussed at previous LISA conferences ([1][2]).

For each INAF historical Archive, this website provides information on staff and schedules, and then a brief description about its genesis, its structure, and the sorting and inventory status of documents. Moreover, Stardust offers the complete tree structure of the archives. In some cases, indeed, such as in Padua, Milan, and Turin Observatories, more than a single archive is kept and presented.

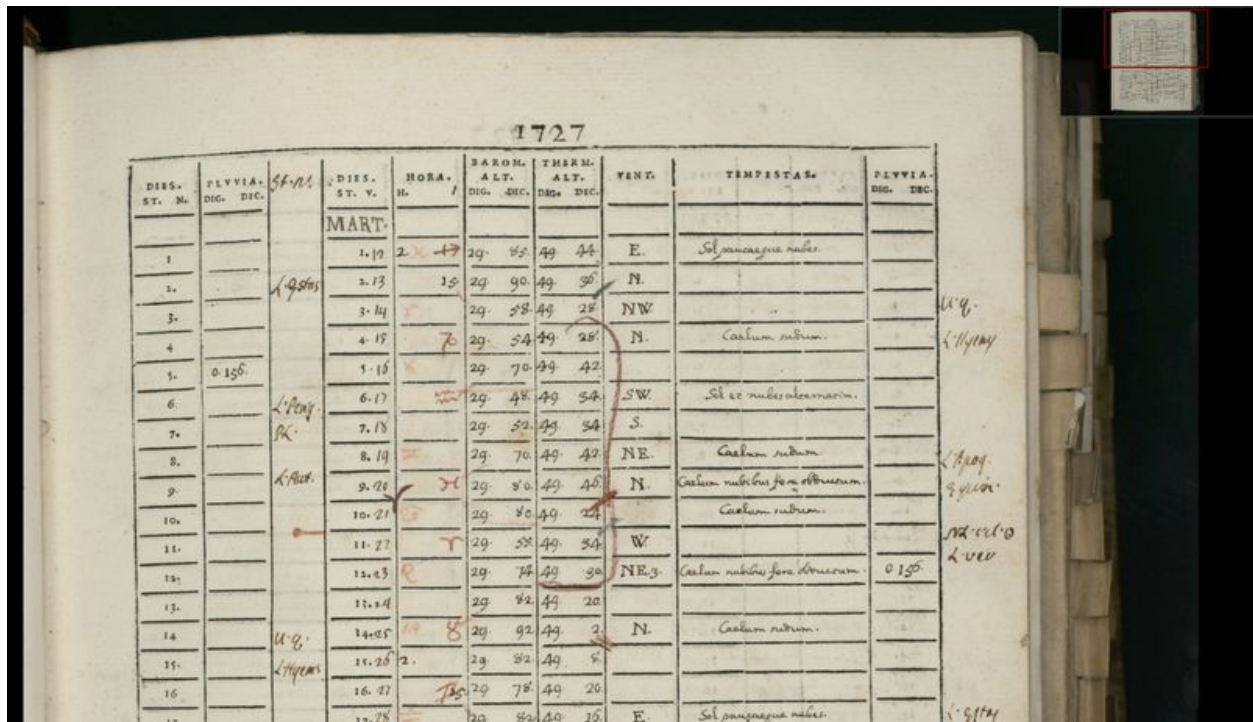
## **The Padua Meteorological Logs**

In 2018, a digitization project of selected archival documents began. First, thanks to the Italian data-center for Astronomical Archives (IA2), a policy has been defined to upload archival documents into the national repository, with the same technology used to store and share astronomical data, as has already been done for ancient books [3]. The first documents digitized in this way were the 18th century meteorological logs from Padua. The oldest is the 1725-1764 Latin handwritten register of Marquis Giovanni Poleni (1683-1761), Professor of Astronomy and Meteors at Padua University. His scrupulous meteorological records, accurately reported for over 40 years, have proved extremely useful to later scientists. Then, there is the log of Giovan Battista Morgagni (1682-1771), Professor of Medicine at Padua and close friend of Poleni, written in Italian, which cover the period 1740-1763.

Finally, two registers by Giuseppe Toaldo (1719-1797) and Vincenzo Chiminello (1741-1815), first and second Director of the Astronomical Observatory of Padua, over the period 1766-1804, were digitized. These registers are in high demand for consultation by scholars involved in the analysis of climate change, from around the world [4].

The digital images of these logs have been saved in 24-bit RGB mode and in three different sets (uncompressed TIFF at 400 ppi truecolor; JPEG at 300 ppi for consultation on the local network, and JPEG WEB at 150 ppi for consultation via web) with related XML descriptive files in MAG format. So, on the web page of the Padua

Observatory Historical Archive, inside “Polvere di Stelle”, you can check the series preserved here and, scrolling through the various sub-series up to the log you are interested, now you can also directly consulting the digitized material (see Figure 1), as well as check the descriptive information of the specific log.



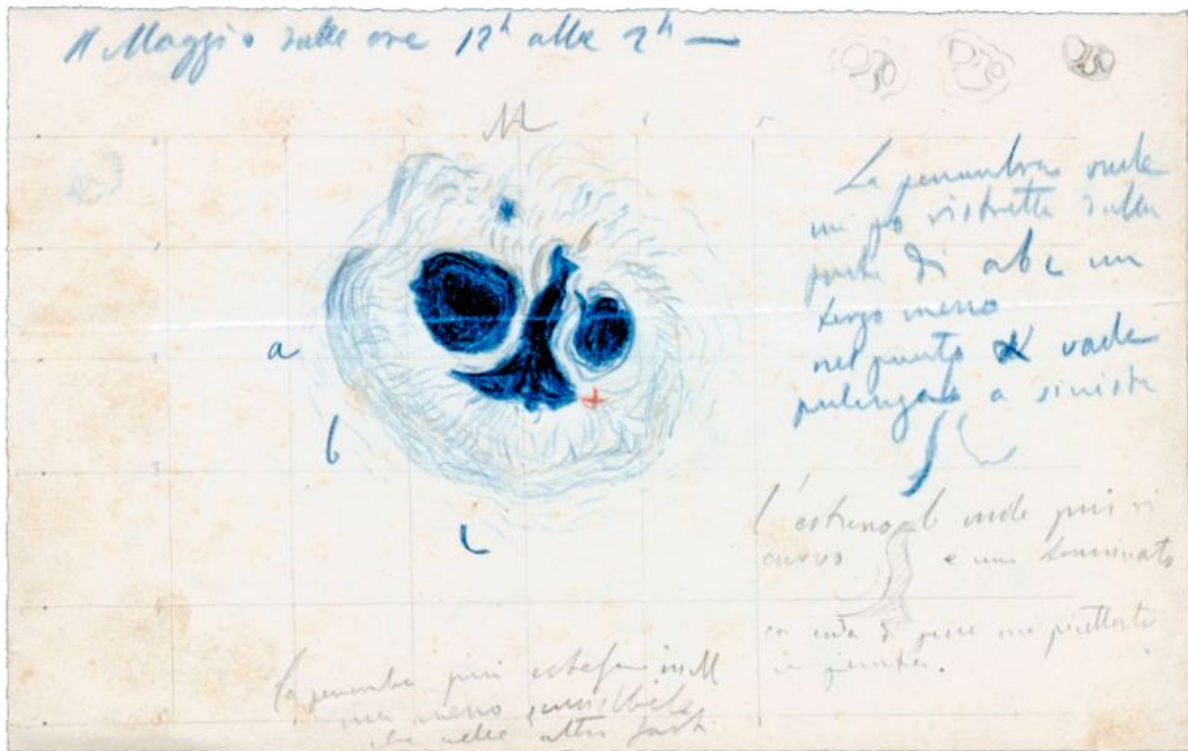
| DIES.  |           | FLUVIA. | DIES.  |  | HORA. | BAROM.         | THERM.         | VENT. | TEMPESTAS.                   | FLUVIA.   |
|--------|-----------|---------|--------|--|-------|----------------|----------------|-------|------------------------------|-----------|
| ST. N. | DIG. DIC. |         | ST. V. |  | H.    | ALT. DIC. SEC. | ALT. DIC. DIC. |       |                              | DIG. DEC. |
|        |           |         | MART.  |  |       |                |                |       |                              |           |
| 1.     |           |         | 1.12   |  | 2.12  | 29. 45         | 49. 44         | E.    | Sil. paucagula nubes.        |           |
| 2.     |           |         | 2.13   |  | 15    | 29. 90         | 49. 50         | N.    |                              |           |
| 3.     |           |         | 3.14   |  |       | 29. 58         | 49. 25         | NW    |                              |           |
| 4.     |           |         | 4.15   |  | 7     | 29. 54         | 49. 25         | N.    | Caelum rubrum.               |           |
| 5.     | 0.156     |         | 5.16   |  |       | 29. 70         | 49. 42         |       |                              |           |
| 6.     |           |         | 6.17   |  |       | 29. 48         | 49. 34         | SW.   | Sil. et nubes obscurior.     |           |
| 7.     |           |         | 7.18   |  |       | 29. 52         | 49. 34         | S.    |                              |           |
| 8.     |           |         | 8.19   |  |       | 29. 70         | 49. 42         | NE.   | Caelum rubrum.               |           |
| 9.     |           |         | 9.20   |  |       | 29. 50         | 49. 40         | N.    | Caelum rubrum fere obscurum. |           |
| 10.    |           |         | 10.21  |  |       | 29. 50         | 49. 42         |       | Caelum rubrum.               |           |
| 11.    |           |         | 11.22  |  |       | 29. 58         | 49. 34         | W.    |                              |           |
| 12.    |           |         | 12.23  |  |       | 29. 74         | 49. 30         | NE.3. | Caelum rubrum fere obscurum. | 0.156     |
| 13.    |           |         | 13.24  |  |       | 29. 52         | 49. 20         |       |                              |           |
| 14.    |           |         | 14.25  |  | 8     | 29. 92         | 49. 2          | N.    | Caelum rubrum.               |           |
| 15.    |           |         | 15.26  |  | 2.    | 29. 52         | 49. 5          |       |                              |           |
| 16.    |           |         | 16.27  |  |       | 29. 78         | 49. 20         |       |                              |           |
| 17.    |           |         | 17.28  |  |       | 29. 82         | 49. 15         | E.    | Sil. paucagula nubes.        |           |

**Figure 1.** A page of the Latin handwritten log by Giovanni Poleni, preserved at the INAF-OA Padua historical archive.

## The Catania Sunspots

Another important set of documents now digitized are the observations of sunspots and solar prominences made at the Catania Observatory in the 19th century. The Catania Astronomical Observatory was established in 1876 by Pietro Tacchini (1838-1905), one of the most famous Italian astrophysicists in the 19th century, on the Etna Volcano, with a management office in the city. Some years later, it was the first in Italy to acquire the name of Astrophysical Observatory. Almost at the same time, also the first Italian chair of Physical Astronomy was established right in Catania. The digitized documents are part of the "Sunspots" Series, which is composed of drawings of spots, faculae, and pores, relating to the observations of the solar photosphere, chronologically ordered from 1865 to 1964. The drawings show the date, time, and annotations relating to each observation. The digitization of the periods 1865-1875 and 1926-1936 has been performed at the moment, for a total of 2516 sketches of the Sun

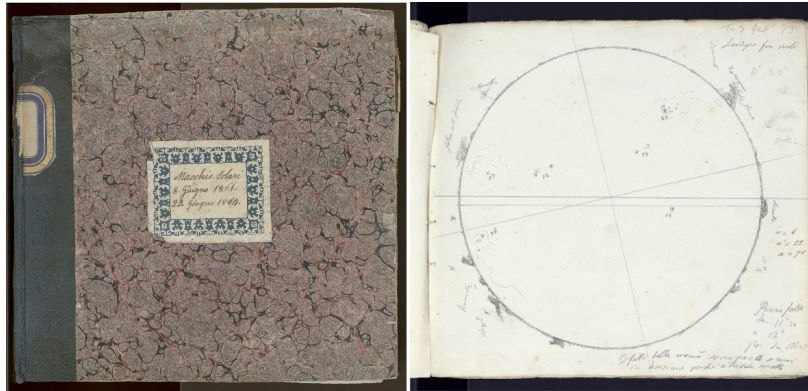
(see Figure 2). Name of the observer, and his annotations are also indicated, when identified. Some of them are by the hand of Pietro Tacchini.



**Figure 2.** Sunspot drawing by Pietro Tacchini on 11 May 1865, preserved at the INAF-OA Catania historical archive.

## Rome solar observations

In addition, more than 10,000 drawings of the solar observations, made in Rome during the years 1858-1887, have been digitized in the past months and in a short time will be available on “Stardust” (see Figure 3). Father Angelo Secchi (1818-1878), the Jesuit priest and astrophysicist who made the first systematic spectroscopic survey of stars and photographed the solar corona during some eclipses, traced many of these sketches [5]. This effort to digitize this material was delayed due to problems that concretely prove that it is more difficult to scan archival material than books. First, archival documents come in many different formats, frequently folded sheets that provide difficulties for photographic calibration. Furthermore, every single detail of the sheet contains scientific information that has to be carefully reproduced in order to be readable. Several previous digitization efforts of the archive in Rome did not satisfy these criteria therefore it was necessary to re-scan many of the documents.



**Figure 3.** (left) Cover of the solar observations logbook from 1861 to 1864. (right) An example of daily observation of sunspots and solar prominences; drawing dated 3 February 1873 preserved at the INAF-OA historical archive in Rome.

## Conclusion

We choose to start this project with meteorological logs and sunspot drawings both to show some beautiful historical objects, and to make historical data available to researchers dealing with statistical analysis of meteorological or astrophysical phenomena. The digitized material, indeed, is closely connected to the birth of these two disciplines, since Giuseppe Toaldo was a pioneer of the scientific meteorology, while Angelo Secchi was a worldwide authority in astrophysics.

Next step of this project is to make available on “Polvere di Stelle” the digital copies of the spectroscopic observations acquired at the Arcetri solar tower from 1926 to 1974.

## Acknowledgement

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