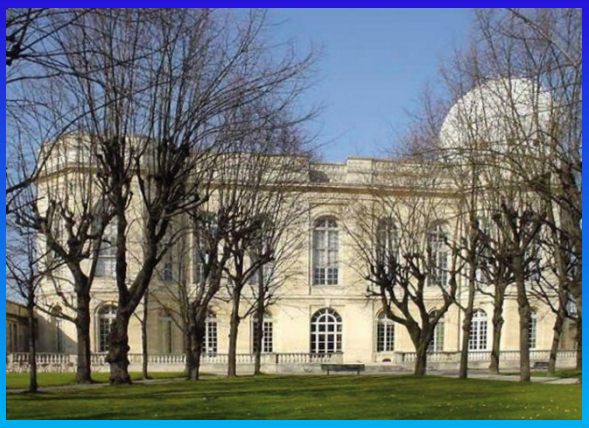
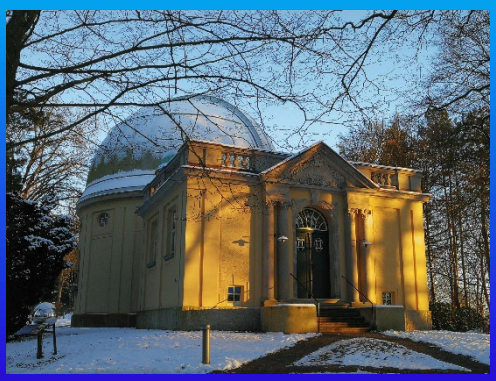
Gudrun Wolfschmidt

Booklet of Abstracts

Classical Observatories and UNESCO World Heritage





Workshop of the IAU Commission C.C4
"World Heritage & Astronomy" and
WG *"Windows to the Universe –*
Classical and Modern Observartories"

Hamburg 2025

Wolfschmidt, Gudrun: Booklet of Abstracts.

Classical Observatories & UNESCO World Heritage (IAU C.C4) and
WG "Windows to the Universe – Classical and Modern Observatories".

Workshop of the IAU C.C4 and WG, Hamburg, August 31, 2025.

tredition®

Figure 0.1:
Large Refractor Building, Hamburg Observatory

(Photo: Gudrun Wolfschmidt)

Gudrun Wolfschmidt

Booklet of Abstracts

Classical Observatories & UNESCO World Heritage

Workshop of the IAU C.C4 and
WG "Windows to the Universe –
Classical and Modern Observatories"

Hamburg, August 31, 2025

Hamburg: Center for History of Science and Technology 2025

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Web page of the IAU C.C4 conference in Hamburg:
https://www.fhsev.de/Wolfschmidt/events/SEAC-HH-2025.php#C4.

Front Cover: Observatories (© Greenwich, © Paris, Tartu and Palermo © G. Wolfschmidt, © Armagh, Hamburg © G. Wolfschmidt).
Back Cover: Stargazing with the Zeiss 1-m-Reflecting Telescope, Hamburg Observatory (Archive Hamburg Observatory).

Prof. Dr. Gudrun Wolfschmidt

Center for History of Science and Technology (GNT)
Hamburg Observatory, Department of Physics, University of Hamburg
Bundesstraße 55, Geomatikum, D-20146 Hamburg, Germany

https://www.fhsev.de/Wolfschmidt/
https://www.fhsev.de/Wolfschmidt/GNT/home-wf.htm.

Kontaktadresse nach EU-Produktsicherheitsverordnung:
gudrun.wolfschmidt@uni-hamburg.de.

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Programme: Classical Observatories & UNESCO World Heritage

Workshop of IAU C.C4 & WG.
Hamburg, August 31, 2025

1.0.1 SOC – Scientific Organizing Committee

- Gudrun Wolfschmidt – Chair
  (GNT, Hamburg Observatory, University of Hamburg)
- Michael Burton (Armagh Observatory, UK)
- Peter Gallagher (Dunsink Observatory,
  Dublin Institute of Advanced Studies, Ireland)
- Giangiacomo Gandolfi (INAF - Rome, Italy)
- Ileana Chinnici (INAF – Osservatorio Astronomico di Palermo, Italy)
- David Valls-Gabaud (CNRS, Observatoire de Paris, France)
- Rebekah Higgitt (National Museums Scotland, UK)

1.0.2 LOC – Local Organizing Committee

- Prof. Dr. Gudrun Wolfschmidt
  (GNT, Hamburg Observatory, University of Hamburg)

1.0.3 Assistants – Helfer

- Astrid Wokke (Bremen, Germany)
- Dr. Katrin Cura (GNT, Universität Hamburg)
- Dr.cand. Dipl.-Phys. Yang-Hyun Choi (GNT, Universität Hamburg)
- Dr.cand. Dipl.-Phys. Björn Kunzmann (GNT, Universität Hamburg)

1.1 Welcome to Hamburg – Gateway to the World

1.1.1 Gudrun Wolfschmidt

Hamburg was founded in the time of Charlemagne around 800. and is situated on the rivers Elbe, Alster and Bille. This green city has Hanseatic tradition and an inspiring cosmopolitan atmosphere. Hamburg is called 'Gateway to the World'.

One can find a mix of culture (museums, music, theatres), gastronomy and nightlife. Landmarks are St. Michaelis Church (8-m-tower clock – the largest in Germany) and the Elbphilharmonie concert hall (Herzog & de Meuron, 2017) – an architectural highlight, as well as the Chile House (a 'Kontorhaus' / office building in expressionistic style, Fritz Höger, 1922–1924) with the large Warehouse complex, called 'Speicherstadt' (1888) – both Unesco World Heritage, and the modern HafenCity (Port City).

Hamburg has a maritime atmosphere (sailing ship Rickmer Rickmers 1896, cargo vessel Cap San Diego 1961, Light vessel LV13 1952, Light vessel / Feuerschiff "Elbe 3" 1888, Viermastbark "Peking" 1911) with the the third biggest container port in Europe. The old port was at Nikolaifleet ('Binnenhafen'), used for sailing ships until around 1900, then Landungsbrücken for steamships. The Navigation School was founded in 1749, in 1790 moved to the 'Baumhaus'.

Astronomy and navigation played a major role: Johann Georg Repsold (1770–1830) founded a private observatory (1802–1812) on the 'Stintfang' (smelt fishing) hill at "Landungsbrücken" (landing stages). The "Deutsche Seewarte" (German Maritime Observatory) with Chronometer Testing Institute was built there (1875).

In addition, the Altona Observatory, Palmaille 9, famous for surveying (Danmark, Hamburg, and Kingdom of Hanover), existed from 1821 to 1873 with Heinrich Christian Schumacher (1780–1850) as first director.

The *new* Hamburg Observatory with Navigation School was founded at 'Millerntor' (Gate of the Windmills) in 1825. A monument for Repsold (1833) markes the place today. For timekeeping a time ball was erected on the Kaispeicher A (a brick warehouse, now Elbphilharmonie) in 1876, which was in use until 1934. The Millerntor Observatory was replaced by the Museum of Hamburg History, founded in 1908, built by Fritz Schumacher (1869–1947), and opened in 1922. The (new) Hamburg Observatory got an impressive Astronomy Park Ensemble, built by Albert Erbe (1906–1912) in Bergedorf.

The Workshop IAU C.C4 & WG will bring together researchers, scholars, and enthusiasts from around the world. They will explore the cultural heritage of observatories in Europe and worldwide, especially observatories with *"Outstanding Universal Value"* as candidates for UNESCO World Heritage status. We also discuss the observatories as "Outstanding Astronomical Heritage" (OAH) – suitable for inclusion in this IAU list.

1.2 Excursion, Saturday, August 30, 2025

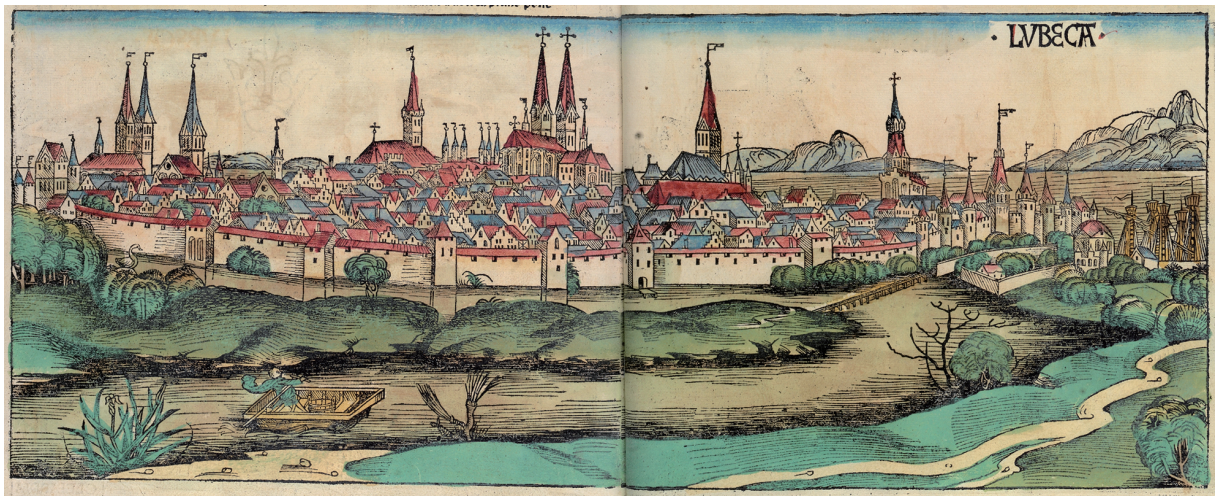

Figure 1.1:
7 Towers of Lübeck (2 Cathedral, Aegidien, Petri, 2 Marien/St. Mary, Jakobi) and St. Catherine without tower (former Franciscan monastery)

(Nuremberg Schedel Chronicles (1493), f. 265–266)

Train RE 8 (11410): 09:06 h – Hamburg Hauptbahnhof (Central Railway Station)
09:52 h – Lübeck Hauptbahnhof – Platform / Gleis 5 or 6

For the excursion, you need either the Schleswig-Holstein-Ticket or the Deutschlandticket. Please look at Public transport and Deutschlandticket.

Lübeck: the chief city of the Hanseatic League 1358 – an association of towns for the protection of trading interests. Lübeck, 14 km from the Baltic Sea.
"Liubice" (Old-Lübeck, founded by Slavs in 819); it was re-founded as "Lubeke" by Adolf II Count of Schauenburg and Holstein in 1143,
Transfer of the diocese to Lübeck in 1163 - the first cathedral in Lübeck was consecrated,
1226 Free Imperial City by Frederick II.
The Stecknitz Canal (1398) greatly facilitated the shipping of salt from Lüneburg.
Lübeck was in the 15th century the second largest city (after Cologne) in northern Germany, with 22,000 inhabitants. After the "discovery" of the Americas, Lübeck's economy declined, and Hamburg with the connection to the North Sea became leading in trade and leading the Hanse.

Highlight: Lübeck, Astronomical Clock (1405/07)
St. Annen-Museum & Marienkirche/St. Mary's church

Figure 1.2:
Left: Lübeck, Astronomical Clock in St. Mary's church,
Right: original Astronomical Clock in St. Annen-Museum

(Photos: Gudrun Wolfschmidt)

- Marienkirche/St. Mary's church (*1251),
  (Schüsselbuden 13, 23552 Lübeck)
  the mother church of Brick Gothic style –
  the highest brick vault in the world at 38.5 m, 120 m long,
  and twin towers 124 m high

  Astronomical Clock (reconstructed after WWII),

  "Dance of Death", 15th century frescoes.

- St. Annen-Museum:
  here you see the rest of the original Astronomical Clock (1405/07);
  Collections from the Middle Ages and the Early Modern Period

- City Walk: Lübeck, Historical Town
  (UNESCO World Heritage-listed Old Town since 1987) –
  Holstentor (1478) – "Concordia domi, foris pax" ("Concord at home, peace outside"),
  Salt storage buildings in the style of the Brick Renaissance (1579 to 1745)
  at the river Obertrave (the salt was transported from Lüneburg, needed for conservation of fish)

  Burgkloster/Castle Monastery (1227) and
  Castle Gate / Burgtor (1444) – remnants of the medieval fortifications.
  Rathaus (city hall), built in Gothic and Renaissance style,
  Alleys and courtyards in Lübeck.

1.2.1 Long Night of Museums in Lübeck, 18–24 h

- European Hanseatic Museum Lübeck – 800 years of Hanseatic history
  An der Untertrave 1, 23552 Lübeck
- Museum Holstentor – Holsten Gate Museum (1464–1478),
  Holstentorplatz, 23552 Lübeck
- St. Catherine's Church (1300),
  church of the former Franciscan monastery
  Königstraße, corner of Glockengießerstraße, 23552 Lübeck
- Niederegger Marzipan Salon (history of marzipan)
  J. G. Niederegger GmbH & Co. KG,
  Breitestrasse 89, 23552 Lübeck
- Museum House – Hanseatic City of Gdannsk/Danzig,
  Engelsgrube 66, 23552 Lübeck.

Train RE 8 – every half hour
(you can decide, when you want to go home):

21:09 h – Lübeck Hauptbahnhof – Platform / Gleis 7
21:53 h – Hamburg Hauptbahnhof (Central Railway Station)

21:37 – Lübeck Hauptbahnhof - Platform / Gleis 7
22:25 h – Hamburg Hauptbahnhof (Central Railway Station).

1.3 Aims and Scope – Classical Observatories & UNESCO World Heritage

Figure 1.3:
Aerial View of Hamburg Observatory

(© Hamburg Observatory Archive)

This workshop aims to highlight the outstanding astronomical heritage represented across many European observatories and consider their merits as candidates for seeking UNESCO World Heritage status. UNESCO awards World Heritage status to sites judged to have "Outstanding Universal Value". Astronomical connections have provided the basis for several such assessments, for instance monuments with alignments to the solstices (e.g., Newgrange in Ireland), observatories with connections to time keeping and navigation (e.g., Greenwich, UK), and mechanical models of the Solar System (e.g., Eise Eisinga Planetarium, Netherlands). The classical form of the astronomical observatory originated in Europe with many well-preserved examples from the 17$^{\text{th}}$ century onwards still extant. In some cases these observatories also remain as active centres of astronomy, where research, education and/or public outreach in the sciences are conducted. These provide

prime candidates for possible future nominations for UNESCO World Heritage. In Ireland the historic observatories of Armagh, Birr and Dunsink have come together to pursue such a nomination. *Birr and Dunsink have just been placed on the UNESCO Tentative List for Ireland by the Irish Government* (Department of Housing, Local Government and Heritage, 18 April 2025).[1]

The intent of this session is to highlight the outstanding astronomical heritage represented across many European observatories and ask whether they be suitable for inclusion in the IAU's list of "Outstanding Astronomical Heritage" (OAH).[2] This may also include observatories that no longer exist but have made significant scientific contributions (e.g., Gotha in Germany, Uraniborg in Denmark). Further, we ask whether some might also be considered for future trans-national UNESCO nominations arising from several countries? While the astronomical heritage must be foremost in the applications, an extensive management plan for the site preservation is also a requirement. Within this plan the cultural and educational values of historic observatories will need to prominent. Thus, attaining UNESCO World Heritage status will also leverage important societal values such as the public communication of science. We will also consider the fate of observatories which are no longer in active use. For instance, in Potsdam the main dome has been transformed into a library, whereas in contrast to Cambridge and Meudon where they are falling into disrepair.

Questions that might be asked include:

- The requirements for an observatory to be considered as Outstanding Astronomical Heritage?
- The requirements needed to consider an observatory as a monument for accreditation for UNESCO Word Heritage?
- What defines a "Classical Observatory" from a cultural viewpoint?

Challenges that are encountered in running Classical Observatories include:

- How to keep historic telescopes working and relevant to audiences?
- What can we learn from historic observatory libraries and archives?
- How can an observatory on the UNESCO World Heritage list proceed with undertaking modern cutting-edge research?
- How do historic observatories manage the balance between visitors' expectations (black holes - wow!)
  versus historic reality (transit telescopes and cataloguing - boring!)?
- How might we retain observatory domes once they have stopped being actively used for research?

1 https://www.gov.ie/en/department-of-housing-local-government-and-heritage/press-releases/ministers-announce-new-addition-to-irelands-unesco-world-heritage-tentative-list-hist

2 https://web.astronomicalheritage.net/heritage/outstanding-astronomical-heritage.

1.4 Programme of the Workshop IAU C.C4 & WG. Hamburg 2025: *Classical Observatories & UNESCO World Heritage*

1.5 Hamburg Observatory, Sunday, August 31, 2025

Gojenbergsweg 112, 21029 Hamburg-Bergedorf

Public Transport to Hamburg Observatory in Bergedorf:
Start: S-Bahn S2 – Bahnhof Dammtor/Messe CCH (Gleis 2)
9:03 – 9:26 Bahnhof Bergedorf (Gleis 3)

Gleis 1 – Bus Platform G Bus 135 (Ringlinie) – Bahnhof Bergedorf 9:34 – 9:44
Justus-Brinckmann-Straße (7 min walk)
Bus 332 – Bahnhof Bergedorf 9:46 – 9:57 Sternwarte (Universität)

1.5.1 1st Session – 10:00–11:05 h Lectures

Chairs: **Gudrun Wolfschmidt and Michael Burton**

- 10:00–10:15 h – Michael Burton (Armagh, UK):
  Introduction: The Unesco Application of the three Irish Observatories Armagh, Birr, and Dunsink

  10:15–10:35 h – Yolanda Muñoz Rey (Cádiz, Spain):
  Royal Observatory of Navy in San Fernando, Spain

  10:35–10:55 h – Gudrun Wolfschmidt (Hamburg, Germany):
  Astronomical Heritage in the Baltic Region – The IAU List "Outstanding Astronomical Heritage"

  10:55–11:05 h – Paul Gabor (Città del Vaticano, Vatican City):
  The "Alliance of Historic Observatories" (AHO)

11:05–11:30 h – Coffee Break

1.5.2 2nd Session – 11:30–12:50 h Lectures

Chairs: **Giangiacomo Gandolfi and Valeria Zanini**

- 11:30–11:50 h – Michele Calvano, Flavia Camagni, Elena Ippoliti, Giangiacomo Gandolfi & Marco Faccini (Rome, Italy):
  Architecture and the Sky: the Digital Reconstruction of the Astronomical Observatory on the Campidoglio in Rome
- 11:50–12:10 h – Paul Gabor (Città del Vaticano):
  From the Gregorian Tower to the Vatican Observatory
- 12:10–12:30 h – Marco Faccini, Giangiacomo Gandolfi, Tiziana Macaluso & Roberto Danizi (Rome, Italy):
  From the "tin can" on top of the Capitol Hill, to the domes of the Astronomical Observatory of Rome
- 12:30–12:50 h – Giangiacomo Gandolfi, Marco Faccini, Tiziana Macaluso & Roberto Danizi (Rome, Italy):
  Chasing forgotten Astronomical Observatories in Rome

12:50–14:00 h – Lunch Break – Café Stellar

- Poster:
  Federico Di Giacomo (Padua, Italy):
  From Santini to Gaia: the improvement of the modern astrometric data with the use of XIX century stellar catalogue

1.5.3 3rd Session – 14:00–15:00 h Lectures

Chair: **Paul Gabor**

- 14:00–14:20 h – Valeria Zanini (Padova, Italy):
  La Specola of Padua: A Living Observatory of Outstanding Astronomical Heritage
- 14:20–14:40 h – Marco Citossi & Giulia Iafrate (Trieste, Italy):
  Trieste Astronomical Observatory and the Reinfelder Telescope: Historic Roots and Present-Day Structure between City and Basovizza
- 14:40–15:00 h – Durruty Jesús De Alba Martínez & Mónica Martínez Borrayo (Guadalajara, Mexico):
  The former Observatorio Astronómico y Meteorológico del Estado de Jalisco and its Library: the Mutual Spread of Astronomical Knowledge between México and Europe, Towards the Recognition of Astronomical Heritage

15:00–15:30 h – Coffee Break


Figure 1.4:
1-m-Zeiss-Reflecting Telescope and Large Refractor of Hamburg Observatory

(Photos: Gudrun Wolfschmidt)

- 15:00–17:00 h – Guided Tour through Hamburg Observatory
  by Gudrun Wolfschmidt and Matthias Hünsch (Hamburg Observatory):
  Astronomical Heritage of Hamburg Observatory in Bergedorf (built 1906–1912), a culturally and historically significant ensemble –
  Architecture, Instruments, Exhibitions

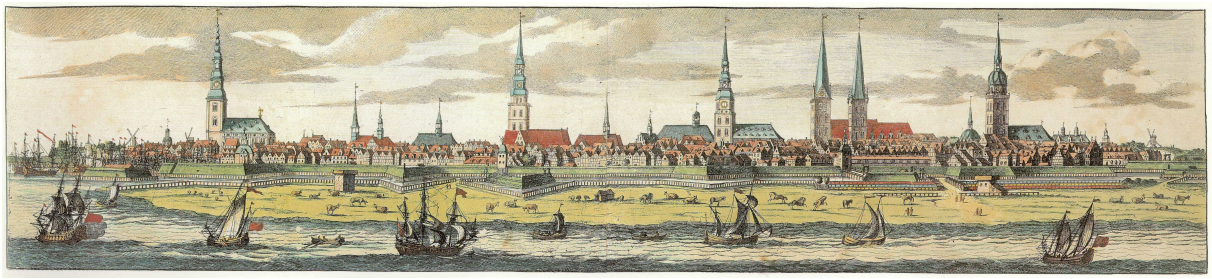

Figure 1.5:
Hamburg (Schenk 1682)

- 17.30 h – Back to Hamburg City
- 18.30 h – City Walk in Hamburg to places of former observatories

- 20 h – Dinner

1.5.4 Proceedings

I offer to publish the lectures (and posters) in a proceedings book in my series "Nuncius Hamburgensis" as Vol. 64.[3]

Here also the lectures of the EAS Session LS10 (Classical Astronomical Observatories and UNESCO World Heritage) can be included.[4]

3 https://www.fhsev.de/Wolfschmidt/GNT/research/nuncius.php.
4 https://eas.unige.ch/EAS2025/session.jsp?id=LS10.

Figure 2.1:
Hamburg Observatory: Main Building, Star Gazing with the 1-m-Zeiss-Reflector, Time Ball, Large Refractor (Repsold/Steinheil)

(Photos: Gudrun Wolfschmidt)

G. Wolfschmidt: Booklet of Abstracts – Classical Observatories & UNESCO World Heritage. Workshop of IAU C.C4 & WG. Hamburg 2025

1st Session

2.1 *Royal Observatory of Navy in San Fernando, Spain*

Yolanda Muñoz Rey

University of Cádiz (Spain)
Royal Academy of San Romualdo of Sciences, Letters and Arts

yolanda.munoz@uca.es

The Royal Observatory of Navy in San Fernando, in its more than *250 years of uninterrupted scientific activity*, was the first Astronomical Observatory in Spain and has been and remains one of the most important scientific institutions in the country. Integrated into the structure of the Spanish Navy within the Science/Culture Section, it is an institution with a rich history and significant historical astronomical value. Its main activities include Astronomy, Geophysics, and the Time Section.

Figure 2.2:
Royal Observatory of Navy in San Fernando, Spain

(credit Ministery of Defense)

In the field of *Astronomy*, the Observatory has dedicated services, including the Ephemeris Calculation Service, the Wide-Field Astrometry Service, the Solar Astronomy Service,

and the Meridian Astrometry Service. These services reflect the observatory's scientific activity and contribution to the observation and study of the cosmos.

It has a *Library* whose catalog includes references ranging from Ptolemy and Copernicus to the present day. Its facilities currently occupy most of the Observatory's main building, and its more than 30,000 volumes, including the important collection of periodicals, form one of the most interesting scientific libraries in the country, inseparable from the Observatory's scientific work and the teaching duties of the Naval School of Advanced Studies. The Cartography Collection, composed primarily of nautical cartography of the Spanish coasts published in the 18$^{\text{th}}$ and 19$^{\text{th}}$ centuries, includes more than 3,500 maps, charts, and plans.

It also houses a *Historical Archive* that preserves the administrative and scientific documentation generated by the institution from its creation in the mid-18$^{\text{th}}$ century until well into the second half of the 20$^{\text{th}}$ century. The Archive consists of 603 filing boxes with documentation and 1,187 handwritten volumes, 80 of which contain observations from the Astrophotographic Catalog and 992 calculations from the Nautical Almanac.

The *Collection of Historic Instruments* is particularly important for understanding historical astronomical practice. It includes spectacles and quadrants, essential tools for astronomical observation and measurement in ancient times, as well as clocks designed specifically for navigation, highlighting the crucial role of astronomy in determining time and position at sea throughout history. Comprised of 1,245 collections, it includes astronomical and geophysical instruments, nautical and scientific clocks, other technical, scientific, and educational instruments, and other historical and cultural collections, including the engraving matrices used in the Sky Chart project between the late 19$^{\text{th}}$ and early 20$^{\text{th}}$ centuries.

The Observatory's historical significance is also evident in its function as the *Time Section*. It has been responsible for determining and disseminating the official time in Spain, keeping records of official time changes in the country since 1918. This work is vital for navigation, science, and civil life. Furthermore, among the different disciplines it covers, the *Geophysics Section* of this Observatory regularly works on Geomagnetism, Seismology, Geodesy, and Meteorology.

Furthermore, the Observatory remains connected to the historical application of astronomy through the organization of events such as the *Astronomical Navigation Seminar*, demonstrating a continued interest in and study of this discipline and its practical use.

Overall, the combination of its astronomical services, its valuable historical collections of books, archives, and instruments, and its historic role in determining time position the Royal Naval Observatory as a key institution for research and the enhancement of historical astronomical heritage, which, in this case, is fully preserved in situ and contextualized.

Keywords: Royal Observatory of Navy in San Fernando, Astronomy, Scientific Heritage.

Figure 2.3:
Instruments of the Royal Observatory of Navy in San Fernando, Spain

(credit Ministery of Defense)

References

Lafuente, Antonio & Manuel Sellés: *El Observatorio de Cádiz (1753–1831).* Madrid: Ministerio de Defensa 1988.

González, Francisco José:*El Observatorio de San Fernando (1831–1924).* Madrid: Ministerio de Defensa 1992.

González, Francisco José:*La Biblioteca del Real Observatorio de la Armada: Historia de su formación y descripción de sus fondos.* Madrid: Ministerio de Defensa (Boletín ROA; 10) 1997.

González, Francisco José; García Polavieja, Carmen & José M. Merino:*El Archivo Histórico del Real Instituto y Observatorio de la Armada. Guía e Inventario.* Madrid: Ministerio de Defensa 1988.

González, Francisco José; López Vico, Francisco R. & Mercedes Espada Bordes:*La Colección Museográfica del Real Instituto y Observatorio de la Armada. Catálogo de Instrumentos Científicos y Patrimonio Cultural.* Madrid: Ministerio de Defensa 2020.

2.2 *Astronomical Heritage in the Baltic Region – The IAU List "Outstanding Astronomical Heritage"*

Gudrun Wolfschmidt

GNT, Hamburg Observatory, University of Hamburg, Germany

gudrun.wolfschmidt@uni-hamburg.de

Astronomical clocks (14th and 15th century), typical for the Hanseatic region, or the Gottorf Globe (1664), made in Schleswig in the Baroque period, represent a valuable astronomical cultural heritage, an ensemble characterized by science, art, craftsmanship, technology, and religion.

The first observatories were supported by patrons such as dukes or kings, but also academy and university observatories (e.g., Rundetårn 1642, "Specula" in Rostock 1662, Kiel 1769, Uppsala 1741, Vilnius 1753, Stockholm 1753, Greifswald 1775), and private observatories (Hevelius in Danzig) were founded in the Hanseatic Cities. Very famous is the Struve Arc (1816 to 1856) with Tartu Observatory, which was added on the Unesco World Heritage List.

The IAU List "Outstanding Astronomical Heritage" (OAH), which I started in 2018, identifies the cultural and astronomical values of observatories, which played a significant role because of their cutting-edge scientific research carried out there. The focus is on the period from the Renaissance to the 20th century.

The OAH list has several goals:

1. to identify observatories, suitable for an Unesco application (Tartu, three Irish observatories),
2. for a comparative analysis – for finding observatories with comparable features (like e.g., the development of architecture and instrumentation, or the invention of the dome or the clock drive).
3. to remember observatories where the actual building may be damaged or destroyed, and the original instruments may no longer exist in situ or not at all, they have no chance to enter the UNESCO list, but they provided impressive research and discoveries by outstanding astronomers (like in the Baltic: Copernicus, Tycho Brahe, Ole Rømer, and Rostock).
4. Not only observatories should be included but also astronomical clocks or mechanical planetariums (like the Gottorf Globe, Schleswig, or the Eise Eisinga Planetarium, Franeker, 1781) or the optical planetarium.

Keywords: Observatories, Cultural heritage, Astronomical heritage, Astronomical clocks, Gottorf Globe, Eise Eisinga Planetarium.

Figure 2.4:
Upper left: Tycho's Observatory Uraniborg (1576),
Model in the Deutsches Museum Munich
Upper right: Observatory of Hevelius in Danzig/Gdansk, (1649–1679),
Model in the Deutsches Museum Munich
Lower left: the oldest observatory "Specula" Rostock (1662), Model
Lower right: University Observatory Vilnius (1753)

(Photos: Gudrun Wolfschmidt)

References

Brahe, Tycho: *Astronomiae instauratae mechanica.* Wandesburg 1598.

Elmqvist Söderlund, Inga: The Old Stockholm Observatory in a Swedish Context and an Argument for the Necessity of an Inventory of the Swedish Astronomical Heritage. In: Wolfschmidt, Gudrun (ed.): *Cultural Heritage of Astronomical Observatories – From Classical Astronomy to Modern Astrophysics.* Berlin: hendrik Bäßler (International Council on Monuments and Sites, Monuments and Sites XVIII) 2009, p. 235–249.

Kampa, Irena: *Die astronomischen Instrumente von Johannes Hevelius. The Astronomical Instruments of Johannes Hevelius.* Ed. by Gudrun Wolfschmidt. Hamburg: tredition (Nuncius Hamburgensis; Vol. 47) 2018 (484 pages).

Lühning, Felix: *"... eine ausnehmende Zierde und Vortheil" – Geschichte der Kieler Universitätssternwarte und ihrer Vorgängerinnen 1770–1950.* Neumünster: Wachholtz Verlag (Sonderveröffentlichungen der Gesellschaft für Kieler Stadtgeschichte, Band 56) 2007.

Müller, Peter: *Sternwarten in Bildern. Architektur und Geschichte der Sternwarten von den Anfängen bis ca. 1950.* Berlin, Heidelberg: Springer 1992.

Wolfschmidt, Gudrun: Die Sternwarte der Universität Vilnius. In: Wolfschmidt, Gudrun (ed.): *Astronomie im Ostseeraum. Astronomy in the Baltic.* Proceedings der Tagung des Arbeitskreises Astronomiegeschichte in der Astronomischen Gesellschaft in Kiel 2015. Hamburg: tredition (Nuncius Hamburgensis; Vol. 38) 2018, p. 248–261.

Wolfschmidt, Gudrun: Cultural Heritage of Observatories in the Context with the IAU-UNESCO Initiative – Highlights in the Development of Architecture. In: *Advancing Cultural Astronomy: Studies in Honour of Clive Ruggles.* Ed. by Efronsyni Boutsikas, Steve McCluskey & John Steele. New York, Berlin, Heidelberg: Springer 2021, p. 291–314.

2.3 *The "Alliance of Historic Observatories" (AHO)*

Paul Gabor

Città del Vaticano, Vatican City

pgabor@specola.va

The Alliance of Historic Observatories (AHO) is a geographically diverse association of historic (> 50 years old) astronomical observatories that have played pivotal roles in advancing our understanding of the cosmos, today brought together by common objectives and challenges.

The purpose of the Alliance is to address the needs of its member organizations and professionals working in fields related to historic observatories such as conservation of historic instruments and buildings, history research, modern research applications for heritage equipment and public education.

Keywords: Alliance of Historic Observatories (AHO)

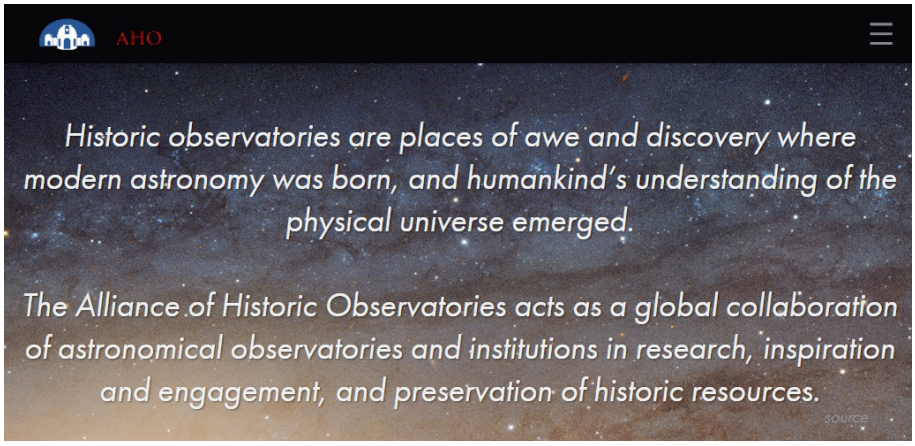

Figure 2.5:
Alliance of Historic Observatories (AHO)

References

https://historicobservatories.org/.

2nd Session

2.4 *Architecture and the Sky: the Digital Reconstruction of the Astronomical Observatory on the Campidoglio in Rome*

Michele Calvano[1], Flavia Camagni[1], Elena Ippoliti[1],
Giangiacomo Gandolfi[2] & Marco Faccini[2]

1 Sapienza University of Rome, Italy
2 INAF Astronomical Observatory of Rome, Italy

michele.calvano@uniroma1.it, flavia.camagni@uniroma1.it, elena.ippoliti@uniroma1.it, giangiacomo.gandolfi@inaf.it, marco.faccini@inaf.it

The Campidoglio Astronomical Observatory, predecessor together with the Collegio Romano Observatory of the current INAF – Astronomical Observatory of Rome and located in the 19th century on the Campidoglio, is an important testimony to the architectural and scientific evolution linked to celestial observation. Today, its physical absence poses a challenge to collective memory and cultural continuity. In response, the project of its three-dimensional digital reconstruction has been conceived to preserve, interpret, and disseminate this important heritage through digital means. This initiative combines methodological rigour, historical research, and virtual restoration, with the aim of rendering the observatory accessible to both specialists and the public. It forms part of a broader cultural strategy that seeks to promote the value of lost or inaccessible heritage through immersive digital tools, such as Virtual Tours composed of interactive panoramic imagery. These instruments not only facilitate remote access but also encourage new ways of engaging with historical architecture.

Central to the project is the collaboration between scholars in architectural representation from Sapienza University of Rome and astrophysicists from INAF, the National Institute for Astrophysics, who specialise in the history and design of astronomical instruments. This interdisciplinary cooperation has enabled a comprehensive analysis of the available documentary sources-ranging from historical maps and architectural drawings to scientific notes and archival photographs. Through this process, specific semantic meanings have been reattributed to architectural components directly linked to the building's scientific function. Elements that had been marginalised or misinterpreted in previous readings have been reconsidered considering their original role, contributing to a more accurate and holistic reconstruction of the observatory's spatial logic. The methodological approach is based on the acquisition and processing of heterogeneous historical materials, including plans, sections, textual descriptions, and iconographic documentation. These sources were digitised and imported into a CAD-based modelling environment, where a stratigraphic analysis of the building's transformations over time was conducted.

The chosen historical phase for reference corresponds to the directorship of Lorenzo Respighi (1886–1889), a period marked by important scientific developments and archi-

tectural interventions. The digitised documents were redrawn in vector format, correcting distortions resulting from scanning processes, and aligned to construct a coherent three-dimensional reference grid. This served as the framework for 3D modelling, which was carried out with attention to geometrical accuracy and proportional consistency. The architectural elements were progressively classified according to semantic categories reflecting their historical and functional significance. Throughout the process, the digital model was continuously compared with analogous observatories and scientific buildings of the same period, allowing for the integration of representative stylistic and functional components. The result is a detailed and semantically rich digital reconstruction, suitable for educational use, scientific dissemination, and museum exhibition. This operation, which fuses archival research with advanced digital representation techniques, not only safeguards the memory of a lost architectural artefact, but also revitalises its scientific identity, fostering a deeper understanding and appreciation of heritage through interdisciplinary dialogue and public engagement.

Keywords: Digital reconstruction, Cultural heritage, Archival investigation, 3D model, Scientific dissemination

References

Apollonio, Fabrizio I.; Fallavollita, Federico & Riccardo Foschi: The critical digital model for the study of unbuilt architecture. In: Niebling, Florian; Münster, Sander & Heike Messemer (eds.): *Research and Education in Urban History in the Age of Digital Libraries.* Cham, Switzerland: Springer International Publishing (Communications in Computer and Information Science (CCIS); Vol. 1501) 2021, p. 3–24. https://doi.org/10.1007/978-3-030-93186-5_1.

Cabezos-Bernal, Pedro Manuel & Juan J. Cisneros-Vivó: Valorization and dissemination of lost urban heritage: Valencia, the walled city. In: *DISEGNARECON* 11 (december 2018), n. 21, https://doi.org/10.20365/DISEGNARECON.21.2018.12.

Calandrelli, Ignazio: *Descrizione scientifica del Circolo Meridiano collocato nel nuovo pontificio Osservatorio della Romana Università: Memoria del Prof. Ignazio Calandrelli.* Roma: Tipografia delle Belle Arte 1855.

2.5 *From the Gregorian Tower to the Vatican Observatory*

Paul Gabor

Città del Vaticano

pgabor@specola.va

We present a brief of the 450 years of astronomical research in Rome under the Holy See's patronage, emphasizing the extant monuments within the Vatican City State and other Church possessions in the city of Rome. We introduce the Specola Vaticana (Vatican Observatory), the current institutional embodiment of the Papacy's commitment to astronomy.

Figure 2.6:
Papal Palace from Castel Gandolfo

(credit: Vatican Observatory)

In this Abstract, we limit ourselves to a few salient points. Astronomical facilities in Rome, apart from a number of notable individual contributions over the centuries, are

linked mainly to two institutions, the Holy See and the Society of Jesus. Upon his election in 1572, Gregory XIII created a commission for the overdue calendar reform. A member of the commission, Father Ignazio Danti, O.P., was put in charge of the construction of a tower (started in 1576), later known as the Gregorian Tower or the Tower of the Winds, with a meridian room and observing platforms. Meanwhile, at the Roman College of the Society of Jesus, Father Christopher Clavius, S. J, who arrived in Rome in 1561, greatly contributed to the Roman College's Academy of Mathematics, making it a centre where many Jesuit "mathematicians" (a term also covering astronomers) were formed over the next century. Clavius, who was also a member of Gregory XIII's commission, wrote the definitive report on the new, Gregorian Calendar. The Gregorian Tower as well as a tower of the Reman College served astronomical purposes. The Gregorian Tower is well preserved.

In 1850, Father Angelo Secchi, S.J., became the director of the Observatory of the Roman College and built observing facilities on the roof the Church of St Ignatius. Pius IX elevated it to a Pontifical Observatory. Some traces of these structures are extant.

In 1891, Leo XIII renewed the observatory at the Vatican, starting at the Gregorian Tower, as the Vatican Observatory or Specola Vaticana. In 1835, the Specola moved to the Papal summer residence of Castel Gandolfo, and two telescopes were inaugurated on the castle's roof, a Double Astrograph and a Visual Refractor, both by Carl Zeiss Jena. In 1942, a separate pavilion was built in the gardens to house the Carte-du-Ciel telescope, and in 1957, another dome was added to the pavilion, housing a new Schmidt camera by Hargreaves and Thomson of London. All four telescopes can be visited together with an exhibit on the Specola's past and present.

Light pollution forced the Specola to seek out new opportunities for observational work outside of its Castel Gandolfo seat. In 1980, collaboration with the University of Arizona in Tucson was formalized, allowing Vatican astronomers access to the observing facilities of the University. The 1.8-metre Vatican Advanced Technology Telescope was dedicated in 1993 on Mt. Graham.

Keywords: Gregorian Tower, Tower of the Winds, Specola Vaticana, Observatory of the Roman College, Castel Gandolfo, Double Astrograph, Schmidt Camera, Vatican Advanced Technology Telescope

References

Chinnici, Ileana: *Decoding the Stars: A Biography of Angelo Secchi, Jesuit and Scientist.* Leiden: Brill 2019.

Coyne, George; Hoskin, Michael & Olaf Pedersen (eds.): *Gregorian Reform of the Calendar.* Proceedings of the Vatican Conference to Commemorate its 400th Anniversary 1582–1982. Pontificia Academia Scientiarum, Specola Vaticana 1983.

Maffeo, Sabino: *The Vatican Observatory: In the Service of Nine Popes.* Vatican Observatory Publications (2nd Edition) 2001.

Figure 2.7:
Vatican Advanced Technology Telescope (VATT) Dome in Winter

(credit: Vatican Observatory)

2.6 *From the "tin can" on top of the Capitol Hill, to the domes of the Astronomical Observatory of Rome*

Marco Faccini, Giangiacomo Gandolfi, Tiziana Macaluso & Roberto Danizi

INAF Astronomical Observatory of Rome, Italy

marco.faccini@inaf.it, giangiacomo.gandolfi@inaf.it, tiziana.macaluso@inaf.it, roberto.danizi@inaf.it

October 28th, 1938: the Astronomical Observatory of Rome was inaugurated at Villa Mellini, on the Monte Mario hill in Rome. Is this really the first time in history that the Capital of Italy has its own astronomical observatory?

In reality, this is only partly true. The inauguration of the Astronomical Observatory of Rome at Villa Mellini is only the last step of a much longer journey, which has its roots in the fifteenth century, and developed over the following centuries when astronomy was still a science to be refined, and Roman nobles and prelates lent their roof terraces to private observations by astronomers and enthusiasts.

From private experiences to the birth of the Astronomical Observatory, the journey is very long and certainly passes through a process of "definition" and a semantic analysis of the meaning of the terms "Astronomical Observatory". What is the difference between a "specula" where astronomical observations take place and an Astronomical Observatory?

The history of the Astronomical Observatory of Rome is certainly a useful starting point for addressing this question. We will therefore try to retrace the final stages of its history, starting from the decision of the University of Rome, Sapienza, to organize a permanent venue for systematic astronomical observations: the Terrace of the Tower of Nicholas V on the Palazzo Senatorio at the Campidoglio. We will follow about 100 years of history of Roman Astronomy and its connections with the history of Rome and the palaces of Roman power.

Our journey will begin in 1824, with F. Scarpellini and the cabinet of scientific instruments he owned and made available for the experiments of the students of Sapienza and the papal bull "Quod Divina Sapientia", issued by Pope Leo XII. It will continue with the development on the terrace of the Palazzo Senatorio at the Campidoglio of a permanent astronomical dome, when Rome saw its skyline modified on that very symbolic building. It is with I. Calandrelli, starting in 1852, that the Sapienza Observatory takes shape and later, thanks to L. Respighi, director since 1865, that the University has a real Astrophysical Observatory. The terraces and rooms of the Palace will change over the years, becoming populated with domes, "tin can (barattoli)" as the Romans called them, and instruments dedicated to astronomical and astrophysical research selected by the directors who followed one another.

Until the 1920s when the end of the systematic activities of another Roman astronomical observatory, the Observatory of the Collegio Romano at Sant'Ignazio in Rome, will lead to the fusion of the two structures in a new project, the Rome Observatory. An observatory that initially existed in a delocalized way and almost exclusively on paper, but which had, starting in 1923, G. Armellini as director of three structures, scattered throughout the capital. We will focus on these last years of great changes, to follow Armellini's project that will lead us to the inauguration in 1938.

Armellini supported the cause of providing Rome with a modern astronomical observatory and began by optimizing the buildings and instruments at his disposal at Collegio Romano and Observatory of Campidoglio and identifying the location of Villa Mellini as the best opportunity to create the new Observatory and Astronomical Museum of Rome. These were years in which domes and telescopes changed destination and use, requests for funding clashed with the increasing tension before the war and with the needs of a regime that mainly cared about science for propaganda purposes.

We will consider the archive documents and photos of those years that will show us the stories and difficulties that led to the creation of what was then, for over 60 years, the headquarters of the Observatory and Astronomical Museum of Rome.

Keywords: "Astronomical Observatory", Rome, Campidoglio, Giuseppe Armellini, dome, telescope.

References

Armellini, Giuseppe: Il primo centenario dell'Osservatorio del Campidoglio. In: Calendario del R. Osservatorio Astronomico di Roma. Roma 1927.

Armellini, Giuseppe: R. Osservatorio e Museo Astronomico di Monte Mario. In: Quaderni di Studi Romani. Roma: Istituto di Studi Romani 1939.

Buonanno, Roberto: Il Cielo sopra Roma – I luoghi dell'astronomia. Milano: Springer 2008.

Cacchiatelli, Paolo & Gregorio Cleter: Le Scienze e le arti sotto il pontificato di Pio IX. – "Osservatorio astronomico dell'Archiginnasio Romano sul Campidoglio". Con tavola incisa in rame: circolo meridiano di Ertel donato da Pio IX. Roma: Tipografia delle Belle Arti [1860–1869].

Calandrelli, Ignazio: Pontificio Nuovo Osservatorio della romana Università. In: Atti dell'Accademia Pontificia dei Nuovi Lincei, a.VI, Session III del 3 aprile 1853.

Calandrelli, Ignazio: Descrizione scientifica del Circolo Meridiano del R. Osservatorio dell'Università. Roma 1855.

Maffei, Paolo: L'Origine dell'Osservatorio Astronomico di Roma. In: Bollettino storico della città di Foligno XXIX–XXX (2005–2006), p. 87.

Monaco, Giulio: Il Museo Astronomico e copernicano dell'Osservatorio astronomico di Roma. In: AA.VV., Roma Capitale 1870–1911. La cultura scientifica a Roma 1870–1911. Venezia: Marsilio 1984.

Secchi, Angelo: Astronomia in Roma nel pontificato di Pio IX. Roma 1877.

2.7 *Chasing forgotten Astronomical Observatories in Rome*

Giangiacomo Gandolfi, Marco Faccini, Tiziana Macaluso & Roberto Danizi

INAF Astronomical Observatory of Rome, Italy

giangiacomo.gandolfi@inaf.it, marco.faccini@inaf.it, tiziana.macaluso@inaf.it, roberto.danizi@inaf.it

The eternal city has a lengthy tradition of places adapted and equipped for astronomical observations, in antiquity invariably associated to terraces of pre-existing buildings or clearings on hilltops. Locations as varied as the towers of the Lateran at the time of Sylvester II either the Tower of the Winds in the Vatican Palace or Innocenzo Malvasia's vineyard on the Janiculum Hill during Galileo's visit of 1611. They were mostly incidental and characterised simply by dark skies and wide horizons, at least until the end of Seicento, the age of Cassini, when they became occasion for social gatherings and regular scientific activity. We propose here a selection of hidden and unrecognised or understudied Roman "specole" worthy of further investigation that trace the radical transformation and progressive institutionalisation of the astronomical observatories between the 18$^{\text{th}}$ and 19$^{\text{th}}$ century.

We will recover amateur and private terraces (the atelier-specola in Palazzo Patrizi Montoro, Audifreddi's observatory in the convent of S. Maria sopra Minerva and the specola Caetani in 18$^{\text{th}}$ century), the first stable revolving structures (the "tin cans" of Campidoglio and Collegio Romano Observatory), soon replicated by amateurs (the tower of Paolo Bulla), the proliferation of astronomical stations in the Vatican State after the capture of Rome by the Kingdom of Italy (Leonine Tower, Janiculum Observatory) and finally the appearance of hemispherical domes over the skyline of the city. This historical itinerary, that reflects on a local level the world evolution of the modern observatory both as a building and as an institution, will culminate in the adaptation of Villa Mellini as the XX century Observatory of Rome and in its almost immediate fragmentation in different facilities.

Keywords: "Astronomical Observatory", Rome, Campidoglio, Collegio Romano, Vatican Observatories, astronomical terraces.

References

Buonanno, Roberto: *Il cielo sopra a Roma: i luoghi dell'astronomia.* Cham: Switzerland: Springer Science & Business Media 2007.

Castro Tirado, Miguel Ángel: *El observatorio astronómico: Un diálogo entre ciencia y arquitectura.* Doctoral thesis, Universidad de Málaga, 2019.

Figure 2.8:
Paolo Bulla (1885) – Notizie sopra all'osservatorio privato di Paolo Bulla

Markkanen, Tapio: The development of the classical observatory: From a functional shelter for the telescope to the temple of science. In: *Acta Baltica Historiae et Philosophiae Scientiarum* **1** (2013), 2, p. 38–52.

Monaco, Giuseppe: *L'astronomia a Roma: dalle origini al Novecento.* Rome: Osservatorio astronomico di Roma 2001.

Poster

2.8 *From Santini to Gaia: the improvement of the modern astrometric data with the use of XIX century stellar catalogue*

Federico Di Giacomo

INAF – Astronomical Observatory of Padova, Italy

federico.digiacomo@inaf.it

INAF – Astronomical Observatory of Padua, with its rich history, is a remarkable example of how historical astronomical institutions have contributed – and continue to contribute – significantly to the advancement of science and the development of technology in multiple fields of astronomy and astrophysics. Among the instruments that represent this tradition the Starke Meridian Circle plays a fundamental role. Built in the first half of the 19th century, it was the principal instrument used by Giovanni Santini, the third director of the Padua Observatory, and his assistant astronomer Virgilio Trettenero to compile the famous Paduan Catalogues: five stellar catalogues published between 1840 and 1870, containing the positions and magnitudes of over 10,000 stars down to the tenth magnitude, with a declination of $\pm 15°$ around the celestial equator (Zanini 2016).

In recent years, astrometry has been completely revolutionized by modern space missions such as Hipparcos and Gaia, both designed and developed by the European Space Agency. With its latest data release, Gaia has provided the positions, parallaxes, and proper motions of about two billion stars, with a limiting magnitude of 20 and a precision of the order of a milliarcsecond (Gaia 2021). However, GAIA offers poorer astrometry for the brightest sources (G<5). In this juncture, historical astrometric catalogues, more than 150–170 years old, can help both to refine the astrometric parameters of the brightest stars and to identify celestial objects that, over this time span, have had anomalous movements or luminosity variability. In this context, the five Paduan Catalogues, created by Giovanni Santini using the Meridian Circle of the Astronomical Observatory of Padua, can contribute to improving our knowledge of specific astrometric quantities provided by modern astrometric catalogues (Di Giacomo 2023).

In this talk, we will present a combined analysis of these historical catalogues, already praised at the time for their great precision, and modern Gaia measurements, illustrating the scientific and technological value of the instrument and its contribution to the evolution of astrometry. In particular, the results we obtained demonstrate that the data collected by the Paduan astronomers are the most precise of the pre-photographic era, which would allow both to update the positions and to determine the proper motions of the brightest stars observed by Gaia. This approach, which combines the analysis of historical archival data with observations from modern scientific instruments such as the Gaia satellite, represents a perfect synergy between past and present astronomy. It will also be possible to conduct a specific study on some stars that show variability or apparently anomalous movements from the mid-19th century to the present day. This approach, which combines archival analysis and cutting-edge astrometric technologies, demonstrates the extraordinary continuity between the past and present of astronomy. It is also possi-

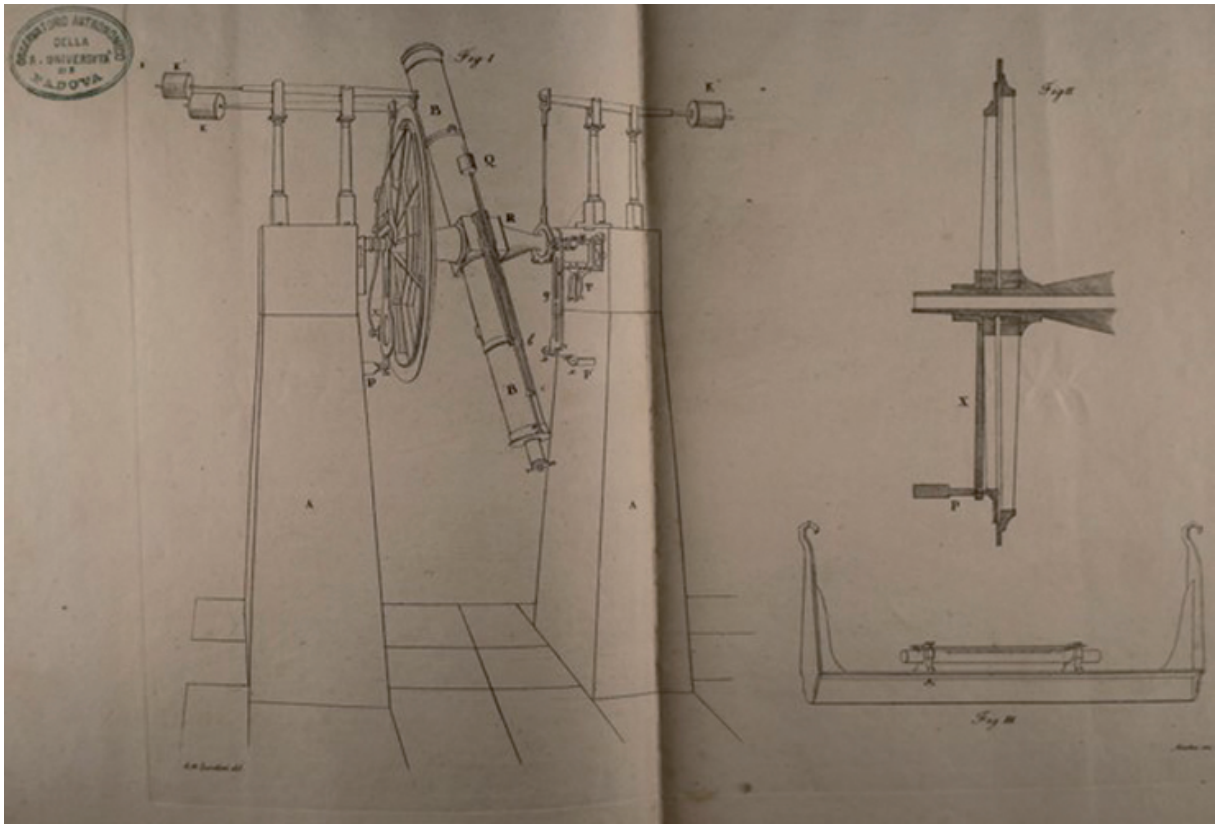

Figure 2.9:
Project of the Meridian Circle

(INAF Astronomical Observatory of Padua, Historical Archive)

ble to initiate studies on stars with persistent variability or anomalous motions over time, from the 19th century to the present.

The Padua Meridian Circle, therefore, is not only a heritage to be preserved but also an active scientific resource. Its example demonstrates how historical observatories, if adequately valued, can continue to make significant contributions to contemporary astrophysical research.

Keywords: Padua Observatory, Astrometry, Meridian circle, Gaia

References

Di Giacomo, Federico; Zaggia, Simone & Valeria Zanini: From Santini to Gaia: the improvement of the modern astrometric data with the use of XIX century stellar catalogue. In: *Atti del XVIII Congresso nazionale SISFA, Perugia, 26–29 September 2023.* Pisa: Pisa University Press 2023.

Gaia collaboration: Gaia Data Release 3: Summary of the content and survey properties. In: *A&A* (2021), 43940-22.

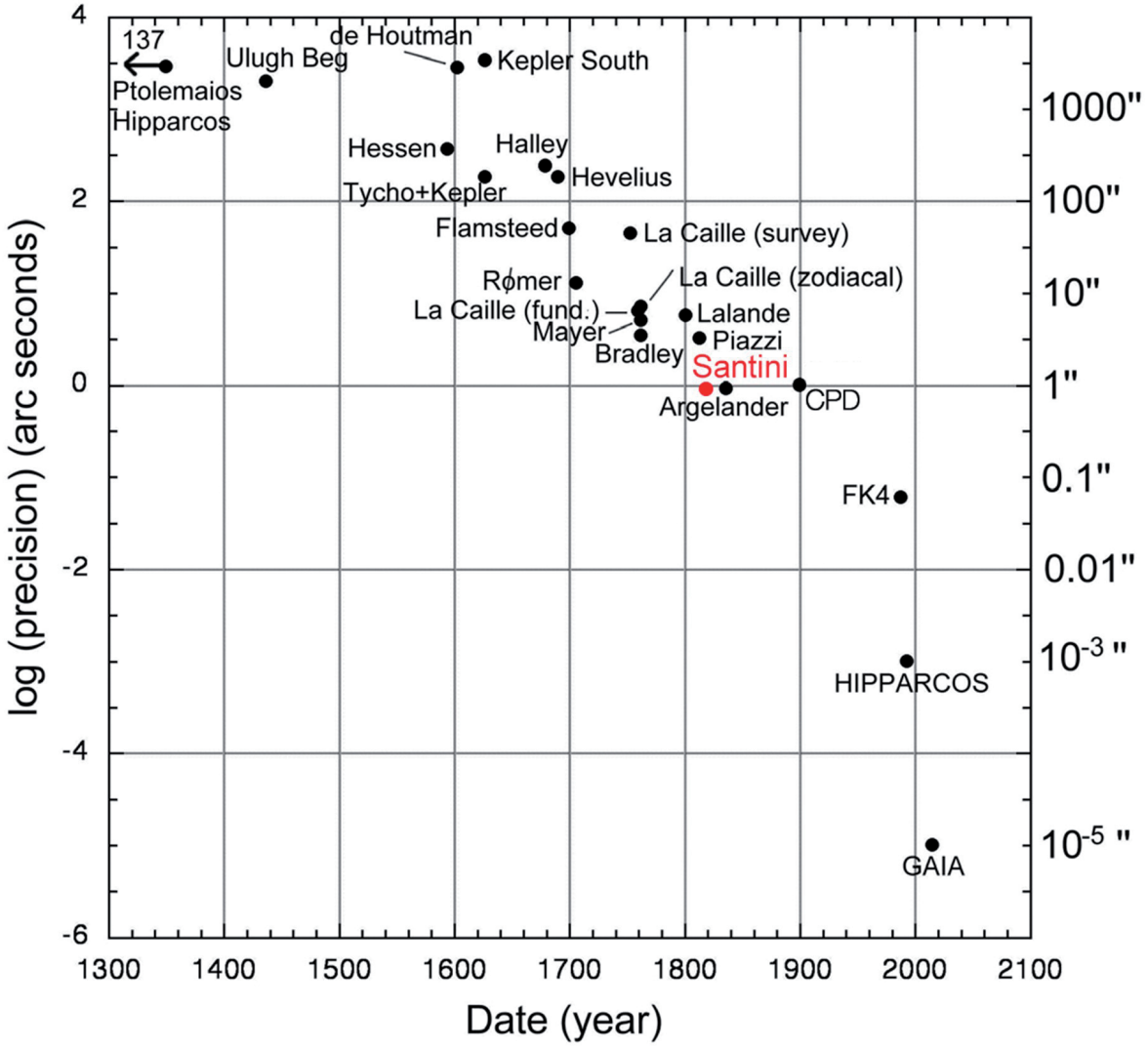

Figure 2.10:
Valuation of the accuracy of astrometric catalogues as a function of tim

Zanini, Valeria & Simone Zaggia: Giovanni Santini, the Meridian Circle and the Paduan Catalogues: the top of classical astronomy in the XIX century in Italy. In: *Atti del XVIII Congresso nazionale SISFA, Napoli, 4–7 ottobre 2016.* Pavia: Pavia University Press 2016.

3rd Session

2.9 *La Specola of Padua: A Living Observatory of Outstanding Astronomical Heritage*

Valeria Zanini

INAF – Astronomical Observatory of Padua, Italy

valeria.zanini@inaf.it

La Specola of Padua stands as a prime exemplary case of *Outstanding Astronomical Heritage* (OAH), encapsulating over eight centuries of architectural, scientific, and cultural history. Originally a medieval tower known as the Torlonga, in 1767 it was transformed into an astronomical observatory by the Republic of Venice, under the guidance of its first Director Giuseppe Toaldo. Today, La Specola remains a site of active scientific research and public engagement, while also diligently preserving its rich historical and scientific astronomical heritage. Culturally, it reflects the evolution of astronomical thought from the legacy of Galileo to the dawn of modern astrophysics. Scientifically, it continues to contribute to contemporary research through the INAF Astronomical Observatory of Padua.

The observatory's historical significance is deeply rooted in its educational and public mission. From its inception, Toaldo envisioned La Specola not only as a research facility but also as a didactic space (Zanini 2023). The frescoes in the Figures Room, depicting key figures in the history of astronomy from Ptolemy to Newton, were designed to educate visitors about the development of astronomical knowledge. Similarly, the Meridian Room features an 18th-century mural fresco of the heliocentric system, offering a visual narrative of the solar system as understood before the discovery of Uranus.

La Specola's commitment to heritage preservation is evident in its extensive archival and museological work. For instance, the observatory has digitized meteorological logs dating back to the 18$^{\text{th}}$ century, including those of Toaldo and his predecessors, making them accessible through the INAF "Polvere di Stelle" portal (Zanini et al. 2022). These invaluable documents are crucial not only for the history of science but also for contemporary climate research.

Public engagement is a cornerstone of La Specola's mission. The observatory has long welcomed visitors through guided tours, exhibitions, and educational programs. During the COVID-19 pandemic, it launched a virtual tour (Zanini et al., 2023), allowing global audiences to explore its historic spaces and instruments remotely. This initiative reflects a broader strategy to balance heritage conservation with accessibility and innovation, particularly for those with mobility difficulties, or other circumstances preventing in-person visits. This commitment is further demonstrated by a new multilingual tour developed for an increasingly international audience seeking access to Padua's scientific cultural heritage.

The observatory's dual identity – as both a monument and a research institution – raises important questions for the future of historical observatories. How can such sites remain scientifically relevant while preserving their authenticity? How can they meet the

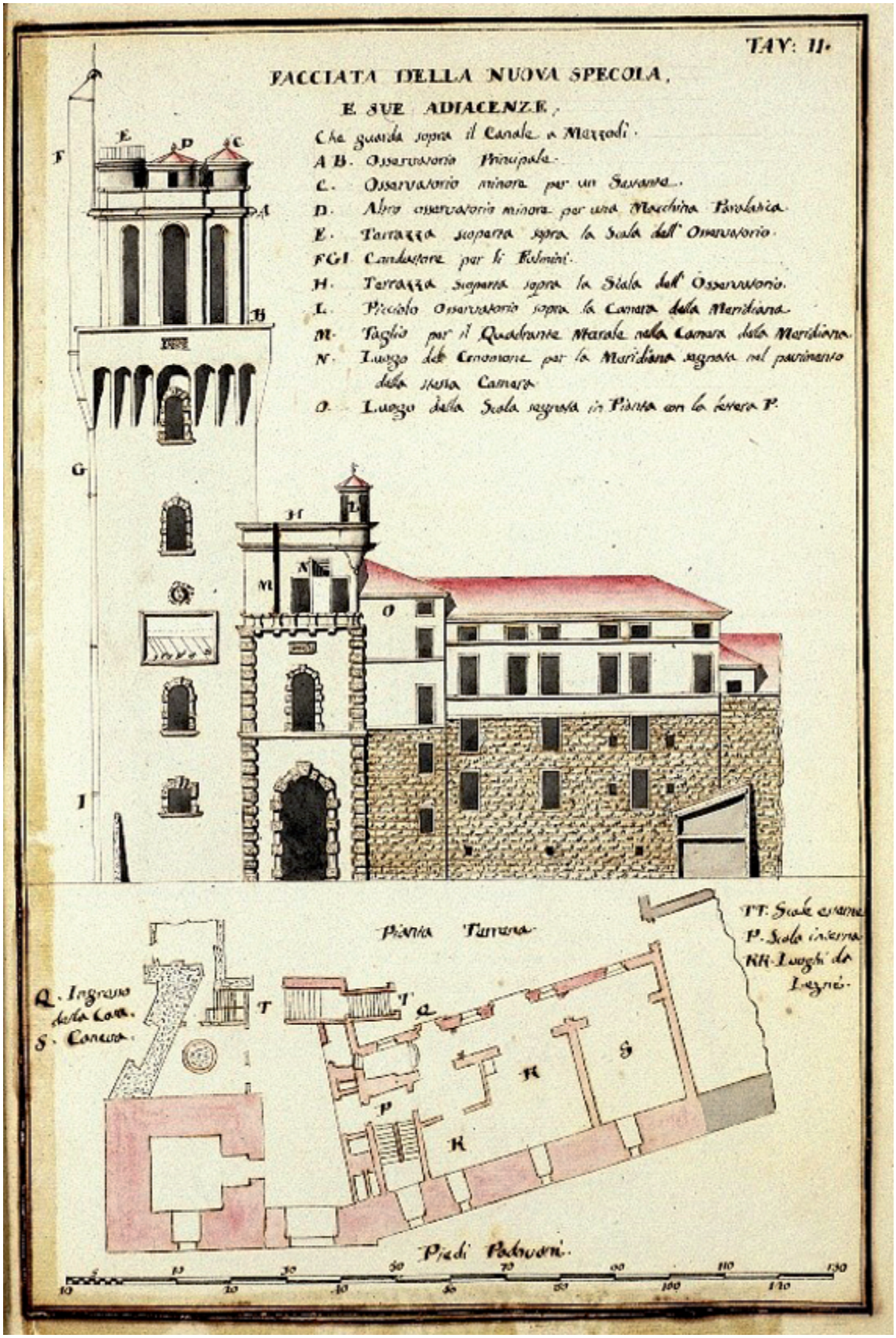

Figure 2.11:
Project for the Observatory realized by the Architect Domenico Cerato

(credit Padua Observatory)

Figure 2.12:

Partial view of the frescoes in the Figures Room
Recognizable from right to left: Copernicus, Tycho Brahe, Galileo, and Kepler

(credit Padua Observatory)

expectations of a public fascinated by black holes and exoplanets, while honoring the precision of classical astronomy?

La Specola offers a model for addressing these challenges. Through careful stewardship, scholarly research, and innovative outreach, it demonstrates that historical observatories can be both guardians of the past and active participants in the scientific present. Its layered history, ongoing research, and commitment to public education make it a living monument of astronomical heritage – one that continues to inspire, inform, and evolve.

Keywords: Observatory of Padua; Astronomical Heritage; Scientific Preservation.

References

Zanini, Valeria; Gasperini, Antonella & Mauro Gargano: Old documents, new technologies: the preservation and valorization of the Italian astronomical archives. In: *Bulletin of the American Astronomical Society* (BAAS) **54** (2022), Issue 2.

Zanini, Valeria: La Specola di Toaldo: eredità culturale di Galileo. In: *Atti e Memorie dell'Accademia Galileiana di Scienze, Lettere ed Arti in Padova* **CXXXIV** (2023).

Zanini, Valeria; Di Giacomo, Federico & Marco Dima: Il tour virtuale al Museo La Specola di Padova. In: *INAF Report* (2023).

2.10 *Trieste Astronomical Observatory and the Reinfelder Telescope: Historic Roots and Present-Day Structure between City and Basovizza*

Marco Citossi & Giulia Iafrate

INAF-OATs – Osservatorio Astronomico di Trieste, Italy

marco.citossi@inaf.it, giulia.iafrate@inaf.it

The story of the Reinfelder & Hertel refractor telescope is a unique example of how place, technology, and astronomical culture intertwine across centuries. The *252 mm (f/14.2) Reinfelder & Hertel – Fraunhofer refractor telescope*, constructed in Munich in 1895 and featuring an air-spaced achromatic doublet objective, was brought to Trieste by Johann Nepomuk Krieger (1865–1902), one of the most innovative selenographers of his era, in 1896. The lens, housed in a brass barrel and engraved with the makers' name, represents the classic aplanatic design with air spacing and a flint glass element at the rear, showing marks of artisanal construction. Installed at Krieger's private Pia Sternwarte, the telescope became not only an essential scientific tool but also a symbolic bridge between Trieste's longstanding maritime and astronomical traditions and the modern quest for precision in lunar mapping.

Upon Krieger's arrival in Trieste with the Reinfelder in 1896, a new phase began in the city's astronomical history. The instrument's advanced optics-recently confirmed by technical inspection and restoration-enabled Krieger to discern and record lunar details beyond the reach of contemporary photographic plates. He pioneered a hybrid methodology: using low-resolution photographic negatives from leading observatories as geometric templates, he then layered visual subtleties observed directly through the Trieste refractor. This synthesis, made possible by the Reinfelder's capabilities, resulted in his celebrated *Mond-Atlas* (1898), which set new standards for accuracy and artistic quality in lunar cartography. The Mond-Atlas, initiated and largely completed in Trieste, brought international attention to both Krieger and the city's astronomical environment.

The lens itself, after decades of use and some incorrect historical remounting, was recently restored. Technical tests revealed its original quality: after proper cleaning and correct reassembly of the positive (crown) and negative (flint) elements, optical evaluation showed only minimal spherical undercorrection and chromatic aberration typical of classical achromatic lenses, confirming its excellence for visual observation. No significant astigmatism or material defects were found. This technical restoration ensures that the instrument continues to represent a masterpiece of late 19$^{\text{th}}$ century optical craftsmanship.

After Krieger's early death, the fate of the Reinfelder refractor remained closely linked to Trieste. Rather than being dispersed or lost, the telescope was preserved and is now a key artifact in the heritage collections of the INAF Osservatorio Astronomico di Trieste.

At present, the historical Reinfelder refractor is conserved inside a small observatory dome at Castello Basevi, the official seat of INAF-Osservatorio Astronomico di Trieste. This location, situated in the city center, preserves the instrument as an important symbol of the observatory's heritage and its scientific tradition.

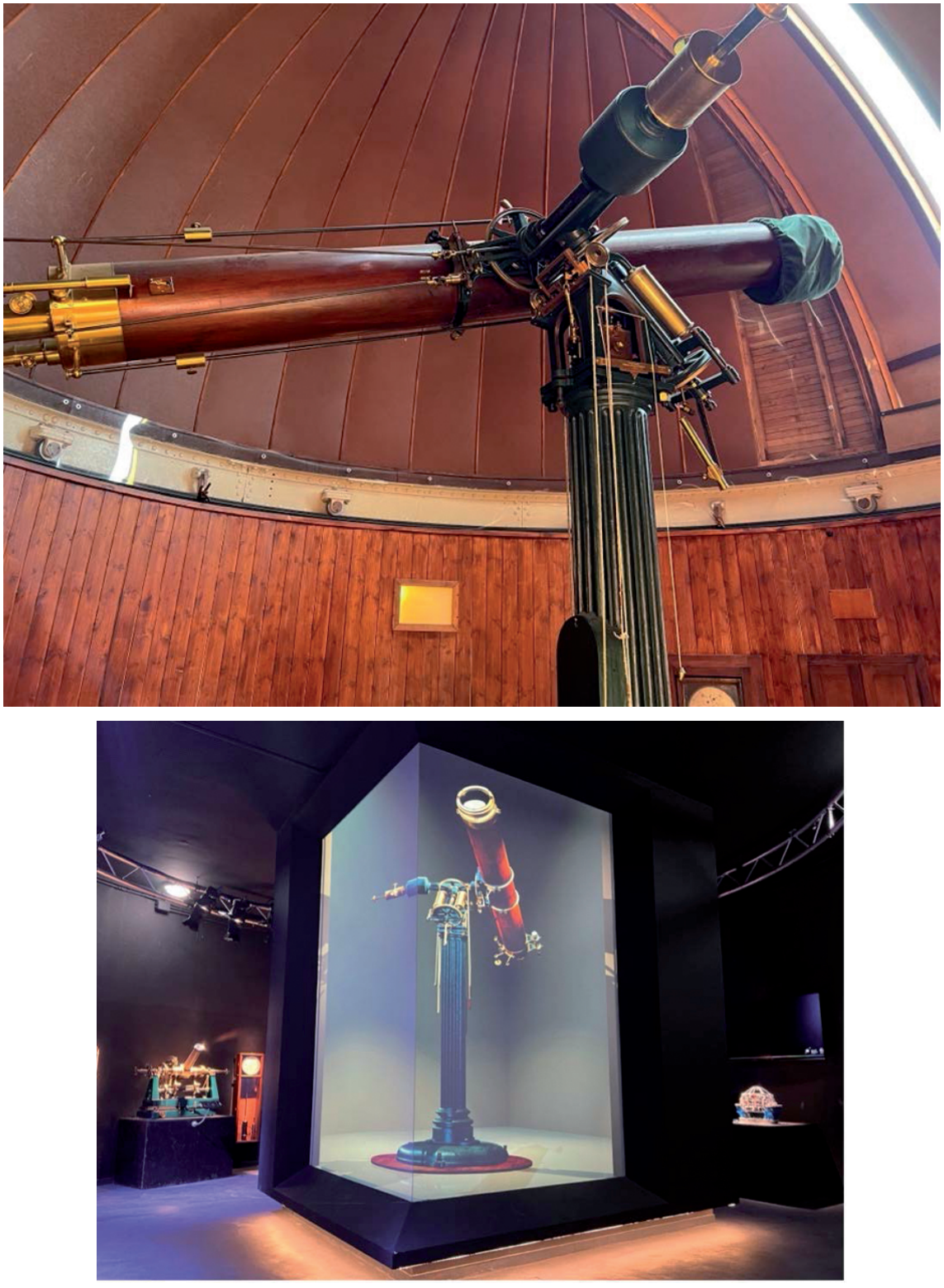

Figure 2.13:

The Reinfelder Telescope
3D projection of the historical Reinfelder Telescope
in the multimedia exhibition at the Specola Margherita Hack

(credit INAF-Astronomical Observatory of Trieste)

Figure 2.14:

Castello Basevi (1898), official headquarters
of the INAF-Astronomical Observatory of Trieste (INAF-OATS)
Another view of Castello Basevi, Trieste

(credit INAF-Astronomical Observatory of Trieste)

Figure 2.15:
Specola Margherita Hack

(credit INAF-Astronomical Observatory of Trieste)

In 2022, the reopening of the Specola Margherita Hack marked a new chapter in public engagement with this heritage. The ground floor of the observatory hosts an immersive, multilingual multimedia exhibition that retraces the city's astronomical history from its 18th-century origins to the present. A highlight of this exhibition is the *virtual 3D projection of the historical Reinfelder telescope, displayed as a central interactive feature.* This immersive installation allows visitors to explore the telescope's historical and scientific significance, bridging the gap between physical artifact and digital storytelling. The exhibition further contextualizes the role of the Reinfelder in the making of Krieger's *Mond-Atlas*, situating both the instrument and the observer at the core of Trieste's scientific identity.

Interactive touchscreens supplement the experience, offering digitized access to rare historical volumes – including the *Mond-Atlas* – and original archival documents. These technologies have revolutionized astronomy education at the Specola, blending historical reverence with innovation and making the Reinfelder refractor a living component of public engagement.

The restoration and exhibition of the Reinfelder refractor, alongside its digital projection, serve as a model for the preservation and revitalization of scientific instruments as cultural heritage. They exemplify how astronomical tools can acquire new meanings and audiences when embedded in an interactive, narrative-driven context. The story of the Reinfelder in Trieste thus demonstrates that the impact of astronomical instrumentation extends well beyond its period of active scientific use, continuing to shape collective memory and inspire future generations through innovative forms of communication.

Keywords: Astronomical instruments, Reinfelder refractor, Trieste, scientific heritage, interactive exhibition.

References

Ashbrook, Joseph: Johann Krieger, lunar cartographer. In: *Sky & Telescope* **44** (1972), 3, p. 138–142.

Iafrate, Giulia: *Organizzazione, gestione e svolgimento visite per scuole e pubblico alla rinnovata Specola Margherita Hack nell'anno 2022.* INAF Technical Report: 268. INAF Repository 2023. http://hdl.handle.net/20.500.12386/33834.

Iafrate, Giulia & Federico Gasparo: *Progettazione e realizzazione del nuovo percorso storicodivulgativo multimediale della Specola Margherita Hack.* INAF Technical Report 235. INAF Repository 2023. http://hdl.handle.net/20.500.12386/33087.

König, Rudolf: *Johann Nepomuk Krieger's Mond-Atlas. Zweiter Band.* Vienna: Kaiserliche Akademie der Wissenschaften 1912.

Sheehan, William & Thomas Dobbins: *Epic Moon: A History of Lunar Exploration in the Age of the Telescope.* Richmond, VA: Willmann-Bell 2001.

Wolfschmidt, Gudrun: Die Bedeutung der Mädlerschen Mondkarten in der Entwicklung der Mondtopographie. In Deutsches Museum. In: *Wissenschaftliches Jahrbuch des Deutschen Museums.* München: Deutsches Museum (Abhandlungen und Berichte; N.F. 7) 1990, p. 132–154, 156–158.

Wolfschmidt, Gudrun: Historical Telescopes and Observatories in Europe. In: *Journal of Astronomical History and Heritage* **11** (2008), 2, p. 113–122.

2.11 *The former Observatorio Astronómico y Meteorológico del Estado de Jalisco and its Library: the Mutual Spread of Astronomical Knowledge between México and Europe, Towards the Recognition of Astronomical Heritage*

Durruty Jesús De Alba Martínez[1] &
Mónica Martínez Borrayo[2]

1 Instituto de Astronomía y Meteorología,
Centro Universitario de Ciencias Exactas e Ingenierías,
Universidad de Guadalajara, Mexico
2 Secretaría de Cultura, Gobierno del Estado de Jalisco;
Doctorado en Ciudad, Territorio y Sustentabilidad,
Universidad de Guadalajara, Mexico

durruty.dealba@academicos.udg.mx, dalba@astro.iam.udg.mx, monica.borrayo@jalisco.gob.mx

To find a postcard from Austrohungarian Empire in the archives of the *Instituto de Astronomía y Meteorología* (IAM) from the Universidad de Guadalajara (UdeG) tell us a brief story of the circulation of the astronomical knowledge between México and Europe that enriched with some books titles located now in the historical fund of the IAM library that was established on April 02, 1889 as the *Observatorio Astronómico y Meteorológico del Estado de Jalisco* that in October 12, 1925 become part of the new founded UdeG as their first unit mainly devoted to scientific research.

In this work are discussed the elements that permit us to consider the facilities, book collection, instruments and other elements of the IAM-UdeG as an integrated astronomical heritage site by the authorities of the Jalisco's State government, and this allow in the future to elevate the request of UNESCO recognition.

Keywords: Astronomical heritage, library collection, astronomical knowledge.

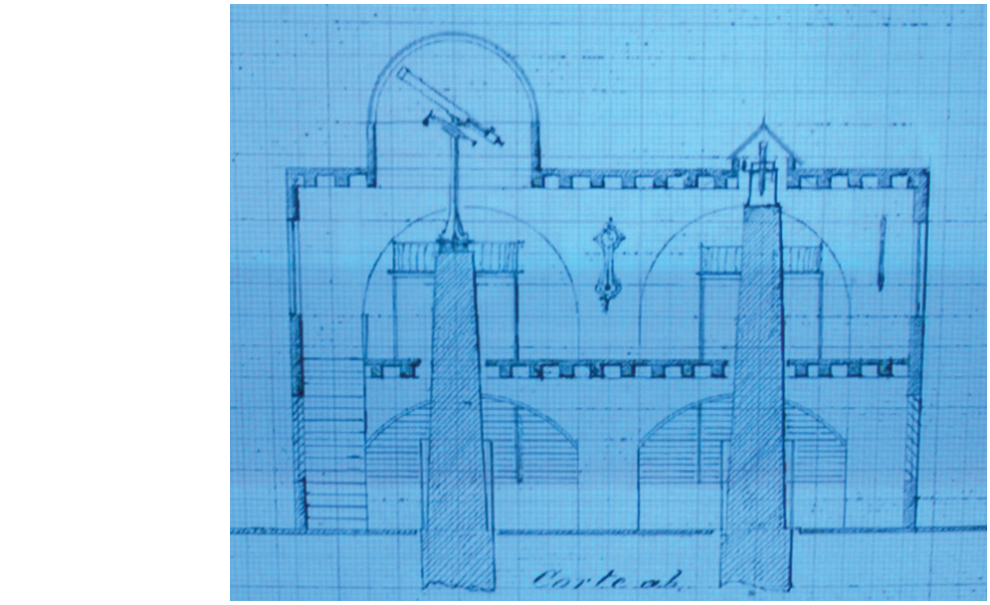

Figure 2.16:

Above: First location of the observatory (circa 1889) in the former Jesuit College of San Juan, then in use as *Escuela de Ingenieros de Guadalajara*
Below: *Observatorio Astronómico y Meteorológico del Estado de Jalisco* (circa 1894)

(credit: Ing. Gabriel Castaños, Archivo Histórico de la Universidad de Guadalajara)
(Archives of the *Instituto de Astronomía y Meteorología* (IAM)
from the Universidad de Guadalajara (UdeG))

Figure 2.17:

Letter from P. Julius Fenyi, S.J., Haynald Observatory (founded in 1878), Kalocsa, Hungary, to the Observatorio Astronomómico y Meteorológico del Estado de Jalisco by Observatorio Astronómico y Meteorológico del Estado de Jalisco

(Archives of the *Instituto de Astronomía y Meteorología* (IAM) from the Universidad de Guadalajara (UdeG))

Figure 3.1:
Hamburg Impressions: Elbphilharmonie, Landungsbrücken – Hamburg Port, Light Vessel

(Photos: Gudrun Wolfschmidt)

Appendix: General Information

3.1 Links

- Centre for History of Science and Technology
(https://www.fhsev.de/Wolfschmidt/GNT/home-wf.htm),
Hamburg Observatory, University of Hamburg
Bundesstrasse 55 Geomatikum, 20146 Hamburg
Homepage Gudrun Wolfschmidt (https://www.fhsev.de/Wolfschmidt/),
Organisation of Conferences – Wolfschmidt
(https://www.fhsev.de/Wolfschmidt/tagung.php)
- Hamburg Observatory in Bergedorf
(https://www.physik.uni-hamburg.de/en/hs.html),
Department of Physics, MIN-Faculty, University of Hamburg
Gojenbergsweg 112, 21029 Hamburg
- Förderverein Hamburger Sternwarte e.V. (FHS)
(https://www.fhsev.de/),
(Association for Promoting Hamburg Observatory) & Events 2025
(https://www.fhsev.de/fhs-v25.php)
- European Society for Astronomy in Culture (SEAC)
(https://www.archeoastronomy.org/)
- Gesellschaft für Archäoastronomie (Association for Archaeoastronomy)
(https://archaeoastronomie.org/)
- SEAC Astronomical Heritage Chat/Blog
(https://www.archeoastronomy.org/content/about-seac/glass-plates.html)
- Heritage Working Group (HER WG)
(https://www.coimbra-group.eu/working-group/heritage/)
- Working Group for the History of Astronomy in the Astronomical Society
(https://www.astronomische-gesellschaft.de/en/working-groups/history-of-astronomy?set_language=en. Cf. Astrophotography – From the Beginnings (1839) to CCD and Detectors
(https://www.fhsev.de/Wolfschmidt/events/akag-goerlitz-2025.php),
Colloquium of the Working Group History of Astronomy in the Astronomical Society, Görlitz, 19.–21. September 2025.
- Nuncius Hamburgensis – Beiträge zur Geschichte der Naturwissenschaften
(https://www.fhsev.de/Wolfschmidt/GNT/research/nuncius.php)

3.2 Museums and Collections in Hamburg University and in Hamburg

3.2.1 Museums and Collections in Hamburg University

- Museums and Collections of Hamburg University (https://www.uni-hamburg.de/en/museen-sammlungen.html)
- FUNDus! - Database / Research Portal of Hamburg University Collections (https://www.fundus.uni-hamburg.de/en)
- FUNDus! - Database / Research Portal of MIN Faculty: (https://www.fundus.uni-hamburg.de/en/divisions/min)
  - History of science and technology (https://www.fundus.uni-hamburg.de/en/collections/science_tec_history)
  - Hamburg Observatory (https://www.fundus.uni-hamburg.de/en/sub_divisions/astronomy)
  - Schmidt Museum of Hamburg Observatory (https://www.fundus.uni-hamburg.de/en/collections/schmidt_museum)
- Museums and Collections of Hamburg Observatory Scientific Instruments, Archive, and Schmidt Museum (https://www.fhsev.de/Wolfschmidt/events/Sammlungen_HS.php) (Sammlungen der Hamburger Sternwarte – Wissenschaftliche Instrumente, Archiv und Schmidt Museum)
- FUNDus! – Telescopes of Hamburg Observatory Library & Archives The Online Digital Archives of Hamburg Observatory: (https://fundus.uni-hamburg.de/de/collections/large_instruments)
  - Photographic Plate-Archive
  - Image Archive
  - Bernhard Schmidt Archive
- Collections of Scientific Instruments and Models – History of Science and Technology (https://www.fhsev.de/Wolfschmidt/events/Sammlungen_IGN.php) (Sammlungen von wissenschaftlichen Instrumenten und Modellen – Geschichte der Naturwissenschaft und Technik)
- Museum of Nature – Palaeontology and Geology of Hamburg University (https://hamburg.leibniz-lib.de/ausstellungen/museum-palaeontologie.html)
- Mineralogical Museum (https://hamburg.leibniz-lib.de/ausstellungen/museum-mineralogie.html)

- Förderverein Hamburger Sternwarte:
  - Exhibitions (`https://www.fhsev.de/Ausstellungen.php`), cf. Weltbild im Wandel – Von Copernicus bis zur modernen Kosmologie (Our changing World View – From Copernicus to Modern Cosmology) (`https://www.fhsev.de/Weltbild.php`)
  - Restoration (Restaurierung, Sanierung) (`https://www.fhsev.de/restaur.php`).

Figure 3.2:
Exhibition *Our changing World View* (Flammarion 1888), (© Maria Thrun, MK&G)
Melkeveien (Milky Way), Frida Hansen, Oslo (1898)
Creation, Hamburg Master Francke (fl. 1424–1434) (Photo: G. Wolfschmidt)

3.2.2 Museums in Hamburg

- Archaeological Museum Hamburg – Helms-Museum (`https://amh.de/`)

Museumsplatz 2, 21073 Hamburg-Harburg,
200,000 years of the region's history.
Tue – Sun 10:00 – 17:00 h.

- MARKK – Museum am Rothenbaum – World Cultures and Arts
(https://markk-hamburg.de/en/),
Rothenbaumchaussee 64, 20148 Hamburg,
Museum of Ethnology (1879), Africa, Asia, Oceania, the Americas and Europe,
especially Ancient Egypt; Inca Gallery.
Tue – Sun 10:00 – 18:00 h, Thursday 10 – 21 h.
- International Maritime Museum
(https://www.imm-hamburg.de/international/en/), Kaispeicher B, Koreastrasse 1, 20457 Hamburg,
Maritime treasures from 3000 years of shipping and naval history.
Mon – Sun 10:00 – 18:00 h.
- Museum für Kunst und Gewerbe Hamburg (MK&G)
(https://www.imm-hamburg.de/international/en/),
Museumsplatz 2, 21073 Hamburg
(Art and Crafts Museum) – Ancient Art and Antiquities
(https://www.mkg-hamburg.de/en/collection/ancient-art-and-antiquities),
'Mirror Canteen' (1969) by Verner Panton,
the Art Nouveau ensemble 'Pariser Saal' (1900).
Tue – Sun 10:00 – 18:00 h, Thursday 10 – 21 h.
- Kunsthalle (Art Gallery) Hamburg (1846)
(https://www.hamburger-kunsthalle.de/en),
Glockengießerwall 5, 20095 Hamburg.
Three buildings show art through eight centuries:
brick structure from 1869, neo-classical annex with dome from 1919,
and the modern white cube of the "Galerie der Gegenwart" (Gallery of the present)
by the architect Oswald Mathias Ungers (1997).
Tue – Sun 10:00 – 18:00 h, Thursday 10 – 21 h.
- Altona Museum in Hamburg
(https://www.shmh.de/en/altona-museum/),
Museumstr. 23, 22765 Hamburg-Altona.
Art and cultural history of the Elbe region from Schleswig Holstein
and the coastal area from the North Sea to the Baltic Sea.
Wednesday to Friday 10–17 h, Saturday and Sunday 10–18 h.
- Museum of Hamburg History (MHG, 1908)
(https://www.shmh.de/en/museum-of-hamburg-history/),
Holstenwall 24, 20355 Hamburg.
From piracy in Hamburg and its development into a modern Metropolis.
Temporarily closed due to modernisation.
- Museums & Exhibitions in Hamburg
(https://www.hamburg-travel.com/booking/tickets/museums-exhibitions/).

3.3 Public Transport (ÖPNV) and Deutschlandticket

3.3.1 Public Transport in Hamburg

- Public Transport in Hamburg (`https://www.hvv.de/en`)
  Connections / Departures: (`https://www.hvv.de/en/timetables/all-departures`)
- Public Transport in Hamburg during the SEAC 5 days and the excursion to Lübeck:
  (8 days – one day before and after the conference to the airport)
  $5 \times 7.80 + 32 = 71$ Euro – cf. Deutschlandticket 58.- Euro.
- Day Tickets for the Public Transport Hamburg (HVV) –
  (`https://www.hvv.de/en/tickets/single-day-tickets`)
  Day Ticket (Tageskarte) 7.80 Euro (1–2 Rings) A Single Ticket is already 3.90 Euro, so the Day Ticket is better. The Day Ticket (1–2 Rings) includes the travelling to the airport and the observatory.
  You can buy the tickets in ticket machines in metro stations or in the railway stations, but you get no tickets in buses (!).
- Maps for Public Transport in Hamburg (Metro / elevated train Hochbahn, S-Bahn, Buses, Ferry boats)
  (`https://www.hvv.de/en/plans`)

3.3.2 Deutschlandticket

- Deutschlandticket DB
  (`https://int.bahn.de/en/offers/regional/deutschland-ticket?dbkanal_007=teaserBlock_2-1_link_DeutschlandticketINT`)
  or here: Deutschlandticket HVV
  (`https://www.hvv-deutschlandticket.de/en/`)
  (58.- Euro for HVV in Hamburg during the whole conference and for the Excursion: local trains and the public transport in Lübeck.
- The Deutschlandticket is valid in whole Germany (!), when you want to visit more in Germany earlier in August.
- But you have to book the Deutschlandticket electronically already in July,
  and you have to cancel it by the 10th of August latest.
  Then it is valid the whole month of August.

3.3.3 Schleswig-Holstein Ticket

- Schleswig-Holstein Ticket (regional day ticket) for one day – 32.- Euro
  (`https://www.bahn.de/angebot/regio/laender-tickets/schleswig-holstein-ticket`, `https://www.nah.sh/en/tickets/sh-tariff-tickets/`),
  starting at 9 h – (including Hamburg and Lübeck public transportation, `https://www.fhsev.de/Wolfschmidt/events/pdf/HVV-ringe_a-h_Luebeck.pdf`)

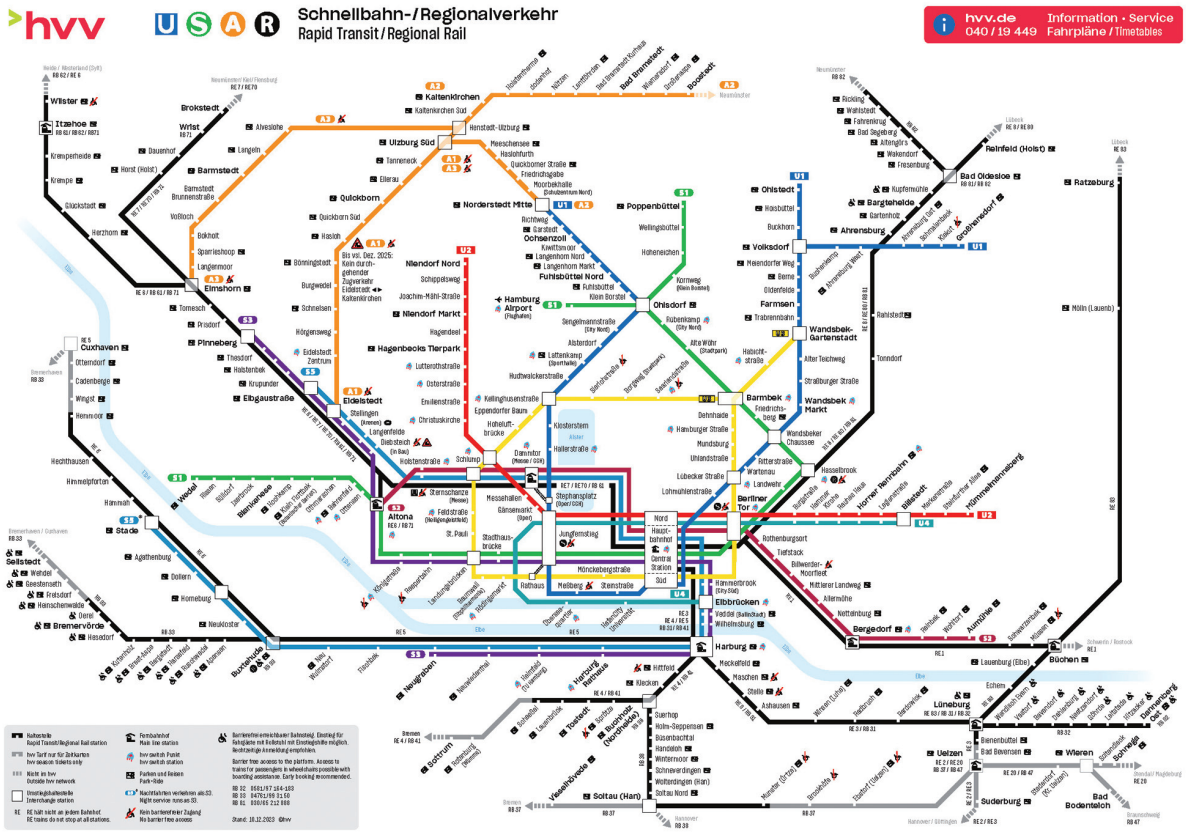

Figure 3.3:
Public Transport in Hamburg – HVV map

(`https://www.hvv.de/en`)

Workshop of the IAU Commission C.C4
"World Heritage & Astronomy" and
WG *"Windows to the Universe –
Classical and Modern Observartories"*

https://www.fhsev.de/Wolfschmidt/events/SEAC-HH-2025.php#C4