

# “LOOK UP!” A Virtual Exhibition about the Historical Astronomical Atlases

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*Abstract:* The new technologies are changing every aspect of our life, socially and workwise. In the same way, digital tools are becoming increasingly important to protect, preserve, and valorise cultural heritage. The digitalization of the archive's documents and ancient books, the realization of augmented reality apps for museums, or even the creation of virtual realities set in cultural or landscape environments that are protected or not open to visitors, are examples of the use of the new technology in the field of cultural heritage.

In this context, the projects “Cosmic Pages” and “Touch Sky” were developed. One of the main goals of these projects was the realization of the virtual exhibition “Look Up!”. It is an effective virtual tool aimed at enhancing and giving maximum dissemination of the collection of the star atlases, cometographies, and selenographies preserved in the Observatories of the Italian National Institute for Astrophysics. This virtual exhibit was conceived and realized allowing the visitors to discover, explore, and understand how our knowledge of the cosmos, the Moon, and the planets has evolved and changed with the time. Using the most advanced technologies, virtual reality, 3D models, videos, etc., visitors can explore the scientific and cultural contents of the star and cartographic atlases.

*Keywords:* Celestial atlas, Virtual Museum, Astronomical heritage, Virtual reality, Educational activities

## 1. Introduction

According to UNESCO, heritage is the value of “Cultural legacy which we receive from the past, which we live in the present and which we will pass on to future generations”<sup>1</sup> and includes the inheritance of tangible (books, buildings, landscapes, monuments) and intangible (folklore, knowledge, language, and traditions) assets of a group or society, and which must be protected, preserved, and valued, for future generations to be inspired.

The increasing advances in digital technologies are impressive and ever-growing, from 3D technology to artificial intelligence and virtual/augmented reality. The possibilities offered by all these tools can be used both to ensure preservation, and to capture the imagination of the youngest. Today, ideas like virtual museums or virtual exhibitions are eagerly adopted (practiced), fuelled by the idea that if visitors cannot get physically to the museum, the museum goes to visitors (Paolini *et al.* 2000). Especially during the Covid-19 pandemic, many institutions expanded their digital offers by creating virtual tours, and apps for smartphones, like MAUTO - the app of the *Museo dell'Automobile* of Turin<sup>2</sup> - or Depot - an augmented reality app of the *Boijmans Museum* in Rotterdam.<sup>3</sup> The National Institute for Astrophysics has also contributed with the creation of virtual tours of historical buildings, 3D models of the astronomical instruments preserved in the Italian Astronomical Observatories, operated by INAF, and virtual exhibitions. All these gimmicks allow virtual visitors, comfortably seated on their sofas, to

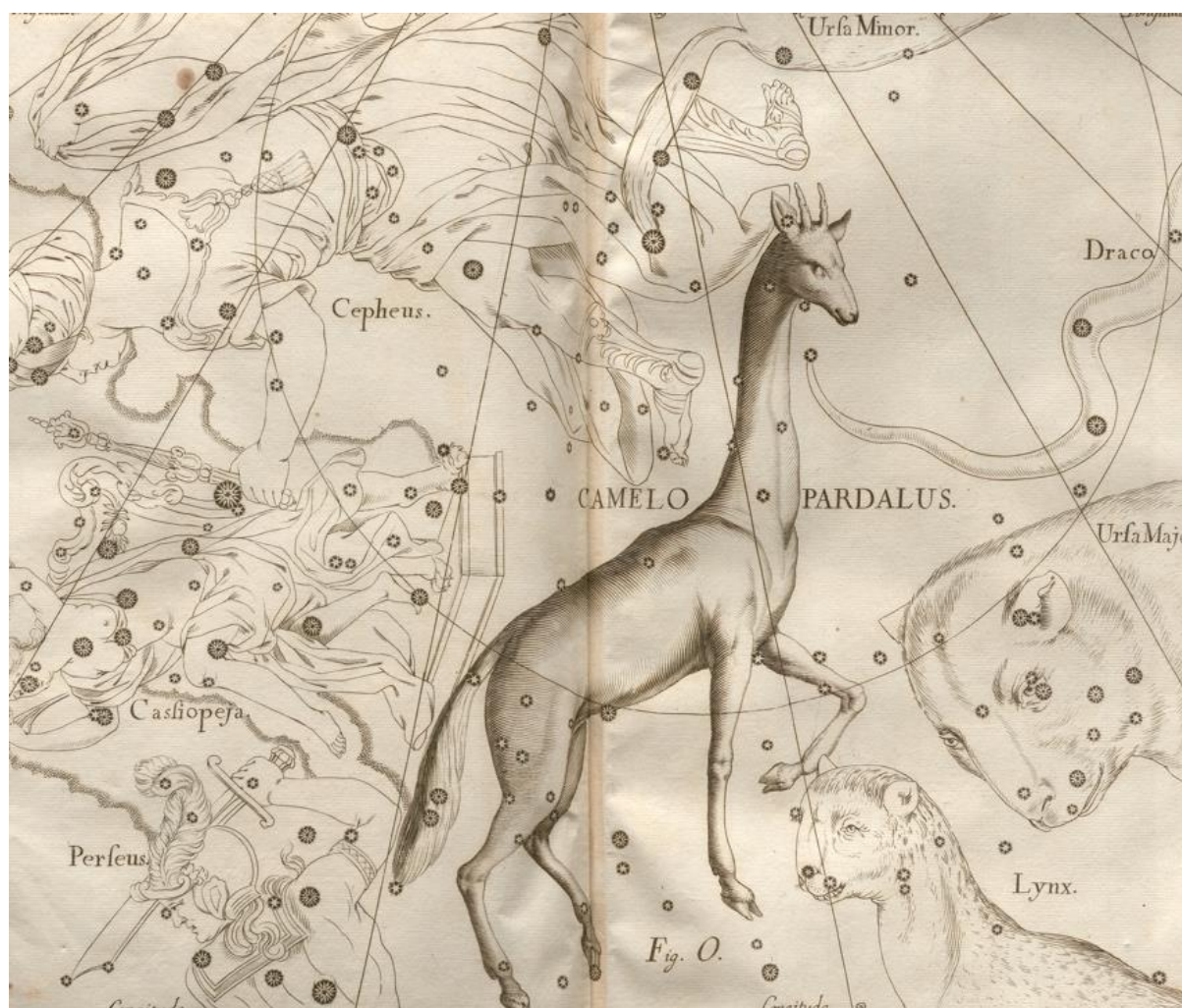
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<sup>1</sup> Definition of the Cultural and Natural Heritage, adopted by UNESCO on 16 November 1972

<sup>2</sup> <https://www.museoauto.com/app/>

<sup>3</sup> <https://www.boijmans.nl/en/depot/app>

follow the programming of the main cultural institutions. Furthermore, new technologies play a fundamental role in the protection, conservation, restoration, research, dissemination and promotion of tangible and intangible cultural assets, coming from all types of cultural institutions (museums, galleries, libraries, archives, monuments and sites). Using this approach, many of the rare books preserved in the Italian Astronomical Observatories were digitised and are now available in the *Teca digitale*<sup>4</sup> of the website *Polvere di stelle* (Fig.1). In this context, digital tools or virtual technologies cannot replace the real experience of visiting a museum or archaeological area, but they can increase knowledge and improve the promotion of cultural heritage.



**Fig. 1.** Constellation of the Giraffe. Detail from Johannes Hevelius, *Prodromus astronomiae* (1690), available on the INAF *Teca Digitale*. Courtesy “Santini” Library, INAF-OAPd.

## 2. The Celestial Atlases preserved in the INAF Observatories

Observing and interpreting the sky has always been one of man’s fundamental instincts. Recognizing the cyclical nature of time and astronomical events were actions of great importance, even practical, started by the Chaldeans and Babylonians and reached us. Fixing and rediscovering myths, heroes and fantastic figures on the celestial vault has characterised ancient cultures and traditions. Between the second half of the 16th century and the beginning of the 17th, illustrated scientific books spread

<sup>4</sup> <https://www.beniculturali.inaf.it/teca-digitale>

throughout Europe. Starting from 1609, moreover, astronomical observations were no longer conducted with the naked eye but utilising the telescope. The celestial world thus revealed a lot of details, illustrated with painstaking care in works of rare beauty, especially the Atlases, which merged art, mythology and science. Johann Bayer's *Uranometry* opens the so called "golden age" of the history of celestial cartography, thanks to the greater accuracy of the positions of the stars derived from the catalogues written by the best observers, such as Tycho Brahe, and to the spectacular aesthetic achieved in the representation of the figures of the constellations. With the development of astronomical technologies, atlases were enriched with stars, as evidenced by the marvellous works of Andreas Cellarius, Johannes Hevelius, Johann Gabriel Doppelmayr, John Flamsteed or Johann Elert Bode. Just the Bode's *Uranographia* (1801) marks the XIX century separation between atlases for professional astronomers and those for the wider audience of astronomy lovers. The great stellar surveys, carried out between the nineteenth and twentieth centuries, opened the way to the most complete stellar investigation realised nowadays with satellites and space telescopes. Through the atlases, therefore, you can follow the historical developments of astronomical science and technology and the advancement of man's knowledge about real constitution and true dimensions of the universe.

Together with research activities in different fields of astrophysics, and in astronomical technologies, INAF promotes projects to preserve and valorise its bibliographic, archival and instrumental heritage. The INAF observatories, the most ancient scientific institution in Italy, hold more than 7000 rare books, including 19 incunabula and 30 manuscripts. Moreover, the Italian observatories safeguard over 1200 astronomical instruments, dated from the 11th century to the first half of 1900, as well as INAF preserves over 3 million documents in its historical archives. Within the INAF cultural heritage the collection of celestial atlases plays an important role for the history of modern culture, due to their painstaking care, these volumes are works of uncommon beauty merging art, mythology and science.

### 3. The project

Within the INAF cultural heritage the collection of celestial atlases plays an important role for the history of modern culture. Atlases show the evolution of the human vision of the cosmos through the ages accurately. The timeline starts from the 1022 stars in the Ptolemy's *Almagest*, moves through the observations made at the beginning of telescope era, and arrives to the great stellar surveys realised in the last two centuries, which precede the most complete ones carried out today with satellites, such as Gaia and Kepler. To enhance and give maximum dissemination to this rich collection of celestial atlases, cometographies and selenographies preserved in the various INAF observatories, the projects "Cosmic Pages" and "Touch Sky" have been developed.

#### 3.1 Digitalization

INAF researchers, technologists and technicians with complementary skills participated in these two projects: astronomers, librarians, historians of astronomy, experts in scientific communication to carry out segments of activities and cultural events that reach different audiences of users.

First, we proceeded with the systematic cataloguing of all the celestial atlases preserved in the INAF libraries, identifying a particularly relevant nucleus of these volumes capable of providing a coherent vision of the development of scientific knowledge on the Universe, on the Moon and on bodies of the Solar system. Subsequently, with the help of a spin-off from the University of Bari, we digitized, using the most innovative data scanning and metadating techniques, the celestial atlases selected and preserved in the INAF libraries.

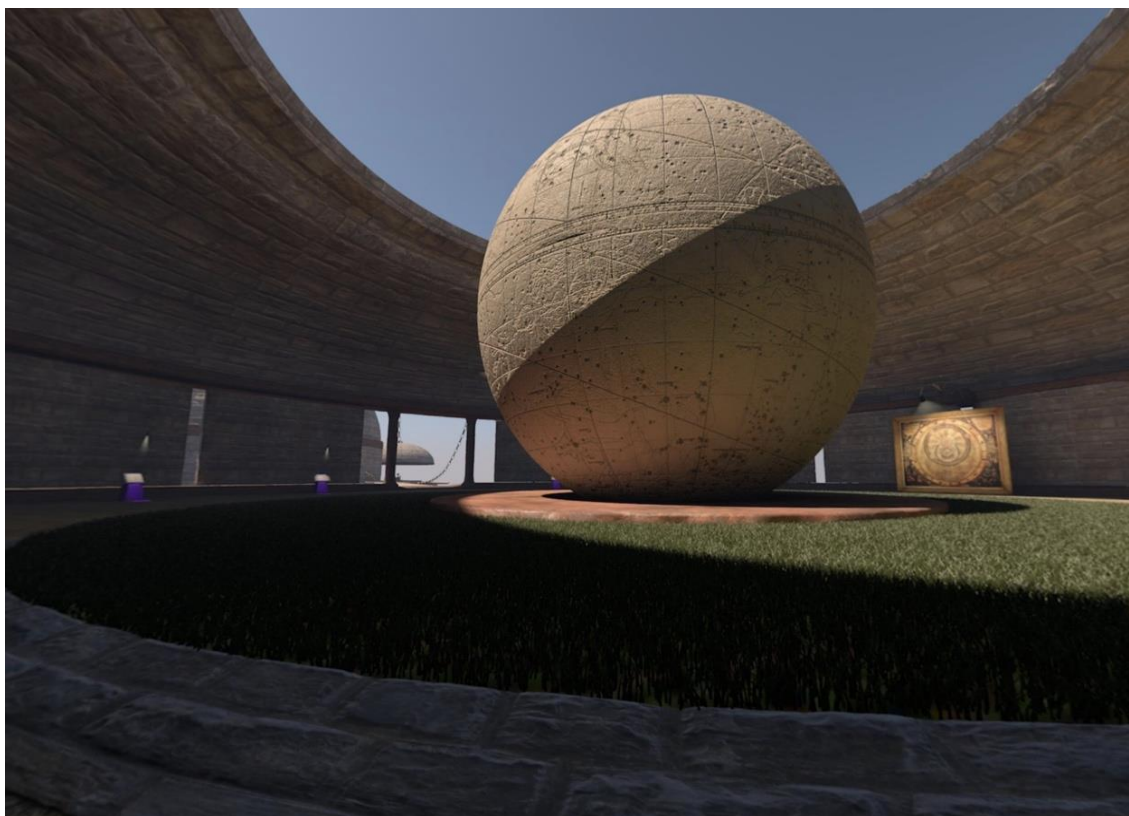
All digitalisations have been integrated into the INAF cultural heritage portal *Polvere di Stelle* for consultation. In this way anyone, in any part of the globe can study, read, analyse the various celestial atlases preserved in the INAF observatories.

### 3.2 The virtual exhibition “Look up!”

Experimenting with new technologies to communicate the value and importance of historical heritage means reaching a large audience and creating new educational opportunities. These are the bases for the virtual exhibition *Look up!* (Di Giacomo *et al.* 2022), which aims to show and give maximum dissemination to the rich collection of celestial atlases preserved in the various Italian astronomical observatories.

*Look up!* is a virtual exhibition, accessible from any device (PC, Tablet, Smartphone, Oculus), whose primary goals are to enhance, describe and give maximum dissemination of the entire collection of the stellar atlases, cometographies and selenographies preserved in the INAF Observatories. As described in the previous section, the collection of celestial atlases plays an important role in the history of modern culture and represents a real milestone in the scientific revolution. Indeed, rare star atlases, including cometographs and selenographs, such as those by Hevelius, Doppelmayr, Flamsteed and Bode, reveal a variety of details accurately showing the evolution of human vision of the cosmos through the ages.

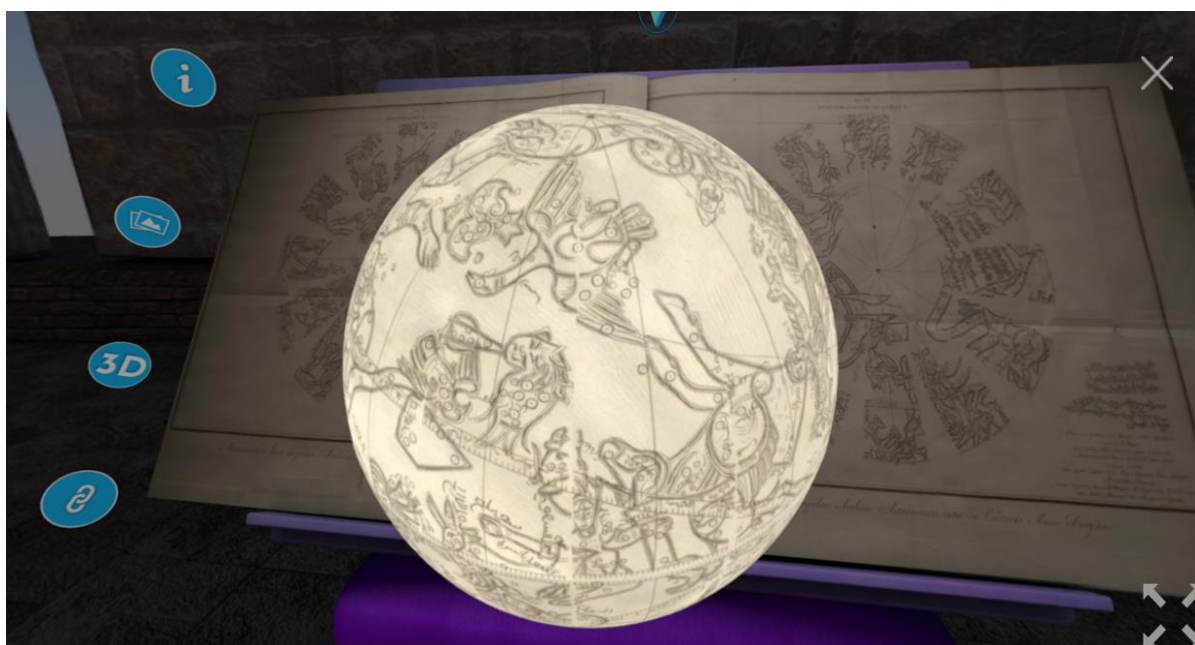
In the first phase of the work, we have realised a detailed storyboard containing both the description of the virtual environment (structure, characteristics, mobility, etc.) and all the interactions and content to be provided to users. The virtual environment, created and modelled ad hoc, is divided into three distinct rooms, each dedicated to one of the main themes of the exhibition: the stars, the Moon and the Solar system. All the rooms have a circular structure where the various atlases are arranged on appropriate lecterns along the walls, while in the centre there is a distinctive element of the room (a celestial globe for the star room, a moon for the related room and a modern representation of Mars for the room dedicated to the Solar system). Each room is self-consistent and connected to the others so that the user can freely choose whether to explore a single room or follow a path that takes him through each room (Fig. 2).



**Fig. 2.** The first room of the Virtual Museum *Look up!* where the visitors can explore the evolution of our knowledge of the sky.

Thanks to a series of hotspots the users can move around and approach the various atlas present in the exhibition. In addition, they can browse the different volumes and interact with them and obtain a series of information and contents related to the atlas under analysis, its characteristics and the cultural background in which it was created (Fig. 3). For this purpose, we have made a series of videos, infographics and 3D models regarding various celestial objects. For example, in Bayer's *Uranometria*, the users can observe and analyse the 3D model of the Tycho's Supernova remnant, the rest of a stellar explosion that occurred in 1572. In addition, thanks to a video, the users can have much more information about this object. In the same way we introduced many other models and videos in order to show, e.g., the Saturn Ring described by Huygens, or the lunar phases and the lunation phenomena presented by Hevelius in his *Selenography*, etc.

Finally, to guide users through the different rooms and describe the characteristics of the various atlases, we have created a virtual guide, named Lu. Lu's voice is that of the Italian actor and voice actor Luca Violini. Lu's main task is to guide users around the exhibition, suggesting how to interact with the various atlases on display and providing visitors with information and content about the objects.



**Fig. 3.** In the exhibition we have inserted different 3D models that show different astronomical objects like celestial globe, supernovae remnants, Moon, comets, etc.

### 3.3 The visual identity

In addition to working directly on the exhibition and creating the various video, audio, and 3D contents, we also have studied and created the graphic layout of the entire project.

First of all, we have realised a logo, containing the three basic elements of the exhibition: stars, moon and solar system. Then we have also chosen a colour code to identify the three different rooms and all the other graphic and visual elements inherent to the different environments (hotspots, lecterns, buttons, etc.). In this way the exhibition is easily recognisable, and the user can immediately identify its various sections. The colors chosen are part of a harmonic trio and are:

- a. Purple (#9300F4) for the room of stars.
- b. Green (#00F493) for the room of Moon.
- c. Orange (#F49300) for the room of Solar system.

All this information was then codified in a Visual Identity manual created and published on the project website.

### 3.4 The educational workshop

Using the contents conveyed within the exhibition, we have realised six educational workshops, two for each section of the exhibition (two workshops are regarding the stars and the constellations; two are dedicated to the Moon and lunar phases; finally, two are devoted to the planets, especially Mars). The main objective of these activities is to raise awareness of scientific development, even in areas of greater social fragility and early school leaving. Indeed, these activities have been developed in partnership with *Save the Children Italia* and were carried out in their 'Light Points'. Light Points are places developed to guarantee a future for children living in at-risk suburbs and most disadvantaged areas of cities through free education and support to educational communities.

These activities started in November 2023 and involved seven Light Points spread across the entire national territory (Turin, Milan - Quart Oggiaro, Marghera (Ve), Rome - Ponte di Nona, Naples - Sanità, Palermo - Zen, Catania). More than 300 children aged between 6 and 15 took part in the various activities (Fig. 4).

To evaluate both the degree of satisfaction and the level of learning of the various workshops proposed, all participants were given a simple survey, before and after the activity, with a few questions regarding the topic covered (Fig. 5). By analysing the data obtained from this analysis it was possible both to understand the level of knowledge of the participants and to improve some of the activities making them more engaging and efficient. In general, all the children found the activities extremely interesting and by comparing the pre-activity and post-activity questionnaires, an adequate understanding of the various concepts examined was seen.



**Fig. 4.** Some children during one of the educational workshops

So, the workshops aim to reach that segment of the school population that suffers from greater social fragility, promoting and supporting the individual's self-determination and self-expression, regardless of personal condition, gender, social status, or culture of belonging. In doing so, they use the cultural heritage of Italian astrophysics as a tool for growth and an opportunity to develop new skills and passions.

## La scatola delle fasi lunari

Cosa sono le fasi lunari?

QUANDO VEDIAMO LA MEZZA LUNA E LA LUNA PIENE

---

Noi vediamo sempre la stessa faccia della Luna?

No

Ogni quanto si ripetono le fasi lunari?

Circa 28 giorni

Circa 30 giorni

Ogni settimana

Perchè  
Ti sei divertito/a?

Sì

No

Perché?

PERCHÉ HO SCOPERTO DELLE COSE NUOVE È ERA BELLO ↓

Fig. 5. Example of the final test

### 3. Conclusion

The virtual exhibition “Look up!” represents an important tool for spreading scientific culture and enhancing the very rich historical heritage of the Italian Astronomical Observatories.

In addition to the virtual exhibition, a selection of the most significant atlases has also been collected in a catalogue entitled *Cosmic Pages: stellar atlases in Italian astronomical observatories* (Chinnici & Gargano 2022), published by Arte'm.

Finally, the two projects, “Touch Sky” and “Cosmic Pages”, gave rise to the documentary film *Touch sky carte mappe atlanti stellari*, edited by Davide Coero Borga and Marco Cantini; this is the first documentary film promoted and produced by the National Institute of Astrophysics which was broadcast on 11 July by Rai Cultura and is currently available on RaiPlay.

The main reason that prompted us to focus our attention on this particular type of bibliographic material lies in the fact that the exact representation of the sky is not a scientific enterprise that ended in the past: it marks contemporary research and also the near future. The valorisation and study of this extraordinary historical heritage constitutes a further important element for the knowledge of the numerous treasures which are conserved in Italian observatories and give an admirable sign of continuity towards the contemporary research of the most noble and sublime of sciences, which is astronomy.

Despite the formal closure of the two projects, we are still working on adding new contributions and translating the entire exhibition into other languages to be able to reach users in every part of the globe, helping to enhance and protect the past to make it available and usable for all present and future generations.

### **Acknowledgments**

Thanks to all the people who contributed and collaborated in the creation of the “Look up!” exhibition.

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