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Royal Astronomical Observatory of Madrid: science, history, and heritage

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Abstract

We present a newly published book on the Royal Astronomical Observatory of Madrid, which aims at providing an enjoyable but rigorous read on its history, science, and heritage. The book is available free of charge online, and a printed version is also available for purchase. The Royal Observatory, with its privileged location and its rich architectural and instrumental heritage, surprises its visitors and offers countless educational and outreach possibilities. We currently offer guided tours for schools and the general public, which welcome more than 8,000 visitors per year; we are currently also implementing visits focused on families with children. We also discuss the multidisciplinary educational possibilities offered by the Observatory (astronomy, history of art, physics, geography, etc.).

1 Introduction

Figure 1: Drawing by Isidro Velázquez showing a panorama of the Observatory around 1800.

In the centre of Madrid, next to the Retiro Park, hides one of the most beautiful and least known places in the capital. Located on a small hill close to the Puerta del Ángel Caído, at the end of the Cuesta de Moyano, the Royal Astronomical Observatory of Madrid is an institution with more than 200 years of history that has carried out scientific work uninterruptedly from the 18th century to the present day. It was originally founded as the first astronomical observatory with a scientific focus in Spain and formed part of an ambitious urban planning project by King Charles III that brought together zoology, botany, and astronomy, giving rise to an enlightened "axis of science".

Figure 2: The original plan of Charles III included a Natural History Museum (currently Prado Museum), Royal Botanical Gardens, and Royal Astronomical Observatory, forming an urban axis devoted to science.

The most iconic view of the Observatory is undoubtedly the south façade of the building designed by Juan de Villanueva at the end of the 18th century. At the top of the hill stands a majestic neoclassical portico with a delicate *tempietto* (or *tholos*) reminiscent of classical Antiquity. This building has become a symbol of the Observatory and has witnessed its history from its foundation in 1790 to the present day. The Observatory has played an essential role in the declaration of the Prado-Retiro axis as a Unesco World Heritage Site, and the image of the south façade of Villanueva's building has become the epitome of the scientific facet of this so-called *Paisaje de la Luz* (the "Landscape of Light") site.

2 Royal Astronomical Observatory of Madrid: science, history, and heritage

The main motivation of this talk is the recent publication of a book that aims to be an accessible guide to the history and heritage of the Observatory. The book follows the trajectory of the guided tours to the Observatory, which hosts a rich collection of buildings surrounded by a pleasant garden in the very centre of the city. We begin our tour in the building by Juan de Villanueva, one of the best examples of neoclassical architecture in Spain. Inside, a

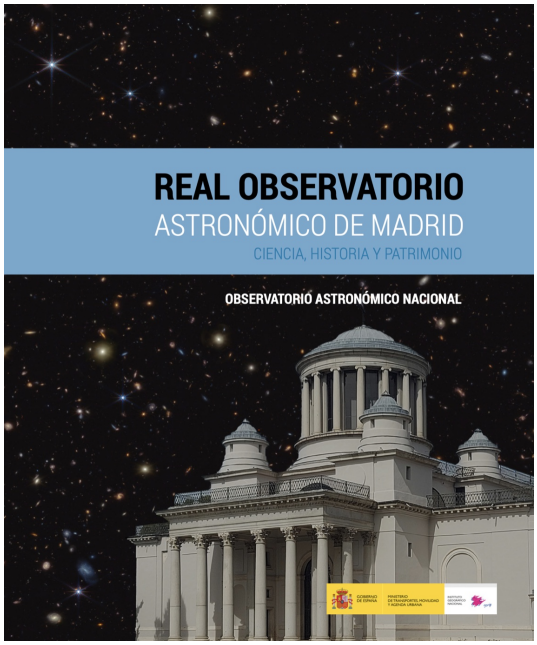

Figure 3: Cover of the book "Royal Astronomical Observatory of Madrid: Science, history, and heritage".

hypnotic Foucault pendulum, a splendid library and a rich collection of scientific instruments await us.

William Herschel built what was probably the best telescope in the world for our Observatory at the end of the 18th century. Built in 1796-98, this large telescope with a diameter of 61 centimetres and a focal length of 7.6 metres was destroyed in 1808 during the Napoleonic occupation. We will go back to the origins of this telescope and describe the replica, the only one of its kind in the world, which can be admired at the Observatory. The pavilion housing the replica of Herschel's telescope was designed by the prestigious architect Antonio Fernández Alba.

Lastly, inaugurated in 2010, the Museum of Earth Science and the Universe consists of a small display showing the public a rich collection of scientific instruments spanning from the 18th century to the present day. Far from being limited to astronomy, this exhibition emphasises the relationship between the various disciplines covered by the National Geographic Institute, such as geodesy, cartography and geophysics, and which, in one way or another, are related to the history of the Observatory. The Observatory became part of the Geographic Institute in 1904 and, as we show throughout the book, astronomy has played an important role in geodetic measurements, which are the basis for developing accurate maps. The museum building was also designed by Antonio Fernández Alba and includes a conference room in the basement.

The book was published in paper format with full-colour illustrations in early 2024, and is also available for free in PDF format here:

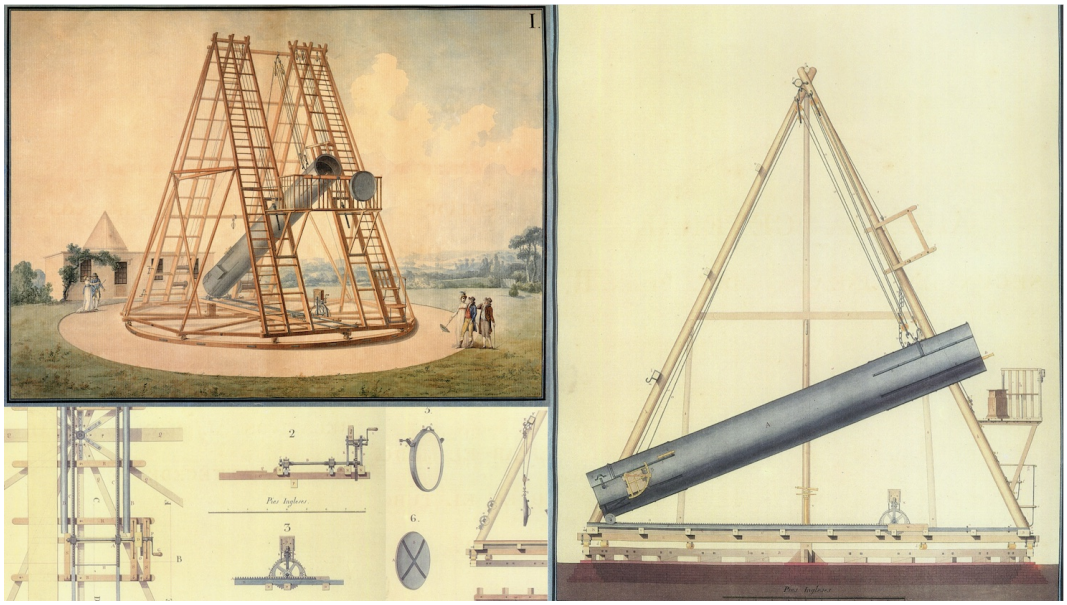

Figure 4: Drawings of the 25-foot Herschel telescope, which arrived in Madrid in 1802.

https://www.ign.es/web/resources/acercaDe/libDigPub/ROAM-ciencia-historia-patrimonio.pdf

3 Program of public visits

Guided tours of the Observatory are currently available to the public, as well as visits for schools. Our visitors get amazed by this true architectural and scientific jewel that evokes some of the highlights of the history of science in our country. As shown by Fig. 5, there has been a steady increase in the number of yearly visitors since 2011, except for a sharp decrease in 2020-2021 which is obviously related to the COVID-19 pandemic. In 2024, we expect to welcome around 7500 visitors.

The tours for general public are given by professional researchers from the National Geographic Institute. On the other hand, we have a program for schools that runs on Friday mornings, with visits which are free of charge for school groups thanks to a cooperation program signed with the association CEATE, "Confederación española de aulas de tercera edad". These tours, given mostly by retired engineers, fosters bridges between different generations.

4 The Observatory as a didactic resource: a transversal approach

The Royal Observatory recently hosted a course for high-school teachers aimed to raise awareness of the large didactic potential of this institution in the context of the Unesco World

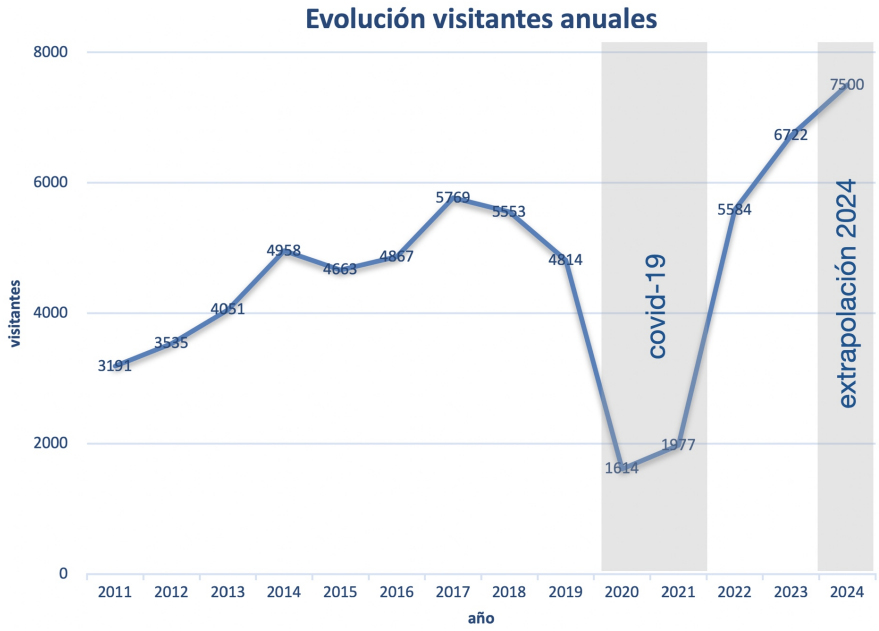

Figure 5: Statistics of number of visitors attending the guided tours to the Royal Astronomical Observatory of Madrid.

Heritage Site, the "Landscape of Light". Through a dedicated tour and a 90-minute presentation, we discussed the opportunites that the Observatory offers for schools, both in the context of visits or classroom work.

The most obvious angle that the Observatory offers is science and, particularly, astronomy. The visit to the Observatory can be understood as an approach to the history of the telescope (from Herschel's small telescopes, similar to the one he used to discover Uranus, all the way to 20th century telescopes and modern radio telescopes). This also offers the opportunity to discuss optics and astrophysical discoveries. The Foucault pendulum is a fantastic tool to discuss the rotation of the earth and basic physics.

The Observatory is one of the most interesting examples of Spanish neoclassical architecture, and it was declared by the government as a *Bien de Interés Cultural* (Asset of Cultural Interest). As such, this allows for a transversal approach combining Spanish history (the origins of the Observatory being closely attached to Charles III) and history of art. The Villanueva building can be compared to the Italian Renaissance villa (such as Palladio's Rotonda) and was partially inspired by Vesta's temple in Tivoli.

Being part of the Geographical Institute, our Observatory hosts one of the most interesting collections of geodetic and cartographic instruments in Spain. This includes the famous Ibáñez de Ibero's ruler, used to measure the fundamental base of Spanish cartography in 1858. Ruler, tripods and sheds were moved 3,665 times to cover the total length of the survey, which would be crucial for carrying out a proper topographic map of the entire

country.

Last but not least, literature also finds its space in the visit to the Observatory, with our magnificent library and connections with some classical novels, such as Benito Pérez Galdós's "El Doctor Centeno". In that novel, the Observatory appears several times, and we are told about the meridian measurement that used to take place every day in order to determine the exact time of midday, and its connection with the Puerta del Sol clock.

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