

# Transformative Interactive Experience at Specola Margherita Hack for Enhanced Public Engagement in Astronomy

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**Abstract.** The Specola Margherita Hack merges cutting-edge technology with historical insight to revolutionize astronomical education and public engagement. The ground floor features an interactive, multilingual multimedia exhibit that not only chronicles the Astronomical Observatory's extensive history but also integrates immersive technologies such as a 3D-projection of the Reinfelder telescope and interactive touchscreens for digital exploration. Upstairs, a state-of-the-art 60 cm reflecting telescope provides visitors with direct, unmediated views of the cosmos, complemented by a dome-integrated projection system for interactive celestial simulations. These enhancements have significantly increased visitor engagement, establishing the observatory as a premier destination for immersive educational experiences in astronomy.

## Introduction

The Specola Margherita Hack, named in honor of the renowned Italian astrophysicist Margherita Hack, has undergone a transformative renovation to celebrate the centenary of her birth in 2022. This observatory, situated in Trieste, Italy, now stands as a beacon of public outreach and education in the field of astronomy, utilizing augmented reality (AR) and other cutting-edge technologies to provide an unparalleled educational experience.[1]

## Enhancing Historical Understanding through Interactive Exhibits

On the ground floor, visitors encounter a newly designed historical-informative multimedia exhibition. This exhibit traces the history and scientific achievements of the Astronomical Observatory of Trieste from its inception at the nautical academy in 1753 to the present day. The exhibition's contents are accessible in four languages: Italian, English, Slovenian, and German, making it inclusive and accessible to a diverse audience.[1-2]

A key feature of the exhibition is a virtual 3D model of the historical Reinfelder telescope, one of the most significant scientific instruments from the late 19th century. This model is projected onto a central base in the room, providing a tangible connection to the past through modern technology. Additionally, volumes of high historical and scientific value have been digitized and are available for consultation via interactive touchscreens, allowing visitors to delve deeper into the observatory's rich history.

## Integrating Modern Technology for Advanced Astronomical Observation

The first floor houses the observatory's new state-of-the-art 60 cm reflecting telescope, meticulously optimized by Marcon of San Donà di Piave to provide unparalleled direct observations of celestial bodies. This telescope is complemented by two smaller refracting telescopes designed for wide-field vision and solar observations. The third telescope is a Coronado HELIOS 1, fixed in parallel to the main telescope. It is an achromatic refractor of 70mm diameter and 400mm focal length for detailed observations of the Sun, including its spots and other solar phenomena.

The integration of a high-definition projector and a specially designed diverging lens transforms the internal surface of the dome into a large spherical screen. This system, supported by a high-

quality computer and audio setup, enables the projection of motion pictures, digital sky maps, educational videos, and live broadcasts of scientific events. Such capabilities allow for continuous engagement, even during inclement weather when direct observation is not possible.

### **Interactive and Immersive Learning**

The Specola Margherita Hack's approach to public engagement is deeply rooted in the principles of interactive and immersive learning. The use of AR technologies facilitates a deeper understanding of astronomical phenomena by allowing visitors to explore the cosmos from perspectives that were previously unimaginable. For instance, the 3D-projection of the Reinfelder telescope not only showcases the instrument itself but also immerses the visitor in the historical context of its use, bridging the gap between past and present.[3]

The observatory's educational programs are designed to cater to audiences of all ages, from school children to amateur astronomers and the general public. By incorporating interactive touchscreens, visitors can engage with digitized historical documents and scientific data, fostering a hands-on learning environment. The dome's projection system further enhances this experience by providing dynamic and visually compelling presentations of celestial events and phenomena.

### **Achievements and Future Prospects**

The Specola Margherita Hack exemplifies the successful integration of modern technology with traditional educational methods to enhance public engagement in astronomy. Since the renovation, the observatory has seen a significant increase in visitor numbers, with approximately 4,000 people per year engaging in its programs. [1] The use of immersive technologies has not only made learning more engaging but also more accessible, allowing individuals of all ages and backgrounds to develop a deeper appreciation for the universe.

In particular, the implementation of 3D projections and AR has enriched the educational content, making it possible for visitors to virtually interact with historical instruments and documents. These technologies have proven effective in making complex astronomical concepts more comprehensible and engaging for a non-specialist audience.

### **Conclusion**

The Specola Margherita Hack stands as a testament to the transformative power of modern technology in the field of astronomical education and public outreach. By merging historical insights with advanced technological tools, the observatory offers a unique and engaging educational experience that fosters a deeper understanding of the cosmos. As we continue to explore the potential of AR and other immersive technologies, the lessons learned from the Specola Margherita Hack will undoubtedly inform future initiatives in planetary sciences outreach, helping to inspire the next generation of astronomers and space enthusiasts.

### **References**

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