

The first planetarium in an astronomy department in Turkey

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Keywords

Public Outreach, Astronomy Education, Training, Science Communication

Among many planetariums in Turkey, Istanbul University hosts the first planetarium in an astronomy department run by professional astronomers and graduate and undergraduate astronomy students. In this work, we present the design and some technical aspects of the planetarium, as well as our experiences since its opening in 2018.

A brief history of Turkey's planetariums

The first planetarium in Turkey was established in the Naval Academy in Istanbul in the 1980s and was used for training naval students to navigate in the open ocean using the stars.

In contrast, undergraduate astronomy students from Istanbul University have been

brought to the Naval Academy Planetarium in Tuzla to obtain experience with artificial sky projection.

Since then, several planetariums have been established in Turkey. Today, fixed, installed planetariums are mostly found in science centres, schools, and museums throughout the country. Interestingly, most of the largest planetariums in Turkey are not in Istanbul but rather in cities such as Eskişehir,

Gaziantep, İzmir, Konya, Kayseri, and Denizli with 14-metre dome diameters and approximately 100 seats each.

Mobile planetariums are also popular as they are very flexible. Public outreach events such as science festivals, telescope viewing events, open nights, and star parties are suitable for portable planetariums. Even though their image quality is not as sharp as fixed planetariums, it is possible to bring a celestial cinema to many schools in rural areas and places without significant infrastructure.



Figure 1: The Department of Astronomy and Space Sciences complex at Istanbul University. The historical and modern domes for telescopes and the planetarium (marked with a red arrow) are noticeable. Image Credit: Istanbul University

Common issues with planetarium operations in Turkey

Since 2000, the number of planetariums in Turkey has increased over 30. Istanbul has the most planetariums (9) in the country (Kartal, 2019). In the left and right-hand panels of Figure 2, respectively, we show the distributions for planetariums established by year and the number of planetariums in various cities in Turkey.

According to the Turkish Astronomical Society (TAD), the main issue with planetarium operations is human resources. People working in planetariums who are in direct contact with the public do not necessarily have an astronomy and space sciences background. However, we believe that in order to have effective outreach, improve the Turkish general public's general knowledge of astronomy, and combat misinformation, training in astronomy is essential for the planetarians.

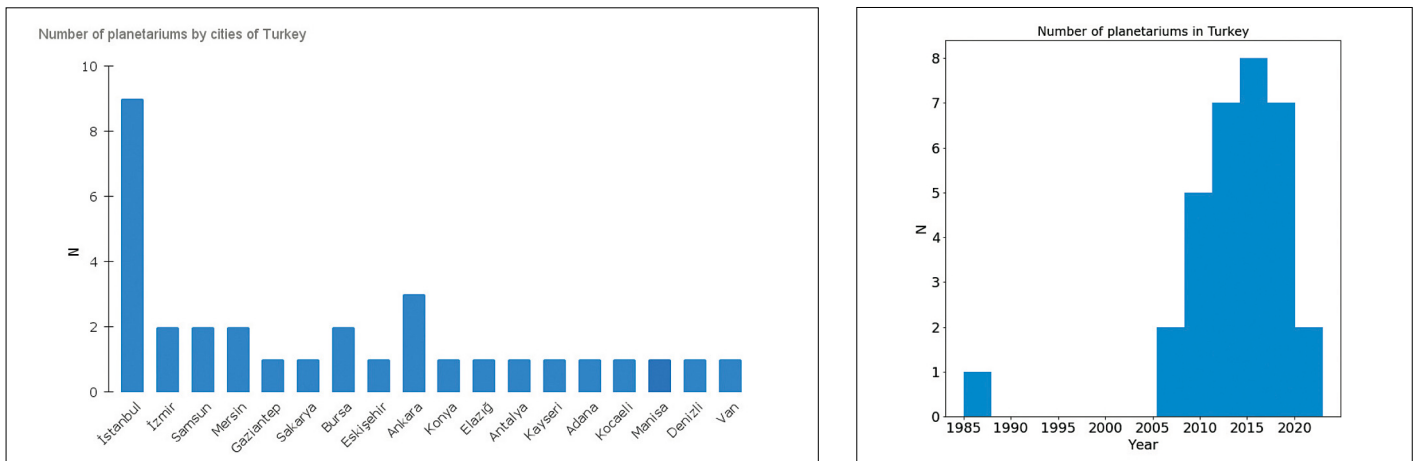


Figure 2: Left: The number of planetariums in Turkish cities. Right: The distribution of Turkish planetariums as a function of when they were established. The oldest planetarium is the Tuzla Naval Academy Planetarium.

For this reason, professional astronomers, especially the heads of astronomy departments and the Turkish Astronomical Society, have been trying to convince the administrations of science centres and museums to employ astronomy graduates.

In the past, establishing a planetarium in Turkey was a significant endeavour. However, today, infrastructure such as domes, seats, projectors, computers and sound systems are affordable for many institutions in Turkey. However, there remains a major issue: producing quality planetarium shows. Thanks to the European Southern Observatory, we can access pre-made and license-free shows¹. However, relying purely on these free sources is not sustainable for most planetariums. Usually, annual fees for planetarium shows are beyond the annual budgets of museums and science centres. Annual budgets are largely driven by entrance fees, which institutions attempt to keep relatively low to introduce astronomy to as much of the general public as possible. Some planetariums operate on an appointment basis and do not request any payment.

The managing team of the Istanbul University Astronomy and Space Sciences Planetarium translated shows provided by ESO and narrated them. Turkish translations and narrated versions of *From Earth to the Universe*, *The Hot and Energetic Universe*, and *Journey to the Center of the Milky Way* were made available to the planetarium community².

Planetarium in an astronomy institution

For a long time, astronomers at Istanbul University struggled to find funding for a planetarium. In that period, a historical Ottoman bath was considered a suitable location for a planetarium, but ultimately not realised. In 2013, Istanbul University decided to rebuild many of the old and unsafe buildings of the astronomy department. The department's administration seized this opportunity to

convince the university administration and architects to include a place for a planetarium (see Figure 1).

The new building has a 7-metre dome for a planetarium and was constructed to host 39 audience members (Figure 3). It took over four years to accrue the necessary funds to furnish the planetarium with the main projection and operation systems. The Elginkan Foundation agreed to donate some of the missing systems for the planetarium, but we were forced to



Figure 3: View of the planetarium from the operation desk. Image Credit: Istanbul University



Figure 4: A close-up view of projectors and planetarium seats. Image Credit: Istanbul University

accommodate a more affordable and sustainable solution.

The planetarium architect devised a plan to use multi-projectors based on image mapping techniques. The projectors used for this purpose are much more affordable than common brands' special planetarium projectors. To reach a 4K resolution with the merged image on the full dome, we needed to incorporate 10 projectors. We employ a powerful computer to combine the images transferred via HDMI cables and efficient video mapping software to create the 4K dome image. This was the first planetarium in Turkey with 4K resolution and located within an astronomy institution (Saygac & Alis, 2018). Figure 4 shows three of the projectors and their placement in the dome.

Istanbul University Planetarium³ started its operations in February 2018. By 2020, the planetarium has completed nearly 1500 shows with a total attendance of more than



Figure 5: A scene from the show *From Earth to the Universe* during a screening. Image Credit: Istanbul University

23000 people. These shows were organised by a team of undergraduate and graduate students with close supervision by a faculty member of the astronomy department. For each visit, we introduce the department's history as it is the first astronomy department in Turkey, established in 1933. The audience then visits the historical telescope, as well as the small museum of astronomical equipment that had been used in the department throughout its lifetime. Finally, a typical visit (Figure 5) ends with the planetarium show.

Due to Covid- 19, visits were suspended in March 2020. We are still in the recovery period after the pandemic, with an increasing number of visits.

Planetariums have a wide range of uses and are not limited to public outreach events. At Istanbul University, the planetarium is used in many courses of the curriculum of the astronomy programme, including lectures on spherical astronomy and celestial mechanics. The planetarium has additionally been used for teacher training events at the astronomy department. Under a special protocol, Istanbul University cooperates with the Directorate of National Education, which is the local authority of the Ministry of Education in the city of Istanbul. Teachers selected mainly from the branches of physics, science, and geography are trained for a 12-week program by the faculty members of the department.

Conclusions

Planetariums are crucial for the communication of science, impacting the public's perception of space and instilling a deep understanding of topics in astronomy and other STEM topics that are difficult to visualise. However, the cost of establishing the planetarium and maintaining its operations makes it a challenging investment. From our experience, the major expenses of the planetarium after its establishment are planetarium shows. Particularly, high-quality shows with a well-defined plot and high image quality can be prohibitively expensive.

Planetarians should follow special training for public outreach besides a comprehensive astronomy curriculum. In this regard, a planetarium in the astronomy department of Istanbul University is unique in Turkey,

where the planetarians are professional astronomers and astronomy students.

Installing planetariums with multiple projectors is more affordable than many well-known brands' most common projector systems. However, attention should be paid to the selection of projectors. We should emphasise that not all projectors are suitable for use in planetariums. The most important factor here is the black levels of projectors.

The Istanbul University Planetarium is unique in its design and application of the projection system, in addition to its operational distinction. The experience gained with this planetarium led to the establishment of a larger planetarium in the Karsiyaka district of Izmir, with a dome radius of 14 metres and a capacity of nearly 100 people.

Acknowledgements

The authors are grateful to the public outreach team at the Department of Astronomy and Space Sciences of Istanbul University and acknowledge the strong support of the Department Head, Professor Dr Tansel Ak, and the university administration. The Planetarium in the Astronomy Department at Istanbul University was established with the generous donation of the Elginkan Foundation.

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Notes

- ¹ European Southern Observatory pre-made and license-free shows are available at: <https://supernova.eso.org/for-planetariums/>
- ² Turkish translations of the titles listed above can be found at: <https://www.eso.org/public/videos/archive/category/fulldome/>. For more planetarium shows in Turkish, see this website: <https://astronomi.istanbul.edu.tr/bilimtoplum/gosteri.html>
- ³ For more information on the Istanbul University Planetarium, visit this website: <https://astronomi.istanbul.edu.tr/bilimtoplum/index.html>

Biographies

Sinan Alis is an assistant professor at the Department of Astronomy and Space Sciences of Istanbul University. His main research field is extragalactic astronomy, but he also extensively conducts and coordinates public outreach events, teacher trainings, and astronomy and astrophysics olympiads for high-school students. Sinan is also the IAU National Outreach Coordinator for Turkey.

A. Talat Saygac is a professor at Istanbul University who studies cataclysmic variables and novae. He is also the co-author of a popular astronomy book in Turkey, *Gökyüzünü Tanıyalım* (or, in English, "Get to Know the Sky").

F. Korhan Yelkenci is an astronomer at Istanbul University working on galaxy evolution. He is an expert on spectroscopic observations and reductions and contributes to several follow-up programmes. In addition, he gives speeches at public outreach events, as well as teacher and high-school trainings in different cities across Turkey.