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Our Work at Kharkiv Planetarium named after Yu. O. Gagarin

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1. Introduction

The world's first planetarium opened in Germany a century ago. The starry sky optically created on a dome-shaped screen not only fascinated people but also provided amazing learning opportunities. It was a harbinger of a new era. Interest in planetariums has since spread globally. Today there are over 4,000 planetariums in the world, and ever-advanced optical mechanisms are being developed to simulate the night sky. Planetariums today make full use of computer and digital technologies to reproduce the beauty of starlit skies. Japan is one of the countries providing original projectors, programs, and educational materials to planetariums around the world. Not all planetariums in the world, however, are fully functioning. In February 2022, the Russian Federation launched a war against Ukraine, a sovereign state in Europe.

2. Planetariums in Ukraine

Ukraine has planetariums in the seven cities of Kyiv, Kharkiv (Kharkiv Planetarium named after Yu. O. Gagarin), Dnipro (Planetarium Noosphere), Donetsk, Kherson (Kherson Planetarium named after Yu. O. Gagarin), Vinnytsia, and Odesa.

Each of these planetariums is equipped with a star hall, exhibition space, and observatory. Ukraine has smaller planetariums also in Uzhhorod, Uman, Mykolaiv, Zaporizhia, and Kremenchuk, where shows are presented to smaller audiences (see map at the end of the text, added by *JPA editorial board*).

3. Outline of Kharkiv Planetarium named after Yu. O. Gagarin

Kharkiv Planetarium named after Yu. O. Gagarin opened on April 21, 1957. It is housed in a four-story building. It has a generously-sized Star Hall for projecting stars and planets, with a dome measuring 13.5 m in diameter and a seating capacity of 160. The hall consists of two seating areas, one on each side of the projector. All seats face in the same direction. The floor is level for the front five rows, but stepped for the rear five rows for a better view of the shows. The planetarium is situated on the third floor of the building, and the observatory equipped with telescopes is on the fourth floor. Until 2022, the planetarium received as many as 100,000 visitors annually (Photo 1).

Photo 1. Exterior view of Kharkiv Planetarium named after Yu. O. Gagarin.

It was not by chance that the Kharkiv Planetarium opened the same year as the dawning of the age of human space exploration. Instrumental in the Kharkiv Planetarium's founding was Kharkiv-born astronomer and honorary doctor Nikolai Pavlovich Barabashov[1]

*JPA (Japan Planetarium Association) website: https://planetarium.jp/


Photo 2 (left). Young visitors pictured in front of exhibits about ancient Egypt.
Photo 3 (center). The center of the museum, with a display of a model of Space Shuttle Columbia,[2] manned by a crew including Leonid Kadenyuk, the first astronaut from independent Ukraine. Next to it is a display on Yuri Gagarin, who made humankind's first successful journey into outer space.
Photo 4 (right). Lecturer Olena Zemliachenko (the author) offering commentary to a group of children about the real lunar rover wheel on display.

and his wide network in the international scientific community. Barabashov formed a school of planetarium studies, and several years later established the physical properties of the lunar surface through his research. A real sense of anticipation for an amazing era of unprecedented scientific and technological breakthroughs in human space exploration was shared widely by scientists of the day.

4. Kharkiv, a city of space science

Kharkiv has long been a city of science and cutting-edge technology. V. N. Karazin Kharkiv National University[3] was founded in Kharkiv in the 19th century. A university of major global importance, Kharkiv University today ranks among the best in Europe.

Kharkiv can be rightly called a city of space science. In the mid-20th century, the city was home to thirty space businesses employing nearly 120,000 specialists. Kharkiv businesses today continue to play a vital role in Ukraine's space industry, most notably in the production of rocket and spacecraft control systems.

Kharkiv Oblast has so far given the world twenty-two cosmonauts. One was Alexei Leonov, who received fighter pilot and academic training at the oblast school for air force pilots before becoming the first human to conduct a spacewalk. Six of the twenty-two cosmonauts were born in or near Kharkiv City. Kharkiv City-native Valentin Bondarenko was unfortunately among the space explorers who lost their lives. A member of the first group of cosmonaut trainees, Bondarenko died in a fire during training in an isolation chamber on March 23, 1961. The accident occurred just three weeks before Yuri Gagarin set off on his journey to become the first human to reach outer space.

5. The Space Museum, a highlight of Kharkiv Planetarium

The first floor of Kharkiv Planetarium is devoted to the Museum of Cosmonautics. Exhibits here show how cosmic events have captured the human imagination throughout history, from ancient to contemporary times. Subjects covered include ancient myths from around the world pertaining to the celestial and earthly realms; space symbolism represented in ancient monuments and ornaments; the beginnings of

scientific and philosophical thinking traceable as far back as ancient Greece; early telescopes; pictorial representations of the world as perceived by contemporaries of Copernicus and Galileo; exploration of outer space with the first artificial satellite and Yuri Gagarin's space flight; explorations of the moon by Apollo spacecrafts; international space cooperation; and the construction of the International Space Station in orbit around the Earth. Objects on display include planetary models of Mars, the moon, and Earth; models and photographs of various types of rockets, artificial satellites, space stations, and telescopes; figurines of cosmonauts; and a large number of rare objects, medals, postage stamps, and cosmonaut autographs gifted by Baikonur Cosmodrome. Also on display is a real Soviet robotic lunar rover wheel, which, like all others of its type, was manufactured in Kharkiv (Photos 2, 3, and 4).

6. Star Hall, the heart of every planetarium

Planetariums play very important roles in the dissemination of knowledge about astronomy, earth science, and outer space. Planetariums can host space education classes, astronomy club activities, art exhibitions, and concerts, and celebrate landmark events in the history of human space exploration[4] as well as provide opportunities for members of the public to meet astronauts, amateur astronomers, and scientists. Planetariums today perform a myriad of tasks, the foremost of which is the presentation of shows at the star hall.

Since opening to the public, the projection system at Kharkiv Planetarium has gone through two updates. A fairly simple system was used initially. In 1975 this was replaced by a Zeiss Spacemaster RFP or "Middle Zeiss" projector (Photo 5). Although well-used over many years, this machine still delivers projections that are astonishingly realistic and immersive.

Photo 5 (left). The "Middle Zeiss" planetarium projector currently installed at the Star Hall.
Photo 6 (top right). Projection of a fulldome image with a cityscape of Kharkiv on the horizon.
Photo 7 (bottom right). "Jazz Under the Stars," a live music concert held at the Star Hall.

Since 2014, the planetarium has been using eight projectors to deliver fulldome shows (Photo 6). Especially popular with visitors are the 4K resolution shows. Prior to this, our shows were flatscreen projections employing a single projector. The introduction of the state-of-the-art system was driven by our desire to deliver fascinating content to visitors by embracing the unstoppable advancement of digital technology. The control system currently in use was developed by a Kharkiv programmer. Because the Kharkiv Planetarium has been operated without financial support from the city or state throughout its existence, it cannot afford the luxury of purchasing ready-made fulldome systems. The programmer who developed our system not only provides fixes and improvements on an ongoing basis but also supports Ukraine's other planetariums in building projection systems to meet individual dome diameter and budget requirements. This projection program can be operated via a dedicated smartphone app.

Kharkiv Planetarium presents planetarium shows from a wide range of producers. Some are foreign productions, which need translation into Ukrainian and sometimes also need adjusting to our dome specifications before presentation to audiences. Staff at the Donetsk Planetarium create planetarium content not just for Ukrainian audiences but also for export to planetariums worldwide. I was delighted to come across their shows in Japan, and felt extremely proud as a fellow Ukrainian. Ukraine also has Dnipro- and Kyiv-based groups of amateur planetarium content producers. No less hands-on is our planetarium in Kharkiv, where employees, including myself, would translate text into Ukrainian, provide commentary dubbing, and produce soundtracks combining speech and music. The selection of videos for presentation is also done in-house. Whenever required by show subjects, we use, in addition to fulldome content, flatscreen videos projected onto the center front of the dome.

Shows cover a wide range of subjects. A great number of scientific and educational shows in the field of astronomy are available for astronomy enthusiasts.

Shows for schoolchildren are designed to complement school learning. The Kharkiv Planetarium has courses of shows in astronomy, physics, ecological science, and geography. Teachers can choose either individual subjects, or entire courses, with tickets priced accordingly.

For younger children there are tales of space and space flight adventures to be enjoyed. During the New Year holidays, the planetarium has special space-themed surprises in store for children. New shows introducing children to the night sky are presented every year. Additionally, children are entertained with greetings from the star of the holiday season, Father Frost (Ded Moroz) and his granddaughter, the Snow Maiden (Snegurochka). After immersing themselves in the dark night sky, children are treated to cheerful games, singing, and dance offerings at the Theater.

At the Kharkiv Planetarium, shows are always accompanied by a rich array of music. Occasionally there are also themed live music performances. The sounds of organ, piano, violin, accordion, bandura (a Ukrainian stringed instrument), drum, flute, and saxophone echo inside the dome as audience members soak up the mesmerizing images of space projected onto the Star Hall dome (Photo 7).

7. Special nighttime telescope observing sessions

Another wonderful program at Kharkiv Planetarium is the stargazing session. The planetarium's reflector telescope has a 150 mm aperture, a focal length of 2250 mm, a tube length of under 1 m, and maximum magnification of 375x.

In the past, telescope observing sessions were held regularly in the early evenings to observe the moon, planets, star clusters, and nebulae. Visitors would enjoy spending time photographing observation targets through the eyepiece, or taking snapshots of themselves against the night cityscape.

8. Virtual telescope observing, an ideal solution for children

Real telescope observing is limited to adult visitors, however, because the sessions usually take place during late hours that are less than ideal for children. It would also be harder for children to philosophically accept that it is only when skies are cloudless that stars can be seen, let alone reveal their beauty to us through astronomical telescopes.

Our solution to this dilemma was to offer virtual telescope observing sessions. In a room decorated on the theme of planet Mars, commentaries are provided on the features of Mars and on flight plans to the planet. The eyepiece of the “telescope” shows computer-generated images of celestial bodies, which nonetheless appear to visitors as if they are watching them in real time because the source of the images is not apparent. Both children and adults find our virtual telescope observing sessions highly enjoyable (Photo 8).

Photo 8. Lecturer Olena Zemliachenko (the author, pictured right) in the virtual telescope hall accompanied by physics students.

9. Private programs, a great option for romantic occasions

The spread of Covid-19 increased the demand for our private programs. Private renting of the planetarium is ideal for users looking for optimized learning experiences. The privacy offered by this service has been popular also for declaring love, making marriage proposals, or celebrating anniversaries under the starry sky of the planetarium. Our private programs offer options catering to all tastes and age groups.

Planetariums serve both educational and recreational needs. Planetariums offer experiences that reaffirm our shared humanity. Collaborating with movements for protecting the global environment is therefore another important part of what we do at the Kharkiv Planetarium. The world’s planetariums can play central roles in advancing global harmony, aspirations for peace, environmental protection, and civilization.

All of us live together in a shared house called Earth.

10. About the author

My name is Olena Zemliachenko. I worked as a coordinator at the Kharkiv Planetarium for seven years. The staff was small, meaning each member performed multiple tasks. Below is a brief description of my duties at the planetarium.

My main responsibilities included giving lectures at the Star Hall, where projections of constellations took place, and at the Space Museum and Virtual Telescope sessions. I also compiled new lectures. Additionally, I performed the following duties:

- Creating monthly lecture schedules
- Keeping abreast of the progress of and creating reports on work performed by lecturers
- Creating and recording audio material for new educational lectures
- Running highly specialized physics and astronomy programs at the planetarium for high

school and university students

- Editing fulldome films (on an occasional basis)
- Mobile planetarium shows at schools and kindergartens
- Conducting, as an animator, the planning and execution of birthday parties for children
- Execution and sales of lectures; marketing to increase visitors and corporate clients
- Active participation in astronomy conferences in Ukraine; and in international conferences related to planetariums

My duties were manifold, but I held each in great importance and miss them all. A particular favorite was taking planetarium shows to schools and kindergartens by means of an inflatable dome complete with projector and compact projecting equipment. Bringing the portable dome theater to schools allowed children—who were fascinated by the "spaceship" that had appeared in their assembly hall—to enjoy projections of planets and constellations without the inconvenience of travel (Photo 9).

Photo 9. An inflatable, portable dome installed in a school assembly hall.

11. Support for Ukraine's planetariums

I am often asked what Ukrainian planetariums need the most, to which I confidently reply as follows: Planetarium equipment enables us to screen the most engaging space journeys visitors can ever hope to experience. However, fresh content is constantly required. Forty-minute-long fulldome shows are very expensive for planetariums in Ukraine to purchase. For this reason, I am hugely grateful to the International Planetarium Society for making free resources available.[5] We were also helped by India several years ago, when the country offered us the opportunity to purchase content at reduced prices. The Kyiv and Kharkiv Planetariums took up this offer because they found the purchase conditions workable, though other planetariums did not. The ongoing war makes it near-impossible for us to buy content. Many planetariums have sustained physical damage as well. The Kharkiv Planetarium has lost its windows, floors, and central heating system. It would be prohibitively expensive to bring the planetarium back into full service. Situations are further complicated in Donetsk and Kherson by the fact that their planetariums have been seized by Russian aggressors. As of the beginning of autumn 2022, the only planetariums still actively welcoming visitors are those in Kyiv, Vinnytsia, and Odesa. As such, there would be nothing more helpful to us than charitable donations of new planetarium content. This form of support will help us resume operations swiftly, and attract new visitors.

I firmly believe victory for Ukraine is not far away. The people, cities, and planetariums of Ukraine will hold out. I am deeply grateful to Japan and the Japanese people for supporting us in these difficult times. I had never expected such kindness from complete strangers, so thank you from the bottom of my heart. The plight of my motherland breaks my heart, but this situation is even more dire for my family and fellow countryfolk who remain in Ukraine. I genuinely

wish I could go home, home to where people are staying put to protect our country, and mourning or dreading the loss of their kin and loved ones. I miss my parents and the job I love. I yearn for the end of this terror, when I can once again hold a microphone and say, “Hello! I am delighted to welcome you all to the Star Hall of the Kharkiv Planetarium!”

Olena Zemliachenko, the author

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I wish to thank Galina Vasilyevna Zhelezniak, the director of the Kharkiv Planetarium, for helping me put this text together. Photographic materials include those from the Kharkiv Planetarium website.[6]

Notes

1. Микола Павлович Барабашов (March 30, 1894 – April 29, 1971).
2. Used for the STS-87 mission launched November 19, 1997, which also included Takao Doi among its crew members.
3. Харківський национальний университет імені В. Н. Каразіна, named after its founder, Vasily Karazin.
4. These include Cosmonautics Day observed on April 12 to commemorate the world’s first crewed space flight achieved by Yuri Gagarin; and October 4, launch day of the world’s first artificial satellite, Sputnik 1.
5. The IPS (International Planetarium Society) website (https://www.ips-planetarium.org/) publishes fulldome programs available free of charge.
6. URL http://planetarium-kharkov.org/

This text uses the spelling “Yuri Gagarin” for Ю.О. Гагаріна (March 9, 1934 – March 27, 1968), who was on board first human-crewed flight into outer space.

From JPA editorial board:
The original manuscript was written in Ukrainian and translated into Japanese and English by JPA editorial board.

Planetariums in Ukraine

Planetariums in 7 cities

■ Kyiv	Київ	
■ Kharkiv	Харків	Kharkiv Planetarium named after Yu. O. Gagarin
■ Dnipro	Дніпро	Planetarium Noosphere
■ Donetsk	Донецьк	
■ Kherson	Херсон	Kherson Planetarium named after Yu. O. Gagarin
■ Vinnytsia	Вінниця	
■ Odesa	Одеса	

Small planetariums in other cities

■ Uzhhorod	Ужгород
■ Uman	Умань
■ Mykolaiv	Миколаїв
■ Zaporizhia	Запоріжжя
■ Kremenchuk	Кременчук

*The map and captions were added by *JPA editorial board*.