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PLANETARIAN

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ON THE COVER

"After a long period of suspense caused by distant storm clouds obscuring the view, the sky cleared an hour before the event at our spot in the Ebro Delta. From the moment of first contact, everyone watched the Moon advance across the Sun using eclipse glasses or welder's goggles. In the final minutes before totality, a growing silence settled in as the daylight faded. Everyone could sense that something extraordinary was about to happen. Suddenly, the Sun was replaced by the Moon's black disk. But above all, the solar corona became visible all around it. On this day—August 12, 2026—it didn't actually turn pitch black. Occurring shortly before sunset, this was a unique type of total eclipse, taking place in a kind of twilight. It was all the more beautiful for the breathtaking scene it created: a blend of a terrestrial landscape with altered colors and a cosmic vista usually hidden by the Sun's glare. A magical play of colors unfolded: the bluish twilight of the eclipse's shadow surrounded the obscured Sun, while to the north and south, the atmosphere glowed pink where it was still illuminated by the Sun outside the Moon's shadow cone. The return of the first ray of light marked the end of totality. Applause erupted. Then, we looked at one another. The emotion was overwhelming. We wept together at the sheer beauty of the magnificent spectacle nature had revealed to us—tears of joy. We hugged and kissed. For a moment, we forgot about leaving, as the show continued: the crescent Sun setting, followed by the green flash over the distant mountain range. Then, we went on to enjoy a happy evening at the seaside open-air café, before trying to sleep beneath the shooting stars..." *Jean-Michel Faidit*

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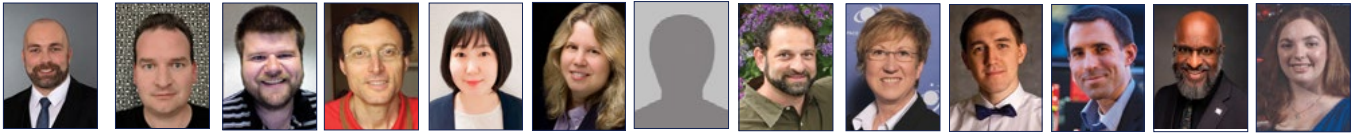


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IPS President Dave Weinrich
Welcome to the 2012
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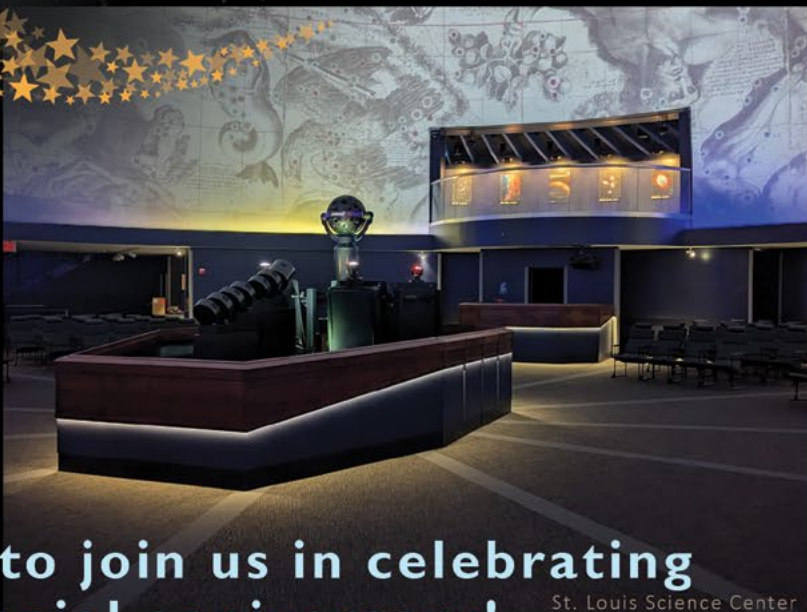
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HELLO FELLOW PLANETARIANS!

A MESSAGE FROM THE PRESIDENT



Shannon Schmoll

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Greetings fellow planetarians!

I am happy to report that IPS 2026 in Fukuoka was a great success. We had over 600 attendees from around the world. Our wonderful hosts showed great hospitality to everyone who attended. They truly did a wonderful job creating space for planetarians to connect and share their work. They also highlighted and invited us to learn about planetarium and astronomy in Japan. At the full-dome film festival, they highlighted Japanese student full-dome films. There were sessions on anime in planetariums. The opening reception included a performance of Amano Iwato Kagura, a traditional dance about a sun-goddess who hides away because of the antics of her brother and her eventual return. There post-conference tours to other major planetariums throughout Japan and a visit to the Suga Shrine that hosts the Nagota meteorite which fell in the year 861. There was even a networking dinner that featured Japanese language lessons. Banquet also opened with a traditional opening of a new barrel of sake with wooden mallets. So, thank you to our hosts for making us feel cared for and welcome.

What I particularly loved seeing at this conference were moments of connection between old friends and the formation of new friendships. I saw how our connections to one another only builds the network of planetarians, creating more opportunities to do great things. I saw presentations on work that was just a seed planted in Toulouse and Berlin. I saw people brand new to the field find camaraderie and joy in finding out they are not in this alone. I saw people present on collaborations that crossed many time zones and disciplines, showing how we can connect beyond planetarians and beyond astronomy.

What I realized in reflecting on the conference was that planetariums are like mushrooms. (I will admit, the sake may have played a role in thinking up this metaphor, but bear with me, it will make sense, I hope). First, some mushrooms at least, have cute little domed caps so there is a resemblance. But mushrooms, like this metaphor, run deeper than that. On the surface a mushroom looks like an individual organism. But beneath the surface, throughout the soil, you see the mushrooms are really part of one larger mycelial organism with lots of smaller connections between them. Not only are they connected to each other, but they also connect to tree roots and help the trees connect to each other. This is like planetariums around the world being connected to each other. The trees are our communities and our collaborators that we bring into this world. Ultimately, planetariums and the planetarians who run them are connectors. The conference is an opportunity to strengthen and make new connections, but that network runs far and wide and allows for us to do the work between the meetings.

I look forward to our next conference in 2028 in Buenos Aires, Argentina! I hope to see presentations from ideas that started in Fukuoka and new ideas being formed for the future. I hope to see you all there. But, even if you can't make it, the network will still grow stronger and larger and that is a good thing for everyone.

With a full heart,



Shannon

UNSOLICITED BIRD FACT

Unsolicited bird fact: Some birds do eat mushrooms, including Jays, Emus, and Cassowaries. Luckily, there are no birds who eat planetariums!

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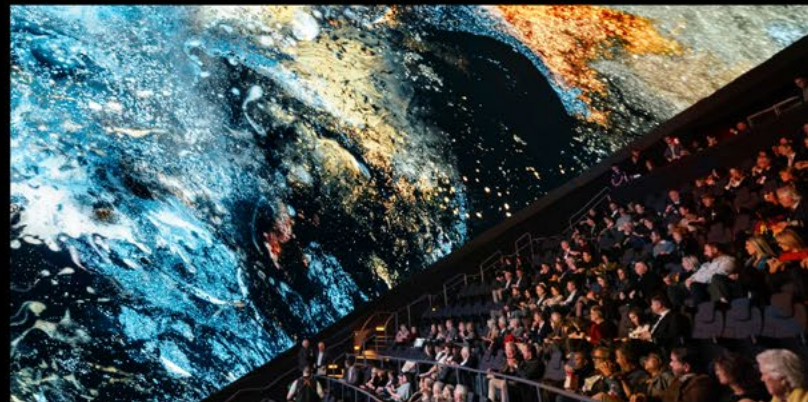


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CURRENT CHALLENGES AND OPPORTUNITIES FOR A PLANETARIUM ON AN AMERICAN STATE UNIVERSITY CAMPUS

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INTRODUCTION

Planetariums housed within academic institutions are uniquely situated as valuable resources yet are often overlooked. Their sustainability can be hampered by shrinking budgets and institutional ambiguity surrounding the role they occupy within academic and community settings. These challenges not only pose a threat to the viability of a planetarium but can also limit its ability to systemically track and document its unique contributions. Consequently, planetariums at academic institutions may not have the capacity or opportunity to conduct formal evaluations that quantify and/or qualify their impact. At the same time, formal program evaluation can be an instrumental tool for informing data-driven insights and decision making, highlighting blueprints of successful programming, and demonstrating accountability to institutions and their studentsⁱ.

This paper does the following: (1) introduces the University of Wisconsin-Milwaukee's (UWM) Manfred Olson Planetarium as a case example of a longstanding planetarium that is embedded at a research institution in one of the most segregated regions in the USA; (2) characterizes the planetarium's unique opportunities and challenges from the perspective of its Director of 20 years (author Creighton); (3) presents findings from a formal evaluation of the planetarium led by an independent third-party evaluation team (authors Haanstad and Nagy); and (4) synthesizes the Director's reflections and evaluation findings into a set of recommendations to be considered for adoption by other university planetariums.

ABOUT THE UWM PLANETARIUM

The UWM Planetarium (hereafter referred to as the planetarium) is on an urban campus that strives to be both a research (R1) and an access institution. The goal is to have the audiences reflect the diverse demographics of the region (38% Black or African American, 34% White, 21% Hispanic, and 5% Asian). The theater has 63 concentric seats situated around a 1965 Spitz A3P optomechanical projector. All programming is live and in person. A typical 60-minute planetarium show is separated into a 25-minute presentation on a particular topic,

25 minutes of guided stargazing, and a 10-minute question period. The presentation portion is augmented with imagery and video projected by four liquid crystal display projectors.

Working on an urban campus introduces an interesting paradox: the audience that is readily available, namely students, do not have time or money to visit the planetarium often. Furthermore, they expect campus events to be free and even to include food (which is beyond the planetarium's means). University employees seldom can participate in daytime programs (a notable exception was the solar eclipse of 2024) and are unwilling to return to campus in the evening or on weekends after their long workweeks. Our principal audience, then, is our community beyond campus. The planetarium typically has 15,000 visitors annually, of whom 45% are with school groups, 30% are general audiences, 17% are private programs such as birthdays or scouts, and 8% are university students.

The planetarium celebrates its 60th anniversary this year, a timely milestone to reflect on the opportunities and challenges observed during Creighton's 20-year tenure while also making strategic choices for the planetarium's future.

OPPORTUNITIES FOR THE PLANETARIUM

The following four major advantages that the planetarium has afforded might apply to other planetariums on academic campuses as well.

EASY ACCESS TO BROAD EXPERTISE

Connecting multiple knowledge areas is central to a vibrant university planetarium. This point was made in a 1973 *Planetarian* articleⁱⁱ, which listed interdisciplinary topics suitable for a university planetarium and called for models to support this. Over the years, the planetarium has collaborated with 93 different units at UWM to present a variety of topics such as revitalization of Indigenous languages with the Electa Quinney Institute for American Indian Educationⁱⁱⁱ, development of self-healing metals for space applications with Mechanical Engineering faculty, and using storytelling techniques in a Theatre course to improve science literacy among university students. The challenge is to find other people who see the potential of



Fig. 2: A bright, colorful image that includes an island, a palm tree, a beach, and stars in the sky that make book constellations.

such interdisciplinary collaborations. Practical strategies for developing such partnerships are discussed in a recent Planetarian^{iv}. These collaborations have been more culturally centered (such as “Arabian Nights”, “Lunar New Year”, and “Storytime in the Caribbean” see Figure 1) rather than technical, as are some of the topics on the 1973 list (e.g., Orbital Dynamics, Geodetic Astronomy, and Applications of Spherical Trigonometry).

STUDENT STAFF BRING FRESH IDEAS, SKILLS, AND ENERGY

Most of the people hired at the planetarium are either art or communications students who like space or students who like performing and are interested in astronomy. These students bring new ideas and a variety of skills. For example, one designer suggested that she make a folding brochure for the event schedule rather than using the standard letter sheet format. These brochures (“zines”) are popular with visitors. Another example is when two students on the team wanted to develop a Halloween program on their own and Creighton agreed. Year after year, crowds enjoy these “Creepy Cosmos” shows, student presenters enjoy agency, and Creighton is free to attend the Great Lakes Planetarium Association annual conference in October and network with colleagues.

BETTER POSITIONED TO OFFER AFFORDABLE PROGRAMS TO THEIR COMMUNITY

Many university planetariums like the planetarium at UWM have a mission of offering inexpensive and free programs. This is possible because the salary of the Director and of the part-time Assistant Director are paid for by the College of Letters and Science. In 2026, the College of Letters and Science agreed to partially subsidize another part-time

position to provide stability during times in the academic year in which students are too busy with coursework or are off campus. However, all the undergraduate student staff salaries, maintenance of the planetarium projector, and any supplies need to be paid by generated revenue. Thankfully, the UWM faculty of the Leonard E. Parker Center for Gravity, Cosmology and Astrophysics (CGCA) have secured National Science Foundation grants that incorporate funds for planetarium student staff as a component of their broader impact and outreach for over 15 years. An additional 8% of the budget has come from the CGCA directly, which means that, for over a decade, tickets have had to cover only 77% of the planetarium’s budget. This allows the planetarium to make 40-50% of its public programming free to encourage any members of the community who might otherwise not be able to attend to visit the planetarium.

LIVE INTERACTIVE PROGRAMS

A team of three presenters offer 400 live shows a year. Instead of spending limited funds on purchasing movies, the production team in collaboration with presenters create in-house shows. This format allows presenters to respond directly to audience questions and fosters more meaningful engagement. Obviously, it is different for large venues that need to offer 10 shows a day, not 10 shows a week, but a small-scale operation allows more intimate experiences (see Figure 2).

These same strengths also introduce challenges.

CHALLENGES FOR THE PLANETARIUM

REVENUE/FUNDING

Funding is probably the single most important challenge the planetarium faces. When Creighton became involved with the planetarium in 2006, ticket prices were \$1/general and \$.075/student, which was not enough revenue to hire

design students who could make more eye-catching posters, film majors who could create interesting animation and video, and eventually journalism/media students who understood trends in social media. By 2026, the prices are still a modest \$7/general and \$5/student.

After the COVID pandemic, higher hourly wages (at least \$14) are needed to attract and keep the best talent even if that necessitates a smaller team. The cost for staffing, computers, and publicity (mostly printing) has increased, but there is hesitation to increase the pricing structure to cover all the additional expenses lest the prices become unaffordable to the community.

HIGH STAFF TURNOVER

Planetarium operations rely on 60–70 hours per week of student help to design programs and visual assets, present shows, train other students, coordinate social media, and sell tickets for events. Students require technical skills (e.g., operating the planetarium projector, managing transactions) and professional skills (working effectively on a team). Because these skills need time to develop and students have typically stayed between 3–5 semesters, training has been an important portion of what student staff do.

Since the pandemic, training has become even more important because there has been a noticeable difference in the amount of time a student remains on staff. Before then, Creighton could be fairly confident that a student staff member would stay until they graduated. However, life has now become more complicated for students. Despite efforts to support student staff through life's challenges, stressors around mental and physical health of their own or a family member have resulted in higher turnover. For example, of the 16 students employed during 2025, 4 graduated and 7 resigned. This level of turnover means that a significant portion of staff time is devoted to training (and re-training) rather than program development.

CHANGING REGULATIONS FROM CAMPUS, THE STATE, AND THE FEDERAL GOVERNMENT

Campus: At UWM, security concerns strictly limit the types of ticketing and charging systems allowed for use. Although it is wonderful to have campus experts advise on cybersecurity, sometimes the solutions that are adopted are not well suited for the specific needs of the planetarium and can further add to the burden of student staff training.

State: UWM is part of the University of Wisconsin System, which means the campus must follow system-wide regulations established under policies and directives set by state government. For example, the system decided, following new federal guidelines, that all digital material available on websites of educational institutions must be accessible. This meant that every webpage, document (PDF or otherwise), video, and image must follow a set of rules that require extensive training. No one questions the value of having accessible materials and learning about universal design;

however, the regulations can add significant additional unexpected workload to the team.

Federal: The US federal government in 2026 has different priorities than it had in the past. There used to be grants that required one to show that the natural sciences are trying to attract underrepresented people to the science, technology, engineering, and math (STEM) fields, whereas this practice is now actively discouraged. This fluid situation deters academics from submitting grants.

GRANTS AND DONATIONS

Grant funding at the current level cannot be assumed. A 23% budget cut will impact how many students are hired, what programs are offered, and how much publicity is possible. Such a cut would change how shows are planned. There might not be as much wiggle room to try new things even for a worthwhile collaboration.

Although the planetarium is part of UWM, which has comprehensive fundraising initiatives, the planetarium team needs to reach out to potential donors and personally thank existing donors for their support. The University Advancement office is also dealing with a shrinking staff and budget, so it is understandable that their staff focuses on departments who have already secured a donor base. The direct link to the planetarium fundraising page that office provided, for example, was useful in reaching more donors.

THIRD-PARTY EVALUATION PROCESS

To demonstrate its impact, authors Haanstad and Nagy carried out a program evaluation of the UWM Planetarium. This third-party evaluation was developed in collaboration with the planetarium's leadership team. During the evaluation's formative stages, the collaborative team met iteratively to establish its goals and overall scope. Specifically, Creighton provided guidance as to the primary and exploratory questions she hoped the evaluation would help address. Further, the Assistant Director provided a sample of individuals affiliated with the planetarium who were well suited to offer insights into these evaluation questions. The third-party evaluation team ultimately held 32 interviews with a wide range of individuals affiliated with the planetarium, including 5 faculty collaborators; 6 former and 3 current student staff; 3 planetarium members; 10 UWM community members and collaborators; 4 general community members; and 1 media reporter. Interviews were semi-structured, aiming to elicit perspectives related to different facets of the planetarium's impact as guided by the primary and exploratory questions. Interviews probed perspectives on the planetarium's role in fostering personal connection to the night sky, promoting cross-cultural understanding, highlighting discovery, and advancing belonging and retention at UWM. Additionally, interviews were conducted across different sites (i.e., campus laboratory, library, or virtual) as selected by interviewees and lasted approximately 30 minutes. Detailed notes were taken during each interview by research assistants affiliated with the third-party evaluation team while Haanstad facilitated the

conversation. Notes included both summarized (synthesized) responses of the semi-structured interview questions alongside verbatim direct quotes, when appropriate, to capture interviewees' perspectives. Throughout the data collection process, the third-party evaluation team performed an iterative rapid qualitative analysis of interview notes to identify cross-cutting themes across questions and interviews. This process is a widely adopted approach across implementation and research settings that facilitates timely and efficient synthesis of results.ⁱ Throughout the data analysis stage, iterative member-checking meetings were held between the third-party evaluation team and the planetarium director to present, discuss, and refine preliminary findings.

EVALUATION FINDINGS

The evaluation identified five interconnected themes that together represent a range of community- and campus- wide impacts. The planetarium was (1) viewed as a “gem” that needs to be preserved; (2) a model of women leading STEM; (3) a gateway into STEM; (4) a place of shared humanity; and (5) a place that promotes student retention. The themes reflect a diversity of voices and at the same time converge on the planetarium's perceived value at UWM and in the broader Milwaukee community.

A “GEM” ON CAMPUS AND ACROSS MILWAUKEE

Interviewees consistently invoked the metaphor of a “gem” or “jewel” when describing the perceived rarity and irreplaceability of the planetarium at UWM and across the broader Milwaukee community. Seen as a special site where Milwaukee meets UWM, individuals spoke of the planetarium representing not solely a campus-based asset but a city-wide strength. Many interviewees reflected on the planetarium as a gem as a way of advocating for keeping it alive, with one faculty collaborator sharing: “The planetarium has been a mainstay on campus when a lot of other things are changing...it is one of those jewels on campus that we need to preserve, we need to upgrade, and we need to focus more resources on.” Echoing this sentiment, a former student alluded to the planetarium's role as a landmark that inspires an ongoing affinity to UWM: “I want to stress how much this planetarium means to so many people. Hundreds and possibly thousands who otherwise wouldn't have an active link to UWM stay connected because of it. People don't always notice when the planetarium does well, but they will notice if it goes missing.”

WOMEN-LED

Notably, we did not explicitly ask about the features or effectiveness of the planetarium's leadership. Yet, a salient theme emerging across interviews was the influence of its predominantly women-led team as a model of women in STEM who champion both science and mission-driven work. Many referenced the director's experiences at NASA—including her work aboard the SOFIA [Stratospheric Observatory for Infrared Astronomy] high altitude observatory—as an inspiration. One UWM collaborator



Fig. 3: Director Jean Creighton is showcasing the exterior of the UWM Planetarium.
Photo Credit: Leah Nolte

reflected: “Girls in science is not something I grew up with. This planetarium... opens minds to new possibilities that girls can go into a new science they haven't heard of before.” Others described the significance of having a director at the helm who carries such prestige in the field while also embodying and executing mission-driven outreach at an academic institution. A media reporter we spoke with shared: “Her [the director's] time in the SOFIA and her experiences to us are big scale...but to have someone like that choose to be in Milwaukee and choose to do public outreach and how that translates to her mission...she's told me these interpersonal relationships and outreach is what I am supposed to be doing. Despite having all this experience, she chooses to stay.”

GATEWAY INTO STEM

Across our conversations, the planetarium was frequently described as a gateway into STEM: “This is a good gateway into STEM...A lot of people push STEM... but often what's missing is that connection piece. They don't have a way of getting excited about it. So I think of the planetarium as a bridge” (UWM collaborator). What appears to distinguish this gateway is the planetarium's unique ability to pair digestible doses of learning with engaging experiences that together spark curiosity extending well beyond the shows themselves. For example, several discussed the effectiveness of post-show Q&A sessions in making complex content accessible and, in doing so, serving as a catalyst for self-directed learning outside of the planetarium. A UWM collaborator emphasized that the planetarium's strength lies in, “...being housed at an educational institution, and...stewarded by academics...which lends itself very well to the educational kind of pursuit that a planetarium should have... what [the director] and her team do very well is focus on the learning and the discovery aspect. And not just feeding people with information but probing their knowledge FIRST, making them feel valued... and then sprinkling in these thoughts, ideas, and ways to explore on

their own. For a lot of people they walk away having learned something but also a craving to dive in a little more.”

A PLACE OF SHARED HUMANITY

While the planetarium provides an entry point into%and ongoing engagement with%STEM fields, interviews highlighted its unifying influence across cultures, disciplines, and backgrounds, fostering a sense of shared humanity under one sky: “The planetarium blends expression, art, and ...it starts and ends with STEM but in between there is people, art and pure humanity” (former staff). In describing the richness of its cultural programming, many described the planetarium as one of, if not the most, diverse places on campus: “Every culture has participated here. In here it’s like the ice melts and everything cools down to peace and brings together the community that is being divided outside” (current staff). The breadth of disciplines and backgrounds represented across our 32 interviews was an additional testament to this theme. Interviewees ranging from professors in Japanese Performance and African Diaspora Studies to Muslim and Indigenous community and campus leaders spoke of sharing pieces of their cultures and disciplines within the planetarium. One of these collaborators shared: “The planetarium really humanizes us... we all live on this same planet. The planetarium highlights different cultures, but at the end of the day, it’s universal. Astronomy is something that is innately human and we’re all born scientists.”

PAVING PATHWAYS TO RETENTION

Interviewees who were students and staff overwhelmingly credited the planetarium with supporting retention at UWM. One current staff member shared, “The planetarium certainly helps with retention. It is a big part of me wanting to stay—stay in college, stay with studies, and get money.” Retention appeared to be mediated by a sense of community around shared interests, professional development opportunities, and allyship for students from underrepresented backgrounds. One former student reflected: “We wanted to keep showing up for [the director] the way she did for us. It was more than a sense of belonging. It was a sense of commitment to each other. In Milwaukee, there is such a lack of diverse resources, diversity in thought and experiences. But the respect that the planetarium shows for students of color and students of different means is everything to me.”

RECOMMENDATIONS

The following recommendations are informed by both the last 20 years at the planetarium and by the third-party evaluation. Together they can offer useful ideas for other university planetariums to consider for their operations and programming.

REVENUE GENERATION

There are university planetariums that are fully funded, others partially funded, some heavily rely on grants, and

some need full cost recovery. Regardless of their situation, a university planetarium is typically expected to offer some free programming for various reasons; however, for institutions that must pay student staff from revenue, it makes sense to also have paid programs to cover expenses. The planetarium saw a large increase in sales when online ticket sales were enabled (even though that introduces additional administrative work). An additional benefit is that one can anticipate how many people are coming to the event in advance and the attendees better appreciate what they see (attendees tend to value experiences more when they have paid for them).

STUDENT STAFF

There are some campus planetariums that have university staff or faculty to cover all duties related to their operations. They typically emphasize student courses and have fewer public offerings. For the many campus planetariums who employ university students, student staff bring important skills for operations from presenting to design and can be a critical aspect of a successful university planetarium. These students gain real world experience and contribute fresh ideas. Working for the planetarium reinforces their sense of belonging in higher education and builds their self-confidence as they are contributing to a larger team.

Given high turnover, ensure that each task can be handled by at least two team members and schedule off-boarding of seasoned staff to new members of the team so students can train each other. New student staff feel more comfortable asking questions of other students. The off-boarding needs to start early. For a mid-May graduation, start off-boarding in mid-February and by mid-April the graduating student should not be responsible for anything so the next person feels some agency to lead and can realize what they still don’t know.

Another solution for part-time staff can be volunteers. For some planetariums, they have retired teachers who are space enthusiasts lead school group shows.

MANAGING REGULATIONS

Be aware of what issues are coming from the campus leadership and state/country legislature. For example, the planetarium team was able to plan updates to their website to comply with new Wisconsin state regulations to make all webpages accessible. At a campus level, systems that are adopted are often not optimized for the needs of the planetarium. Advocate for your planetarium needs and help troubleshoot since you might encounter corner cases that nobody else on the campus experiences. For example, when we offered “Northern Lights” online, the high traffic levels on our website caused the university website to become temporarily unavailable. The campus network staff had

never encountered the issue of over 200 people trying to simultaneously access the website before.

CULTIVATING A PRESENCE ACROSS CAMPUS

Reach out to people across campus to see if the planetarium can be useful in the research or outreach of other units. Consider a wide range of potential collaborations and brainstorm with colleagues what that might look like. This process takes time. There will be dead ends but also valuable collaborations that will enable programming that is exciting and relevant. Such efforts get noticed by your community and are more likely to want to support these innovative programs. Furthermore, these initiatives might be suitable for sponsorship by grants or private foundations in the area.

In recent years, for example, the planetarium team has worked with the Student Health and Wellness Center for programs around mental health (such as “Mindfulness under the Stars”). One of the recommendations that was made by one of the faculty collaborators was to make the planetarium even more belonging-centered: “...I would recommend she work with her past partners on how we can support student wellbeing. How ... spaces like the planetarium can also be leveraged to build community and support student overall wellbeing... how can various sites of research also be sites of restoration.”

MAKING THE PLANETARIUM’S PHYSICAL POSITION CLEAR

Campus buildings are notorious for being hard to navigate even for university employees. To make matters worse for the public, a planetarium might not be visible from the road or the parking lot. Despite all the signs that have been added over the years, a community member during their interview said: “For people coming from the outside, there is sometimes confusion as to where it is. Having signage on the sidewalk, on the outside (not just on the door)... I do know that on numerous occasions people have told me they didn’t make it because they couldn’t find it. There should be something visible when cars are passing by.” Making sure that the physical signage is clear ensures that community members can visit the planetarium.

CONCLUSION

We reviewed the opportunities and the challenges of a university planetarium and presented the findings of a formal evaluation. Based on all this information, we make recommendations to build interdisciplinary programming, a gateway to STEM, and a place for our community to gather. We hope that these insights will enable other university planetariums to become or continue being a gem on their campus.

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CITATIONS

- ⁱGertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. (2016). Impact evaluation in practice. World Bank Publications.
- ⁱⁱ Powers, S. W. (1973) “The Planetarium in College and University Education”. *Planetarian* 2(2), 46-53.
- ⁱⁱⁱ Creighton, J. and Noodin, M. (2018) One Sky: Connecting Indigenous Star Stories. *Planetarian* 47(4), 32.
- ^{iv} Creighton, J. and Mello R. (2021). Infusing Astronomical Concepts into an Undergraduate Storytelling Course. *Planetarian* 50(2), 12-19.
- ^v Creighton, J. (2023) Engaging Our Communities: Building Collaborations to Enrich and Diversify Planetarium Programs. *Planetarian* 52(3), 10-13.
- ^{vi} Creighton, J. (2024) Seeking What Works: Connecting with a Live In-Person Audience. *Planetarian* 53(4), 50-51.
- ^{vii} These hourly wage might seem low. To give context, the Wisconsin’s minimum wage is \$7.25 per hour, which matches the federal rate. This rate has not increased since July 2009. <https://www.jsonline.com/story/news/factcheck/2026/05/21/is-wisconsins-minimum-wage-in-2026-the-same-as-it-was-in-2009/90166616007/>
- ^{viii} Vindrola-Padros, C., & Johnson, G. A. (2020). Rapid techniques in qualitative research: a critical review of the literature. *Qualitative health research*, 30(10), 1596-1604.

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EMOTIONAL INTERACTIONS IN THE PLANETARIUM: EMOTIONAL LANDSCAPE OF SESSIONS WITH YOUNG AUDIENCES

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ABSTRACT

Emotions have a central role in planetarium education. Exploring this topic with a naturalistic approach, a project was conducted, with the aim of studying emotions and their role in planetarium sessions with young audiences. This article presents and discusses an overview of the results.

INTRODUCTION

Since their inception, planetariums have spread around the world bringing the wonders and mysteries of the night sky to the public. This mission has never been more important. Humans are connected to the sky in many ways and this connection has been crucial for the development of human beings and civilizations (Marchant 2020), but in a world where light pollution has been a serious problem for decades, we have been gradually losing this night sky (Falchi et al. 2023). This affects our capability for earth-based astronomy and observations with the public (Walker 2021), and, in general, prevents us from looking at the sky, to learn about it, and wonder. In this context, planetariums provide unique access to the night sky that people no longer see and can have an important role in communicating about the importance of the sky and its preservation, fostering the relation humans have with the sky, bringing awareness to light pollution problems and encouraging people to go outside and observe the night sky. But there are no systematic studies about how this happens and which emotions and processes are involved. Therefore, a research project to study how these aspects are being communicated in planetariums, specifically its emotional components, was conducted in Portugal, with the support of the first IPS Planetarium Education Research Fellowship.

The emotional dimension of planetarium sessions was explored with the objectives of understanding: 1) which emotions are expressed by participants in the interactions during planetarium sessions and what are their characteristics; 2) what methods and communication strategies are used in the planetarium that foster the human-cosmos connection, bring awareness about light pollution, and encourage people to observe the real night sky; 3) what is the emotional dimension of the interactions involving the supra-cited topics.

In this article, the main results of the project will be presented. These topics and the emotional aspect of planetarium education are crucial areas. These results

contribute to the work of planetarians and educators inside the dome, since planetarians will have more tools and resources that provide guidance how to educate about these subjects and how to understand the role of emotions in educational planetarium sessions and its practical processes.

BACKGROUND

Emotions shape our experiences - our interest, engagement and satisfaction. Emotions like surprise, wonder and awe are present in science communication activities (Luna and Bering 2020). They are related to learning (Valdesolo et al. 2017), to well-being, altruism and sense of community (Keltner 2023) and, so, can have long lasting impacts. In general, astronomy has great potential for such emotions (Christensen and Russo 2007; Kessler 2012), where they can play an important role engaging audiences and enhancing people's interest (Davies 2019). Specifically in the planetarium, research points to the importance of the affective dimension of education (Slater and Tatge 2017). Planetarium sessions involve emotions, such as awe (Bonham 2017), and planetarium education can facilitate the encouragement of the public to observe the sky and to connect with it (Bonham 2017). However, despite the growing interest in these topics, research on the role of emotions in informal settings and in science communication is still very limited (Luna and Bering 2020; Falk and Gillespie 2009). This is also true in the planetarium (Slater and Tatge 2017). In their review on astronomy education research, Slater and Tatge (2017) found a variety of studies conducted in planetariums concerned with the affective domain - the domain related to attitudes, motivations and values -, but the results are still scarce and scattered, and mostly focused on pre and post perceptions and attitude changes rather than on the actual emotional expressions during planetarium sessions as they happen. With this project, we address this shortcoming in planetarium research by studying the emotional aspects of planetarium education in situ, using a naturalistic approach, with a specific emphasis on topics related to the engagement with the night sky and the importance of its preservation. Preliminary results of research shows that concepts related to light pollution and awareness about the importance of the night sky and its preservation are present in many sessions and are transversal

to different audiences and different guides (Marques et al. 2024).

This naturalistic research approach has been bringing unique insights to astronomy education. For instance, results about the processes and methods of showing and seeing celestial objects through a telescope (Marques et al. 2020) or of identifying constellations (Azevedo and Mann 2018), the strategies to communicate about time-related content in the planetarium (Marques et al. 2021), or recent studies on the expression of emotion and their role in observations of the sky with telescopes (Marques et al. 2024; Marques and Carlin 2025).

Using these methods allowed for start identifying and systematically mapping and describing the emotional interactions taking place in the planetarium, their contexts and role. Moreover, their relation to the affective and knowledge dimensions of observing, connecting with and preserving the night sky, and the methods used by guides to communicate about these topics was also made clear.

METHODOLOGIES

METHODOLOGICAL APPROACH

To study the planetarium live sessions Conversation Analysis (CA; Sacks 1995) was used. This naturalistic approach acknowledges that these activities are interactional settings and that people get together and produce them in situ, moment-by-moment, through the medium of language. Using CA, the analysis will account for the use of people's language practices, including talk, silences, gestures, and manipulation of objects and equipment, in the sequence in which interactions take place between the participants. From a CA perspective, each planetarium session is unique, but similar methods, strategies and thematics are common, recognizable and identifiable in these activities. The CA approach allows for the in-depth study of the interactions taking place at the planetarium through the meticulous analysis of the video and audio data retrieved from the planetarium sessions recorded without disturbance from the analysts. With CA it is possible to analyze what is happening in the natural environment without interference, exploring the practices taking place in the activities many times passed unnoticed, thereby systematically studying the emotions displayed and the strategies and methods guides use to communicate about the topics explored. By relying on video data of activities, this approach assures reliability of the analysis by making replication by other analysts possible, giving robustness and credibility to the results.

DATA COLLECTION AND CORPUS

The collection of data was conducted in 8 different planetariums in Portugal. A total of 38 live planetarium sessions were recorded, being presented by 9 different planetarians (7 men and 2 women). In total 5 fixed planetariums and 3 portable were part of this study, with most of the studied sessions being conducted in portable planetariums. Both analog and digital planetarium sessions

were recorded. The participation of several planetariums with different characteristics increased the diversification of data in terms of public, planetarians conducting sessions, and planetarium type. The quantity of sessions recorded allowed to reach saturation and diversity of results (Cohen et al. 2010). For reasons of feasibility and focus, we restricted this investigation to the age groups 3-5 (pre-school) and 6-10 (primary school). These groups were chosen because they are age groups where the emotional aspects of planetarium sessions are very important and, despite their separation and differences, there is a relation and continuum in between them. From the total of sessions studied, 11 were presented to children from 3 to 6 years old and 27 from 7 to 11 years old. It was not uncommon to find sessions with mixed groups in these ages, with more than one school year in the same session or pre-school students mixed with 1st and 2nd graders.

Data collection consisted in recording the sessions with visible and infra-red cameras and audio recorders, with minimum disturbance. Participants and their legal representatives authorized the recordings and their use for research purposes. The required ethical guidelines were followed, as were the European Union General Data Protection Regulations (GDPR). In addition, procedures to preserve and secure the data collected, to protect the identity of the participants and to guarantee confidentiality were also implemented.

DATA TREATMENT AND ANALYSIS

The analysis in this naturalistic research using CA was conducted primarily through the multiple visualization of the planetarium session's video and audio recordings and corresponding transcriptions. The process began with the treatment of the raw data (video and audio synchronization, video editing, etc.) and the database construction (organization of the information about the planetarians, public, type of session and planetarium, duration, etc). Then the simple transcription of the 38 planetarium sessions, in a total of more than 26 hours of data, was prepared.

The collected data was then visualized multiple times and the excerpts of data that involved emotions and that refer to the thematics studied (T1 - human-cosmos connection, T2 - light pollution, T3 - encourage to observe the sky) were selected. These selected excerpts were then analyzed and transcribed in more detail, following Jefferson's notation (Jefferson 2004) - a transcript notation that allows for the registration of pauses, gazes, superposition of speech, etc -, and video analyses procedures (Carlin et al. 2021). This pre-analysis reveals a set of almost 500 instances of expression of emotions and almost 200 moments where the referred thematics were mentioned or involved in the interaction.

With the detailed analysis of each excerpt the final corpus of emotion expressions was reduced to 419 instances. Each of these excerpts was categorized in terms of general type of emotion, public that expressed it (individual or collective),

theme that was being communicated, trigger of the emotion, type of engagement of the public and planetarian, among other categories. The 3 thematics (T1, T2 and T3) and how they were expressed was also analyzed. A final group of 172 interactions referring these thematics were identified.

The results were finally integrated and summarized, both quantitative and qualitative, and will be presented in the next section.

RESULTS

EMOTIONAL EXPRESSIONS

The analysis of the 38 planetarium sessions revealed a final corpus of 419 interactions in which emotions were identified. These events are predominantly positive in terms of emotions, although fear, disappointment, confusion, and other negative emotions were also identified. A group of other observations was noted, but not yet categorised and described, related to expressions of boredom and lack of interest. These appear in most of the recorded sessions and are largely non-verbal, manifested as sighs and yawns, looking at the floor or away from the projection, and, in some cases, falling asleep. These will be addressed in further analysis, but it is important to acknowledge their recurring presence in the data.

The nature of emotional expression found across the sessions is varied, and this expression can be individual or collective. Different situations trigger them and different thematics are involved in these emotional moments. It should be noted that the number of expressions analysed does not represent the absolute number of emotions present in these sessions. Some participants are not vocal or expressive in their emotions, others were not loud enough, others were not caught on camera. The results reflect, above all, the tendency and the variety of emotions present – offering a first systematic look at the emotional landscape of these sessions.

In all 38 recorded sessions, without exception, there are moments of emotional expression. Some sessions contain only a few such moments, while others feature more than 20. Taking into account the varying lengths of sessions, this corresponds to a frequency ranging from 0.1 to 0.8 emotional expression per minute in a session. When broken down by age group – pre-school, 1st and 2nd grades, 3rd and 4th grades or 5th and 6th grades, we see a slight decrease in the number of emotional expressions of the public with increasing age. Specially, there are more expressions in the pre-school groups than in the others. The mean is 0.42 expressions per minute in the sessions with pre-school kids, and 0.33, 0.30 and 0.31 for 1-2, 3-4 and 5-6 graders respectively.

The identification of emotions was carried out by analysing the interaction as a whole, taking into account gestures and expressions, when seen, and the vocalizations and talk. Different authors propose definitions and taxonomies of emotions, but in this work, despite referring to the common definitions of these emotions when naming them

EXCERPT 1

1	G	Começaram a imaginar as estrelas todas a fazer umas figuras. They began to imagine all the stars forming shapes.
2	Cs	Oh! Oh! (guide reveals the night sky projection with constellation drawings)
3	T	que giro! How lovely!
4	G	e alguém sabe como é que nós chamamos a estas figuras? And does anyone know what we call these shapes?
5	CS	Não! No!
6	G	São as constela...ções. Constelações! They're constel...lations. Constellations!

Excerpt 1: Children and teacher amazed seeing the constellations. (EE307, PS29, G1)

EXCERPT 2

1	G	Não, os que andam à volta do Sol são os primários. No, the ones that orbit the Sun are the primaries.
2		Os que andam à volta dos primários são os The ones that orbit the primaries are the
3	Cs	Secundários Secondaries
4	G	Os outros pequeninos que andam à volta do Sol chama-se planetas anões The other little ones that orbit the Sun are called dwarf planets
5	C	Ahhh Ahhh

Excerpt 2: Eureka moment, joy for learning/understanding what are dwarf planets. (EE65, PS6, G1)

(Keltner et al. 2019), it is not the aim to univocally describe and identify them, but rather to categorize them in a general way and understand their role in the interaction and in the planetarium session. It is the general feeling of positive/negative emotion, the intensity and the nuances that help describe the emotion and name it. This way we can call similar emotions such as amazement or awe, or joy and delight without the intention to distinguish them with precision. In the data we found what can be described generally as joy, fun and delight, doubt and confusion, amazement and awe, fear and discomfort, eureka and curiosity, surprise and shock, enthusiasm and excitement, sense of accomplishment, amusement and joking, astonishment and disbelief, disappointment and frustration, agitation and impatience, sadness and strangeness. Feelings and reactions of appreciation, defiance, recognition, overwhelm and boredom were also found. Some interactions are transcribed below to exemplify different emotional moments (Excerpts 1 and 2).

In the course of analysing the data, another important distinction emerged: the emotional interactions and the

¹ Excerpts of transcripts include the original Portuguese and an English translation. Captions: G# – guide; C# – child; Cs – children; T – Teacher. References of the excerpts and corresponding recorded session: EE# – Emotional Excerpt; ET1-# – Excerpt of Topic 1; ET2-# – Excerpt of Topic 2; ET3-# – Excerpt of Topic 3; PS# – Planetarium Session.

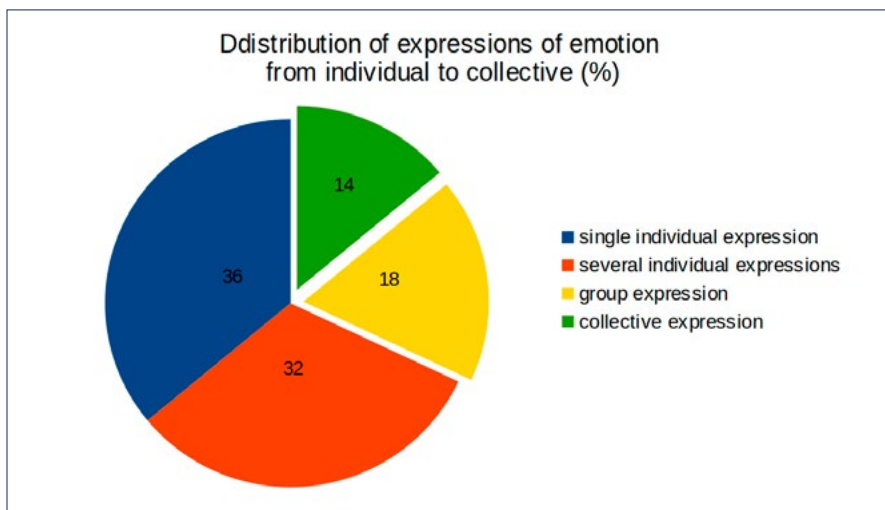


Figure 1: Graphic with the distribution of expressions of emotions by number of people expression it, from individual to collective.

of all the expressions. Some expressions are strictly individual, as others consist of several individual reactions to the same event. The collective expressions of emotions account for the remaining third and are divided by group expression or the whole collective audience simultaneously (see graphic in Figure 1).

These positive emotional responses happen in specific moments of the planetarium sessions and are triggered by several events or related to several situations. Two main components of the session are behind most of the triggers: 1) features in the projection (triggers of visual and performative nature), 2) information conveyed (triggers of informative and conceptual nature). Examples of the main emotional reactions and triggers are:

- Amazement/awe/delight/surprise with something that is projected;
- Surprise/discomfort with the movement of the projection;
- Enthusiasm/excitement for knowing the answer to some question or challenge;
- Enthusiasm/joy for discovering the answer;
- Eureka/joy/ enthusiasm for understanding something for the first time;
- Doubt/awe/disbelieve with some information or concept.

Some of the triggers such as specific explanations or information communicated have the tendency to reach fewer people, or reach them individually. Other events trigger collective emotional moments that surprise and capture the attention of everybody, such as the lighting up of the night sky or of the drawings of constellations. Examples of different emotional interactions can be seen in Excerpts 3, 4, 5 and 6 below.

The thematics involved are also varied. In sessions with younger public the typical subjects are stars, constellations and their stories, planets, the Moon and the Sun and their apparent movements, and the North star. No doubt that the constellations are the thematics that generates more emotions, but that is also due to the fact that it is the most referred topic, occupying the majority of the time of the planetarium sessions. There are more than 100 emotional moments somehow related to constellations, almost 60 about planets, with Jupiter and Saturn being the most common ones, 40 related to the night sky, almost 30 about the polar star and around 20 about stars and the Sun, among others with lesser expression.

The form and methods used to communicate about these topics also influence the emotional outcome. Guides use different methods to make their sessions more exciting and emotional and to keep the children on board. When the triggers are related to content and information, many of the emotional moments happen when astronomical scales



Figure 2: Emotional reactions in different planetariums. Infrared screenshots of video recordings. Most of them are collective wow moments.

expression of emotions can be either individual or collective, when all the group expresses the emotional response as a cohort. This distinction is important and reveals (and also impacts) the dynamic of the group, the session and the emotional experience. The distribution between individual and collective emotional responses shows a predominance of the individual expression, in a total of more than two thirds

EXCERPT 3

1	G	A constelação chama-se Cassiopeia. The constellation is called Cassiopeia.
2		E nós tínhamos que imaginar uma rainha sentada no trono. And we had to imagine a queen seated on a throne.
3	C1	Eu não! I can't!
4	G	Não é fácil, pois não? It's not easy, is it?
5	C2	Não! nem um pouco. No! Not at all.
6	G	Pronto, imaginem aqui uma cadeira, cadeirão e está ali uma pessoa sentada, Well, imagine a chair here, an armchair, and there's a person sitting in it,
7		uma rainha: Cassiopeia, na Antiguidade Grega... a queen: Cassiopeia, in Ancient Greece...
8	C1	Ahhh, já percebi! Ahhh, I get it now!

Excerpt 3: Frustration (lines 3, and 5) and then eureka and enthusiasm (line 8) for finally being able to imagine the constellation drawing. (EE118, PS11, G2)

EXCERPT 5

1	G	O que é que vai acontecer quando o Sol desaparecer? So what's going to happen when the Sun disappears?
2	C1	Já... Already...
3	C2	Vai ficar noite! It'll go dark!
4	G	Vai ficar de...? Noite! It'll turn... dark!
5	Cs	Uau! ehh, xiii Wow! Yay, whoa.
6	C1	Uau Wow
7	C3	que fixe So cool
8	C2	ok, isto é muita giro OK, this is really cool
9	G	olhem, Ficou de noite. E agora nós conseguimos ver muitas estrelas. Look, it went dark. And now we can see lots of stars.
10	C4	A Maria tem medo. Maria is scared

Excerpt 5: Collective awe and delight moment with the revelation of the dark starry sky (lines 5 to 8). In line 10 it is also noticeable that a child (Maria is a fictitious name) is afraid of the dark. (EE147, PS13, G4)

EXCERPT 4

1	G	Amigos, a verdade é que hoje Friends, the truth is that today
2		os astrónomos conhecem mais de 3 mil exoplanetas astronomers know of more than 3000 exoplanets
3		ou seja, planetas que giram em torno de outras estrelas. that is, planets that orbit other stars.
4	C1	A sério? Really?
5	C2	Uau!! Wow!!
6	G	Verdade! It's true!
7	C1	Eu pensava que só existia os planetas do... I thought only existed the planets of the...

Excerpt 4: Astonishment and surprise learning that there are many planets orbiting stars other than the Sun. (EE116, PS11, G2)

EXCERPT 6

1	G	Alguém consegue dizer quem é que está ali a aparecer? can anyone tell me who's appearing over there?
2	C1	Eu sei! Eu sei! I know! I know!
3	Cs	O Sol The Sun
4	C1	Eu sei porquê I know why
5	G	E quando aparece o Sol, o que é que acontece? Fica de And when the Sun appears, what happens? It turns
6	Cs	Dia Day

Excerpt 6: Enthusiasm knowing the answer. (EE52, PS5, G1)

and comparisons are involved, being it about temperature, distance, size, age, etc. The astronomic scale of the universe and its objects is definitely a source of awe, amazement, disbelief and surprise in the sessions recorded. In addition, demonstrations of concepts or information, use of humour and other techniques are also employed. Even so, the most common source of awe and related emotions are the visual features of the planetarium. Planetarians are aware of the potential of the projections in triggering emotional responses from the public. These emotions arise specially when something new is visually revealed. The most effusive reactions, which are related to many of the collective emotional expressions, are triggered by the illumination of the night sky projection, whether when the stars and constellations are revealed or made much brighter. Figure 2, captures the expressions observed during these moments.

The night sky catches people by surprise. These moments are sometimes used to communicate that in a place with low light pollution they could also experience it, for real.

Many times, the emotional reactions are followed by questions and comments and seem to raise participation,

attention in the session and in what the guide is saying/doing/asking. Other times it adds agitation, parallel talk and comments, that can be signs of excitement and of being moved by the emotional event. To other children these moments seem to evoke reflection, lasting joy, contemplation or pause to let the information sink in, as also happens in observations of the sky (Marques and Carlin 2025).

In general, in the different interactions we found that the children engage with the guide, the session and the projection in different ways, namely: answering questions, sharing knowledge and making connections with their experiences, showing emotions and describing them, making questions, observing with attention, and following the guides guidance and instructions.

SPECIFIC TOPICS

Analyzing the topics related to human-cosmos connection (T1), awareness about light pollution (T2), and encouraging people to observe the real night sky (T3), 172 references were found. The results show that these topics are present in most of the sessions, with only three sessions not addressing any of them. Nevertheless, the references occurs in a very subtle or superficial way. In 71% of the sessions there is talk about the human-cosmos connection. Here the topics revolve around the role of ancestors in initiating the observation of the sky, their understanding of the regularities of the events and its utility to measure time. There are also references to the constellations and their relation to culture, the use of stars for orientation and the connection between birthdays, the Earth's revolution and zodiacal constellations, among others. Nonetheless, from all the 69 interactions involving this topic, 58 were conducted by the same planetarian, showing that it is not a topic addressed by the generality of guides participating in this study, and not introduced in a diverse way. An example is transcribed in Excerpt 7, below.

Concerning T2, light pollution, the instances found were less (total of 37), with only 50% of the sessions recorded addressing this topic. Moreover, almost all the references were made by only 2 planetarians, showing that it is a subject that is not so commonly addressed. Most instances refer and describe/define what light pollution is and its impacts. Many times this is exemplified with the night sky projection, by changing the brightness of the projection and the amount of external light in the planetarium. More seldom guides refer to the conditions for observing the Milky Way, the difficulties observing in the city and where to go to observe a dark sky, as exemplified in Excerpt 8.

For the topic T3, with a total of 65 instances, the results were similar, with only 4 guides/planetarians explicitly encouraging people to observe the night sky, explaining how to do it, where and how to start, and just in general encouraging the public to look more to the night sky and its objects. These results also reveal some of the interactional methods guides use to achieve this, for instance, talking explicitly about what is visible later, at night, in the day of the session; affirming that observing the sky is simple; explaining

how to start observing, step by step; inviting the children to look at the sky, to go out that night and observe what they are observing in the planetarium; asking the children to promise they will observe the night sky; telling them that the real sky is much better than the simulated one; making the public know how lucky they are and that they should take advantage of the good sky they have at their disposal, when the sessions take place in smaller cities or villages; and in general encouraging the public to go out, observe and enjoy the night sky and its objects and constellations. Examples of interactions concerning these topics are present in Excerpts 9 and 10.

DISCUSSION

To conclude this overview of the results, some general observations and directions for further development and analyse are presented.

First, the data set is notably rich and different aspects of the emotional expressions can be studied, some of which have already been explored here. It is clear that the role of the guide/planetarian is central and that the methods they employ, both in terms of communication, emotional connection with the public and ways to deliver the content, greatly shape the session and its emotional profile. With the youngest audiences, particularly pre-school children, the role of the educator/teacher that accompanies them is more prominent than in the other age groups studied. Educators actively help children to navigate in the planetarium experience, adapt the language, make connections, help children interpret what they are seeing and enrich the emotional experience by expressing their own emotions, leading and teaching the children. At the same time, young children are very open to the experience and are easily moved, having many effusive and spontaneous emotional reactions of awe, surprise and excitement, sometimes in unsuspected moments. Nonetheless, guides and educators have a specially active work in keeping them engaged, paying attention and following the session. Closer collaboration with educators would help refine the priorities and methods best suited to these audiences.

It is also evident that the more enthusiastic the guide, the more enthusiastic the public, or at least the more openly emotions are expressed. Equally, the larger the planetarium the less opportunity there is for interaction and the sharing of emotions. The kind of interaction with the guide or within the group that can happen in small planetariums after the emotional moment, and that can potentiate the emotion, prolong it, etc., is harder to facilitate in a large planetarium. On the other hand, the visual impact is stronger in large planetariums, however, at least within this dataset, it appears that it is not so much the visual quality itself that triggers the emotional response, but rather the surprise effect of the revelation of the visuals. This should be further analysed. That said, small planetariums appear better suited for small

EXCERPT 7

1	G	E foi assim que a humanidade começou a so... a sobreviver melhor! And that's how humanity began to sur... to survive better!
2		Por exemplo, há um marco muito importante na história da humanidade, For instance, there is a very important milestone in human history,
3		que é a invenção da agricultura. the invention of agriculture.
4		A agricultura só foi inventada depois do Homem observar...? O quê? Agriculture was only invented after Man observed...? What?
5	C	O céu. The sky.
6	G	O céu. Sabem porquê? Porque são as estrelas The sky. Do you know why? Because it's the stars
7		que dizem a altura para semear, para colher... estão a entender? that tell us when to sow, when to harvest... do you understand?
8		Portanto, é muito importante conhecer o céu, não é? So it's very important to know the sky, isn't it?
9		Na antiguidade era muito importante, in ancient times it was very important,
10		e hoje em dia ainda é, não é? Claro! and it still is today, isn't it? Of course!

Excerpt 7: Interaction about the importance of our ancestors knowing the sky.
(ET1-12, PS10, G1)

EXCERPT 9

1	G	não se esqueçam de uma coisa, mais importante, se quiserem um planetário Don't forget one thing, more important, if you want a planetarium,
2		têm todos os dias ao pé de vossa casa um planetário que se chama you have one right next to your home every day, and it's called the
3	T	Céu Sky
4	C	Céu Sky
5	G	céu. ok? basta ir para um sitio escuro, Sky. OK? You just need to go somewhere dark,
6		há aqui muita gente que mora em aldeias, Many of you live in villages,
7		há aqui gente que mora em sitios escuros não há? some of you live in dark places, don't you?
8	C	Há Yes.
9	G	e se de vez em quando foram para um sitio escuro And if every now and then you go somewhere dark
10		e olharem um bocadinho para o céu and look up at the sky for a little while,
11		a pouco e pouco vão conhecendo o céu. little by little you'll get to know it.
12		porque o melhor planetário é sem dúvida o próprio Because the best planetarium is without a doubt the real
13	C	Céu Sky

Excerpt 9: Encouraging observing the night sky with a reminder that the real night sky is always at our disposal. (ET3-11, PS4, G1)

EXCERPT 8

1	G	Infelizmente, não é o céu que a maior parte dos portugueses conhece. Para vocês conseguirem ver céus assim tão estrelados, vocês têm que arranjar sítios que estejam, no mínimo, a cinquenta quilómetros de qualquer fonte de luz. Qualquer cidade, qualquer vila, da maior parte das aldeias...ora, mesmo em Portugal já não há assim muitos sítios onde nós consigamos ter céus assim tão estrelados, céus sem nenhuma luz, céus perfeitos, céus com quase três mil estrelas visíveis. Unfortunately, that's not the sky most Portuguese people know. To be able to see skies as starry as that, you need to find places that are at least fifty kilometres away from any light source. Any city, any town, most villages... well, even in Portugal there aren't many places left where we can have skies that starry, skies with no light at all, perfect skies, skies with almost three thousand visible stars.
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Excerpt 8: References to the poor skies in Portugal and the necessary conditions to find a dark sky. (ET2-34, P37, G6)

EXCERPT 10

1	G	Este é um desafio, olhem... nesta sessão de planetário, o que eu gostava, que vocês se lembrassem quando saírem daqui é de olhar mais vezes para o céu. Que esta sessão sirva para vocês ficarem curiosos, ficarem interessados em conhecer o céu, porque nós estamos aqui a olhar para o céu, mas, se calhar, vocês não conhecem aqui muitas estrelas pois não, pois não? This is a challenge, listen... what I'd love for you to take away from this planetarium session is to look up at the sky more often. May this session make you curious, make you interested in getting to know the sky, because we're here looking at the sky, but perhaps you don't recognise many of the stars up there, do you?
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Excerpt 10: Encouraging to observe the night sky with a wish and a request. (ET3-22, PS11, G2)

EXCERPT 11

1	G	Espero que tenham gostado deste bocadinho I hope you enjoyed this little session,
2		e não se esqueçam de uma coisa muito importante: and don't forget one very important thing:
3		de vez em quando observem um bocadinho o... from time to time, take a moment to look at the...
4	C	Céu. Sky.
5	G	Isso. Isso é que é muito importante. Está bem? That's it. That's what really matters. All right?

Excerpt 11: What really matters. (PS24, G1)

children due to the proximity effect, possibility of feedback, and greater interaction and guidance.

In terms of content, surprise and awe frequently arise from learning something new and extraordinary, as seen, for instance, in children's reactions to the astronomic numbers and scales of the universe. Emotions also emerge when connections are made, when something familiar is recognised in the sky, or when a child discovers that they already know the answer to a question. Methods that can be built into session interactions include inviting children to find objects and answers themselves, encouraging them to draw connections between different facts, prompting them to demonstrate existing knowledge, and sharing surprising information with them. A combination of these ingredients will most likely trigger emotional engagement, attention and enthusiasm (sometimes maybe too much!).

Finally, collective moments are the most effusive ones, bringing everybody together and being contagious. Fostering collective responses and enthusiasm may enhance the emotional dimension of the session, making it more memorable. In the data analysed this is achieved specially through the surprise effect of revealing the night sky for the first time, or by presenting visually striking features such as constellation drawings or high-quality images of planets.

Regarding the topics of fostering a human-cosmos connection and raising awareness of light pollution, these themes could have a deeper and more explicit treatment in planetarium sessions. The fact that the target audience of these sessions was very young certainly influenced the way these topics were approached, in an introductory manner. The results show that the majority of guides do not address these subjects explicitly, while also suggesting that such integration is feasible within existing session structures.

The connections drawn between the history of astronomy and the development of civilizations and science, as well as with everyday life, are noteworthy and give the planetarium sessions an important interdisciplinary dimension.

Light pollution, a pressing problem that affects a large portion of the population in Portugal and many other places worldwide, is under-represented in the sessions. The definition of light pollution, its causes, and its impacts could be explored more thoroughly and illustrated with concrete examples, particularly given that many children have likely never experienced a truly dark sky.

It also seems important that planetarium sessions make an explicit connection to the real night sky. The planetarium is, in part, a simulation of the night sky, and it is important not to lose sight of this purpose and potential. Ultimately, one of the goals of a planetarium session is to encourage people to go out and observe the sky. The planetarium has the potential to act as a "teaser", a way to enthuse the public and inspire them to observe the universe beyond the dome. This connection can be powerfully made through live sessions that recreate the observable sky, often the very sky visible on that

same night. This view is shared by some of the planetarium educators who participated in this study.

FINAL CONSIDERATIONS

In this first systematic look into the emotional landscape of planetarium sessions with young audiences, it is clear that these are emotional activities and that the diversity of emotional expressions is considerable. The planetarium, as a simulator of the night sky that can bring the joy and wonder of looking at the universe and has the potential to offer audiences moments of awe and shared experience, as well as reflection and contemplation.

The overview of results presented here reveals both the richness of this field and its potential for further study, particularly with regards to the specific methods used by guides in creating and managing emotional moments in the planetarium.

Concerning the topics of human-cosmos connection, light pollution and encouragement to observe the night sky, it is valuable for researchers and practitioners alike to explore ways addressing these themes more explicitly, strengthening the connection with the real night sky and bringing greater attention to the problem of light pollution, its causes, and its consequences.

It is also worth noting that the topics explored here, can be, and are, communicated to audiences of all age groups, not only young children, and can in the future be further explored across a wider range of planetarium contexts. Different aspects of the emotional experiences in planetariums, including the topics and phenomena identified and mapped in this present study, also remain open to further research.

We hope the results presented here can serve as a starting point for better understanding the emotions involved in planetarium education, helping to inform session preparation, guide training, and the evaluation of current practice, all with the aim of offering the public richer and more emotionally meaningful experiences in the planetarium and fostering a desire to enjoy the night sky. As captured in the words of one of the guides who participated in this study:

REFERENCES

- Azevedo, F. S., and Mann, M. J. 2018. "Seeing in the dark: embodied cognition in amateur astronomy practice." *Journal of the Learning Sciences* 27:89–136. <https://doi.org/10.1080/10508406.2017.1336439>
- Bonham, M. 2017. "Micro-interactions of cosmic proportions Mediating human-cosmos relationships in the planetarium". In *Microsociological Perspectives for Environmental Sociology*, edited by Brewster, B. H. and Puddephatt, A. J., 17-31. Routledge.
- Carlin, A. P., Marques, J. B. V., and Moutinho, R. (2021). "Investigating learning moments in astronomical observatories using video-recorded data". In *Sage research methods cases part 1*, edited by M. Gill and C. Schorffheide, 1-17. SAGE Publications Ltd. <https://doi.org/10.1002/9781119454545.ch1>

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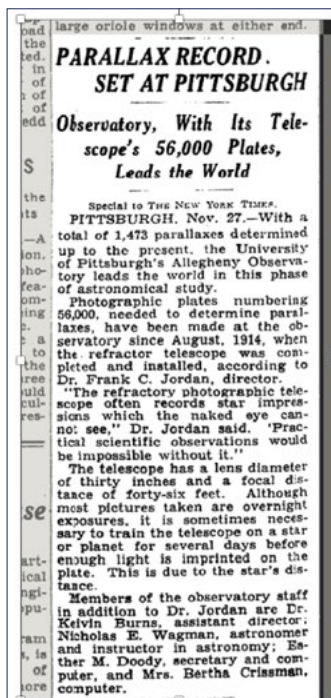
WOMEN OF THE ALLEGHENY OBSERVATORY: PARALLAX COMPUTERS

Linda Kucan

A front-page story in The New York Times on November 27, 1937, carried this headline:

Parallax Record Set at Pittsburgh: Observatory, With Its Telescope's 56,000 plates, Leads the World

The two computers named in the article--Esther M. Doody and Mrs. Bertha Crissman-- are among several women who contributed to the parallax work at the Allegheny Observatory (AO) in Pittsburgh. Ultimately, more than 110,000 glass photographic plates were analyzed by women computers at the AO to determine the distance to stars. Their story is one that has yet to be told. This article attempts to do that.



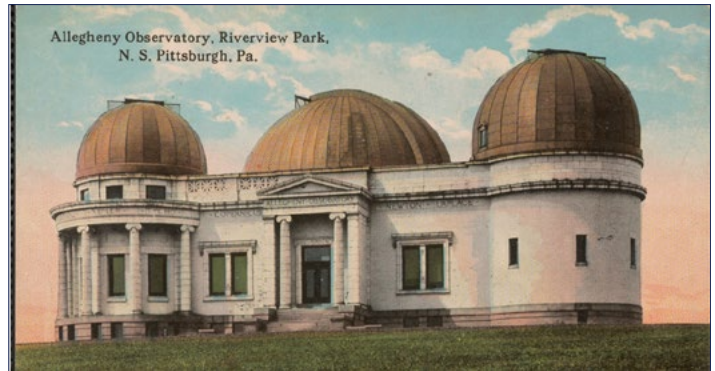
New York Times, November 28, 1937, pg. 1

private individuals, colleges, communities, and the Federal government" (Musto, 1967, p. 87). Of particular importance for the Allegheny Observatory was the construction of the Cincinnati Observatory in 1843. That observatory had been built on money raised by subscription, that is, by pledges from individuals. Taking a cue from that example, a similar subscription effort was launched by Professor Lewis Bradley in southwestern Pennsylvania: he founded a Telescope Association and acquired enough funds from 20 wealthy subscribers to purchase a telescope. The Association sponsored public lectures and viewings, and astronomy became a popular interest. Eventually, a group of residents in Allegheny City donated land for an observatory, and a

Three converging developments created the opportunity for women to engage in the parallax work at the AO. One was the construction of observatories. Another was the rise in educational opportunities for women. And another was the development of glass plate photography. These developments were intimately connected.

AMERICAN OBSERVATORY MOVEMENT

According to historian David Musto, there was a period of "rapid construction of American observatories in the third and fourth decades of the nineteenth century. After the year 1830 or so, observatories were built in increasing numbers by



Allegheny Observatory.

building was erected in 1862. Subsequently, a new building was erected at a higher elevation and dedicated in 1912. That building was named the Allegheny Observatory because the original building was in Allegheny City, which was annexed to Pittsburgh in 1907 and became known as the North Side (Beardsley, 1981).

EDUCATIONAL OPPORTUNITIES FOR WOMEN IN THE UNITED STATES

Historian Margaret Rossiter foregrounded another important but often overlooked development in the United States in the nineteenth century. "[B]y mid-century this nation led the rest of the world in the amount of public and private education available to women" (Rossiter, 1982, p. 1). The founding of some important women's colleges overlaps with the constructing of observatories in the mid- and late 1800s, including: Mount Holyoke (1837), Vassar (1861), Wellesley (1870), and Radcliffe (1879). Among coed institutions, Oberlin College admitted women students as early as 1837, and several universities admitted women in the late 1800s, including: University of Missouri (1868), Northwestern University (1869), University of Michigan and University of California, Berkeley (1870), University of Chicago (1892), and University of Pittsburgh (1895).

It is also interesting to note the awarding of degrees in astronomy and the women faculty who supported women students in earning those degrees in the early 1900s. Vassar, with five such graduates had the most, beginning with Maria Mitchell's student Mary Watson Whitney, who succeeded Mitchell as the director of the Vassar Observatory. Radcliffe, Michigan, and Wellesley also graduated women astronomers before 1920.

GLASS PLATE PHOTOGRAPHY

Concurrent with the construction of observatories and the increase in educational opportunities in astronomy for women was progress in observational astronomy with glass

plate photography. A glass photographic plate is simply a piece of flat glass with a chemical emulsion on it. The plates were attached to telescopes, and images of stars and planets were secured. The plates were developed just as film negatives were developed. Glass plates could be used to determine the location of stars and planets and to compare their luminosity, or brightness. Attaching a prism to a telescope could capture spectra of stars on the plates and so reveal what elements they were made of.

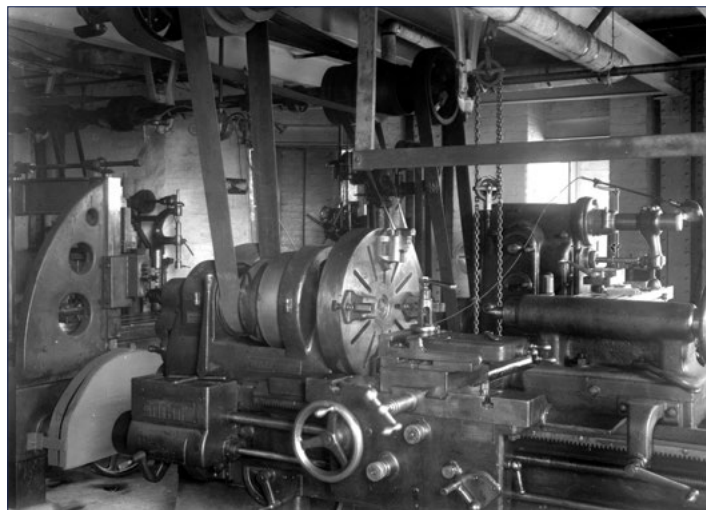
Harvard Observatory collected more than 550,000 glass plates. Those plates provided a wealth of data to be analyzed, and that analysis was carried out by women computers. The word computer is used today to refer to complex machines that can engage in a wide variety of applications, but, in the nineteenth and early twentieth centuries, computers referred to human beings who carried out calculations. The Harvard computers used the data on Harvard's photographic plates to determine the positions of stars as well as their brightness and their composition. The names and accomplishments of these women have been acknowledged in books such as Dava Sobel's *The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars* (2016), and in articles such as Lindsay Smith Zrull's "Women in Glass: Women at the Harvard Observatory During the Era of Astronomical Glass Plate Photography, 1875-1975" (2021). Women computers were also employed at the AO; however, their names and achievements have not been so acknowledged.

THE PARALLAXES OF THE ALLEGHENY OBSERVATORY AND THE WOMEN WHO MEASURED THEM



Frank Schlesinger, who became the director of the AO in 1903, had an abiding interest in the use of glass plate photography with a specific interest in using the data on those plates to determine the distance to stars. Such a focus was a pioneering enterprise. Most observational astronomy at the time was dedicated to determining star location, luminosity, and composition.

The calculations required to determine the distances of stars were complex



Workshop at Allegheny Observatory 1910-1930; University of Pittsburgh Library Digital Collections, Allegheny Observatory Records

and time-consuming, and involved measuring multiple plates exposed across multiple years.

In 1914, the AO acquired a 30-inch refractor telescope purchased by William Thaw Jr. in honor of his father, who had contributed generously to the Observatory over many years. A refractor telescope uses lenses to focus the light from celestial objects. A reflector telescope uses mirrors to focus that light.

The Thaw Refractor was and still is the third-largest refractor in the United States. Over more than 70 years, that telescope was used to expose more than 110,000 plates. In 1915, Schlesinger published an article explaining how photography could be used to determine the distances to stars (Schlesinger, 1915). Specifically, Schlesinger explained that photographing a large area of the sky on a single photographic plate would allow astronomers to use the distances of stars whose positions were already known to determine the distances of stars yet to be measured. Those distances were critical in understanding the dimensions of the cosmos.

The optical parts of the camera used for the parallax work at the AO were designed and produced by the John A. Brashear Company of Pittsburgh. Schlesinger and Charles J. Hudson built the mechanical parts in the workshop of the AO.

Basically, the parallax process involved selecting a star and photographing it at two points in the earth's orbit, once in June and once in December. The parallax, or shift, in the star could be seen by comparing the star's position relative to more distant stars in the background. In an article by Schlesinger and Hudson (1916) describing the process of using a wide-angle camera to determine star positions, Louise Freeland Jenkins is mentioned as one who had provided "very efficient assistance" (p. 72). Jenkins's name also appears with several other women computers in article by Schlesinger published in 1919 which documented the position of 50 stars

using the photographic plates exposed by the Thaw refractor (Schlesinger, 1919).



Louise Freeland Jenkins, Mount Holyoke Archives and Special Collections, 1911

Jenkins was a graduate of Mount Holyoke and became an assistant in astronomy there. In 1913, she was hired as a computer at the AO. By 1915, she had resigned and returned to Mount Holyoke as an instructor. While there, she made use of the college telescope to study sunspots as well as variable stars, stars whose brightness seems to change over time. In 1920, she went to Japan as a missionary, bringing along a telescope so she could continue to observe variable stars. When Jenkins returned to the United States in 1932, she was employed by Schlesinger, who was then the director of the Yale Observatory.

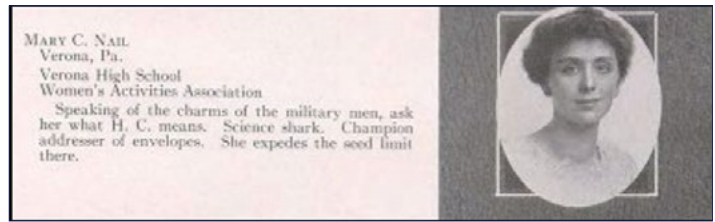
Schlesinger and Jenkins published the second edition of the *General Catalog of Parallaxes* (1935) which documented the parallaxes of 9,000 stars which had been measured at multiple observatories, including the AO in Pittsburgh. Jenkins also co-edited *The Astronomical Journal* until 1958. In her honor, there is a crater on the moon named after her (Hoffleit, 2014).

Other women are acknowledged in articles documenting the parallaxes they computed. Like Jenkins who graduated from Mount Holyoke, they graduated from the women's colleges and co-ed universities mentioned earlier. These include Marie Bender (Swarthmore), Lois Denton (Vassar), Harriet Knudsen (Northwestern), Mary C. Nail (University of Pittsburgh), and Florence Stocker (Radcliffe).

The 1919 article documenting the distances to 50 stars authored by Schlesinger presented the measurement tables for each star with notations about the computers who completed the calculations. For example, for the star Beta Arietis, the notation reads: "Miss Stocker measured Plates 869, 992, 1024, and the last four; Miss Bender the others" (p. 25). Miss Denton is credited with measuring the parallaxes of 29 stars in the same article.

Mary Nail is listed as second author on another 1919 paper with Schlesinger documenting the distances to 30 stars. The article states that "All the measurements were made by Miss Nail" (Schlesinger & Nail, 1919, p.153). Harriet Knudsen is also listed as second author on a 1919 paper with Schlesinger measuring the parallaxes of 25 stars (Schlesinger & Knudsen, 1919). Florence Stocker is second author on a 1920 paper with Schlesinger measuring the parallaxes of 28 stars (Schlesinger & Stocker, 1920). Another paper published in 1920 lists Lois Denton and Marie Bender as co-authors with Schlesinger documenting the parallaxes of 49 stars (Schlesinger, Denton, & Bender, 1920).

Nail was a graduate of the University of Pittsburgh in 1917. In *The Owl*, Pitt's yearbook, she is described as a "science shark" (University of Pittsburgh, 1917, p. 47). A report in the Allegheny Observatory archives notes that Nail and Stocker resigned from the AO in 1918 to take positions at the United



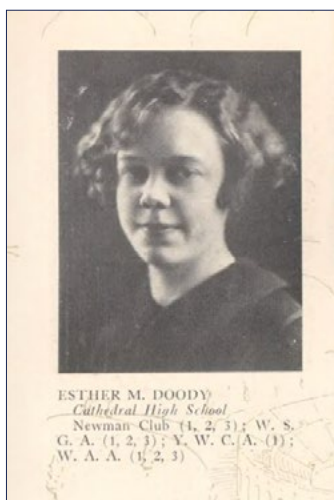
States Bureau of Standards in Washington, DC (Jordan, 1918). Knudsen resigned in 1919 after marrying a co-worker, Carl Kiess. In later years, she co-authored papers with her husband and published pioneering work on the atmosphere of Mars (Sieminski, 2025).

The parallax work was a monumental undertaking. In a 1921-1922 report summarizing that work, Director Heber D. Curtis wrote that: "[O]ur total of about 50 star distances is still about twice as great as that of any other observatory in the world and, in fact, comes fairly close to being as much as has been accomplished by all the other observatories of the world taken together in the field of photographic parallax determinations" (Curtis, 1922). In a report for 1922-1924, Curtis noted that: "Fifty parallaxes have been published in this period by Miss Grier, and about 120 more are ready for publication. This brings the Observatory's total up to about 770, a larger number than has been secured by any other observatory" (Curtis, 1924).

Acknowledgement and authorship are important indications that the work of the computers was highly valued. Such valuing is also apparent in a letter from Director Heber D. Curtis in 1927 to Miss Bretney, a woman who had applied for a computing position but was found wanting. "[Y]ou doubtless yourself realize after a few days trial that this work over here is in many ways a very special one. So much is this the case that I estimate that only about one girl in ten is really fitted for this work [which involve] lightning quickness in the fundamental processes... [and] 'absolute lack of 'nerves'" (Curtis, 1927).

Bertha Grier Crissman was the computer who tested Bretney. In contrast to the computers mentioned above, Grier Crissman worked as a computer from 1920 through 1960 with time away to have her children. She had only a high school education, but her work was considered to be exemplary by editors of *The Astronomical Journal*, where she published numerous articles as sole author. When she resigned in 1928 to have her first child, Director Curtis wrote to her: "You have given us eight years of willing and most efficient service. ... You have also become an unusually rapid and accurate computer in the field of stellar parallaxes. ... In this interval, you have published under your own name the parallaxes of one hundred and sixty stars, which we believe to be the record for any single individual, anywhere" (Curtis, 1928).

Esther M. Doody, a Pitt graduate, was hired to take Grier Crissman's place. When Grier Crissman returned to the AO, she and Doody were named in the front-page story in *The*



Esther M. Doody, The Owl,
University of Pittsburgh Yearbook,
1926, p.85

New York Times mentioned earlier, which announced the remarkable number of parallaxes secured at the AO (New York Times, 1937). Like other computers, Grier Crissman and Doody began their tenure at the AO as secretaries. They were given opportunities to learn measuring and computing and proved their abilities. In 1941, Doody was promoted to astronomer, the only woman to attain that position at the AO up to that time.

Ellen Jameson was another noteworthy computer at the AO during the 1940s

and 1950s. She and Director Nicholas E. Wagman initiated a program of recalculating the parallaxes measured at the AO by making use of the increased number of photographic plates collected over time and better measures of comparison stars (Wagman & Jameson, 1950). Bertha Grier Crissman's daughter Helen was hired at the AO in 1951 as a computer. In the October 1957 issue of *The Astronomical Journal*, she was listed with Director Wagman in an article documenting the parallaxes of 35 stars. In that same issue, her mother was listed as the author of an article documenting the parallaxes of 55 stars. Grier Crissman's last work on parallaxes was published in 1963 (Wagman, Daniel, & Grier-Crissman), three years after her death. She remains the computer with the longest tenure at the AO. By 1960, she had published 401 parallaxes under her name.

It is important to note that computing a parallax involved measuring multiple plates across multiple years. In a 1934 article by Grier Crissman, she explained that computing the distance to 23 stars involved calculations on 30 plates for each star—690 plates for that article (Grier Crissman, 1934). In a 1950-1951 report by Director Wagman, he noted that “Miss Lauterbach is now measuring 105 plates of Sirius taken in the years 1920-26 and 1931-51” (Wagman, 1951).

I could find no photographs for most of the women computers at the AO, including Bertha Grier Crissman. I also could not find personal letters that might capture their “voices.” Rather, their published articles written in a formal register for scientific research is all that is available. For one computer, however, I found a treasure trove of photos, letters, and newspaper clippings in the University of Pittsburgh Library System's Archives and Special Collections—all related to Theodora Lauterbach.

I discovered several documents related to Lauterbach in the archives. One was a note that she wrote to Wagman about a

phone call that Zaccheus Daniel, an observer at the AO, had received (Lauterbach, 1951).

Dr. Wagman: At about 2:15 this morning, Mr. Daniel came through the dome and said a man had called... with a story about a meteorite fall in his backyard! ... Mr. Daniel said that the man lived in the South Hills, and was practically “knocked out of bed” by the impact! The man looked out and saw a fire in his yard. He put it out with a hose. He found a hole about four feet across (I think; or maybe it was four feet deep?) and a chunk of something which he said was several feet long. He said to Mr. Daniel:—I think it's a meteorite. Mr. Daniel seemed to think it was pretty unlikely ... but I think the guy has a pretty good entry for the prize understatement of 1951! Anyway, Daniel suggested that the man phone a reporter, and perhaps call you at work today. I hope he calls, I hope he's got a meteorite, and I hope that the A. O. will beat out the B. P. [Buhl Planetarium] on the publicity angle!

I was intrigued by the flair of this woman who signed her note “Teddy.” I later found a letter from the editor of *The Astronomical Journal* posing some questions related to the manuscript of an article she had written with Wagman (Strand, 1952). Although Lauterbach was the first author, the letter was addressed to Wagman. On the back of that letter, I found Lauterbach's response to the queries. I knew it was Lauterbach who responded because I recognized her handwriting (Lauterbach, 1952). The article was published in



Theodora Lauterbach and Helen Crissman, Theodora Lauterbach Papers,
Allegheny Observatory Records



Director Wagman and Theodora Lauterbach under the Thaw Refractor, 1951.
Theodora Lauterbach Papers, Allegheny Observatory Records

1952 and documented the parallaxes of 52 stars (Lauterbach & Wagman, 1952). So, Lauterbach was an adept computer as well as a meteorite enthusiast.

In the archives, I also found a letter from Wagman to a photographer requesting a copy of a photograph of Lauterbach and himself under the Thaw Refractor (Wagman, 1973). I wanted to find that photo as much as Wagman did, so I asked Zach Brodt, University Archivist and Records Manager. Zach said that Theodora Lauterbach was a name that he recognized because someone had recently donated a box of materials to the archives that included letters, photos, and newspaper clippings—all related to Theodora Lauterbach. The contents of the box had not yet been catalogued, but Zach was willing for me to review them. They were a revelation.

The box included a newspaper article with a photograph of Teddy and Helen Crissman identifying them as astronomy assistants and describing an upcoming star party at the AO where guests could look through telescopes (Theodora Lauterbach Papers).

The photo of Teddy and Wagman under the Thaw Refractor was in the box, too. Wagman is cleaning the huge lens while Teddy looks on (Theodora Lauterbach Papers).

There were 58 letters in the box, all written to Teddy's high school English teacher, Miss Helen DeFrance. A newspaper clipping announced that Wagman and Lauterbach would present a paper comparing past and present parallaxes at the

Annual Meeting of the American Astronomical Association at Indiana University in 1950. In a letter to Miss De France, Teddy described her experience at the meeting as "wonderful days of mighty minds grinding at intangible problems, formal meals, intelligent chats, casual introductions, relaxed faces, long walks, luxurious surroundings, and the very fine sort of indirect humor which seems peculiar to the American Astronomical Association. ... It was grand" (Lauterbach, 1950).

Teddy also composed a history of the AO that was first published in a Pitt magazine and then later as booklet in 1959. In that document, Teddy described the history of the observatory and explained the astronomical research in spectroscopy, parallax, and binary stars being conducted there. She wrote to Miss De France about her work. "The A. O. booklet will be printed in the next (Spring) issue of Pitt—complete, thank God!... Reason for not cutting anything out ... Mrs. Starrett [the editor] said she has read it through sixteen times and still finds it too well-written to bear cutting. ... Honest analysis forces me to suspect that she struggled through it once or twice and found the subject matter too unfamiliar for her criticism. Anyway, it's good news" (Lauterbach, 1952).

In the third paragraph in the introduction of the history, Lauterbach wrote: "Astronomy, the oldest of the sciences, is education in its purest form, for astronomy exists only because men want to know and understand the universe that surrounds them (Lauterbach, 1959, p. 3). Those words are found on the current AO website with the word men changed to people (University of Pittsburgh Department of Physics and Astronomy website).

Lauterbach left the AO to join the US Women's Air Force in 1952, but she continued to correspond with Miss DeFrance and with Director Keiven Burns. In a letter to Burns in May, 1952, from a training camp in Texas, she wrote: "I am just beginning to miss the A.O.--and even the stars. Doesn't it seem fantastic to be unable to see stars when one knows the sky is clear? You see we're not allowed to go out after dark and, indeed, we're supposed to be asleep by 9:30!" (Lauterbach, 1952).

After Lauterbach's death in 1979, retired Director Wagman wrote a vignette about her that was among the papers that Miss De France had saved. His tribute reveals even more about Teddy. "As an observer, she often walked the observatory hill at odd hours of the night to take the morning, midnight-to-dawn, shift. ... Such a shift was a real test of perseverance for a single girl—alone in the large, dark dome, skillfully guiding the giant telescope on a tiny stellar image while exposing one of the tens of thousands of photographic plates used in the extensive program. . . . Her devotion to her work was exemplified at the time of the great snow of November 1950, when she climbed the observatory hill through hip-deep snow to reach the observatory on Saturday morning to see what could be done to put the

Continued on pg. 55



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SCIENCE FICTION UNDER THE DOME

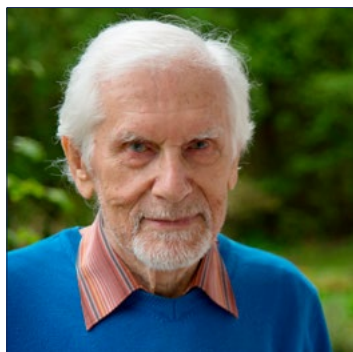
Susanne Paech, CEO, "art meets science – Foundation Herbert W. Franke"

We present three full-dome adaptations of Herbert W. Franke's thought-provoking science fiction short stories. The thrilling plots, one of which was brilliantly adapted into a fulldome production by director Sergey Prokofyev, revolve around the question of whether there is a creator beyond our universe. Franke published the scientific basis for these ideas in a scholarly work titled "The P Principle" ("P" stands for program) in 1995. Franke believed that our universe is shaped not only by initial conditions and the laws of nature but also by a higher-order algorithmic system. This system defines the rules for the interplay of order and chaos, creating increasingly complex structures and even intelligence.

"A LEAP INTO THE VOID": HUMANITY BETWEEN FAITH AND KNOWLEDGE

The producers commissioned the world-renowned fulldome artist, Sergey Prokofyev, to direct the multimedia adaptation of their most significant production to date: "A

Leap into the Void"¹ from



¹ First publication in Herbert W. Franke: ""Sprung ins Nichts", in: "Spiegel der Gedanken", Suhrkamp-Verlag,

Herbert W. Franke was a visionary who always ventured into uncharted territory, whether it was underground, in space, or in the future of art. He was a theoretical and speleologist, science fiction writer and pioneer of generative art since the 1950s. Photo by art meets science – Foundation Herbert W. Franke

This still shows the visual concept of the fulldome production opening "A Leap into the Void," directed by Sergey Prokofyev and produced by the Foundation Herbert W. Franke and HYPERRAUM.TV. Photo by art meets science – Foundation Herbert W. Franke

1990. (Fig. 01) They were written by the austrian theoretical physicist Herbert W. Franke (1927–2022). Prokofyev (brought this profound story of the conflict between faith and knowledge to life with magnificent visuals and a stunning soundtrack created by Luca Lagash and 3001 The Creative Odyssey, keeping the narration so that it remains the central element of the film. See also Sergey Prokofyev's personal statement added in the text box.

Plot summary: A prophet encourages a group of people to jump into a fog-shrouded abyss. His message: "You will fly! You just have to believe!" Frederik is one of them. However, despite the prophet's convincing and repeated message, Frederik is filled with deep doubt. He is certain that humans cannot fly and will therefore plummet to the ground. Everyone else has already plunged into the void, following the prophet's instructions. Now, the prophet turns directly to Frederik, urging him to jump as well. However, Frederik continues to defy the prophet. In a surprising twist, it becomes clear that he is not in reality, but in a virtual test environment. Frederik was the only one to resist the prophet's attempt at manipulation, and thus the only one to pass the test. In an epilogue, Frederik recalls this event from his past life, which subsequently helped him to achieve a successful career. Now, however, he is old and sick and wonders whether there might be a third, unlikely possibility of another existence in a different world at the end of his life.

For this 15-minute production, Prokofyev and the producers decided to create three visual worlds: an introductory world for the short prologue, in which Franke establishes a philosophical framework independent of the main story:

Perhaps our world seems narrower to one person and wider to another, depending on levels of education and freedom. But even the widest horizon is a limit, whether you can overcome it or not. A world experienced, imagined, or simulated...? Whether or not it is a real world is probably less important. What humans expect or hope for is more important than what actually exists. Although an object of hope, some of it eludes description; at best, it can be grasped through a parable. Nevertheless, it is the only thing that can be set against our fears.

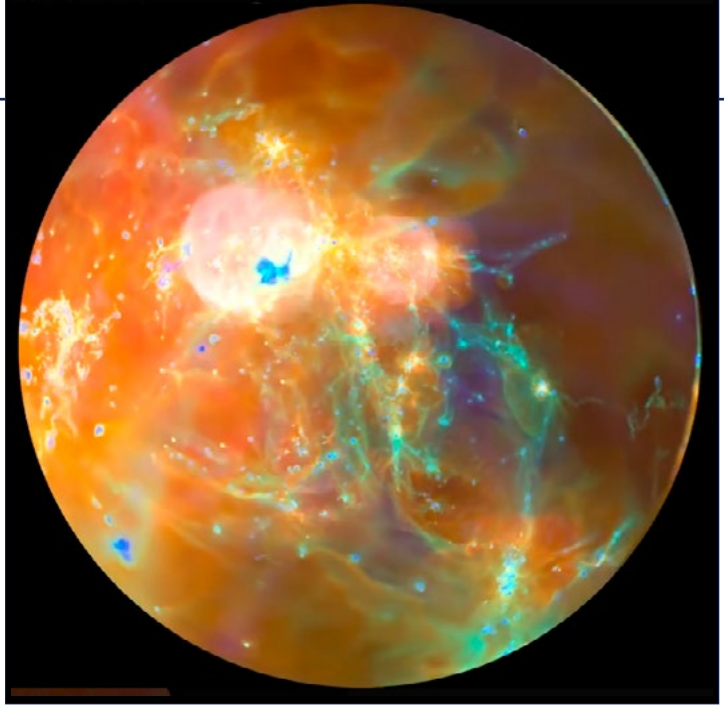
The main section contains the story itself, depicting an abstract, minimalist landscape in which the protagonists act. The characters' faces are not recognizable, representing humanity rather than individual human beings. The epilogue is the only part that makes a difference. There, the main character's face is briefly shown when Frederik recalls his life in the virtual world.

At the heart of the story lies one of humanity's biggest questions: Is there a creator? The question remains unanswered until the very end of this story.

Frankfurt 1990



This still shows the full-dome production “The Green Comet” directed by Susanne Paech and produced by the Foundation Herbert W. Franke and HYPERRAUM.TV. Photo by art meets science - Foundation Herbert W. Franke.



This still shows the full-dome production “The Evolution Game” directed by Susanne Paech and produced by the Foundation Herbert W. Franke and HYPERRAUM.TV. Photo by art meets science - Foundation Herbert W. Franke.

“THE GREEN COMET”: THE LAWS OF NATURE AS A CREATIVE FORCE

“The Green Comet” dates back to 19602. This anthology of 65 ultra-short stories, each only two or three pages long, was the first science fiction book Franke published. This short story is unique in Franke’s creative process: Franke came up with the idea to have the final story unfold without any human characters.

“The Green Comet” is an allegory about the end of the world. The protagonist can be interpreted as an universal “creator”, an entity defined by mathematical laws and algorithms. He ‘exists’ in a vast cosmos made up entirely of energy, and his task is to keep it balanced. However, he suddenly finds himself facing an unexpected challenge. He engages in a showdown with another entity similar to himself and ultimately absorbs it. Searching for the origin of this foreign entity, he stumbles upon a universe enclosed in the fourth dimension, hidden in a corner of his cosmos. He takes the form of a three-dimensional body and plunges into it. Like a comet with a glowing green gas tail, he approaches the Milky Way and finally Earth. What happens next remains to be seen.

The actor portrays a godlike, universal “ruler” of worlds whose existence defies our imagination. This seven-minute production was visualized using generative abstract art. Only at the end can the Milky Way and Earth be seen (Fig. 6-7).

“THE EVOLUTION GAME”: GOD AS A COMPUTER GAMER

The story of “The Evolution Game”³ (1990) centers on Roland Briest, a computer game nerd searching for the ultimate scientific simulation of an emerging, self-aware

² First publication in Herbert W. Franke: “Der Grüne Komet”, Goldmann Verlag, Munich 1960

³ First publication in Herbert W. Franke: “Das Evolutionsspiel”, in: “Spiegel der Geadanken”, Suhrkamp Verlag, Frankfurt 1990

universe. Briest achieves this goal by the end of the story, though he has not foreseen the ultimate consequence of his success. At that moment, the entire universe dissolves. The story’s final sentence reads: “The experiment was a success.” This closing line reveals the Creator to be a player who lost interest in the universe once it became self-aware. Therefore, the Creator brings the universe to an end. This surprising twist portrays the creation of humanity in God’s image in a Kafkaesque manner.

For the full-dome production, the producers used the story’s central theme, a simulation model of the universe, as the visual backdrop for the narrative. At the heart of the production is a magnificent full-dome simulation of the universe known as “Star Forge.” This public domain sequence was created 2022/23 through a collaboration between NORLab in the U.S. and the Mannheim Planetarium. In “The Evolution Game,” Star Forge serves as a visually stunning allegory of the computer game designed by Briest, first presented in a research laboratory.

For the 16:9 version, the producers conducted a few test screenings to compare the perception in a full-dome environment with that of a 16:9 flat projection. The results made it very clear that a conventional screen format engages the viewer visually to a much lesser extent. The producers decided to shorten the “Star Forge” simulation and replace it with other visual worlds. (Fig. 8-9).

THE P-PRINCIPLE – DO WE LIVE IN A COMPUTATIONAL UNIVERSE

These science fiction stories relate strongly to a book showing Franke’s Do we live in a “programmed” universe? In his book The P Principle: The Laws of Nature in Computational Space, he explored this concept in a

Continued on pg. 32



RENDERAREA
FullDome Show Production

A FULLDOME FILM BY JAVIER BOLLAÍN



BETTING ON A LIVING UNIVERSE

DARK BIOSPHERE

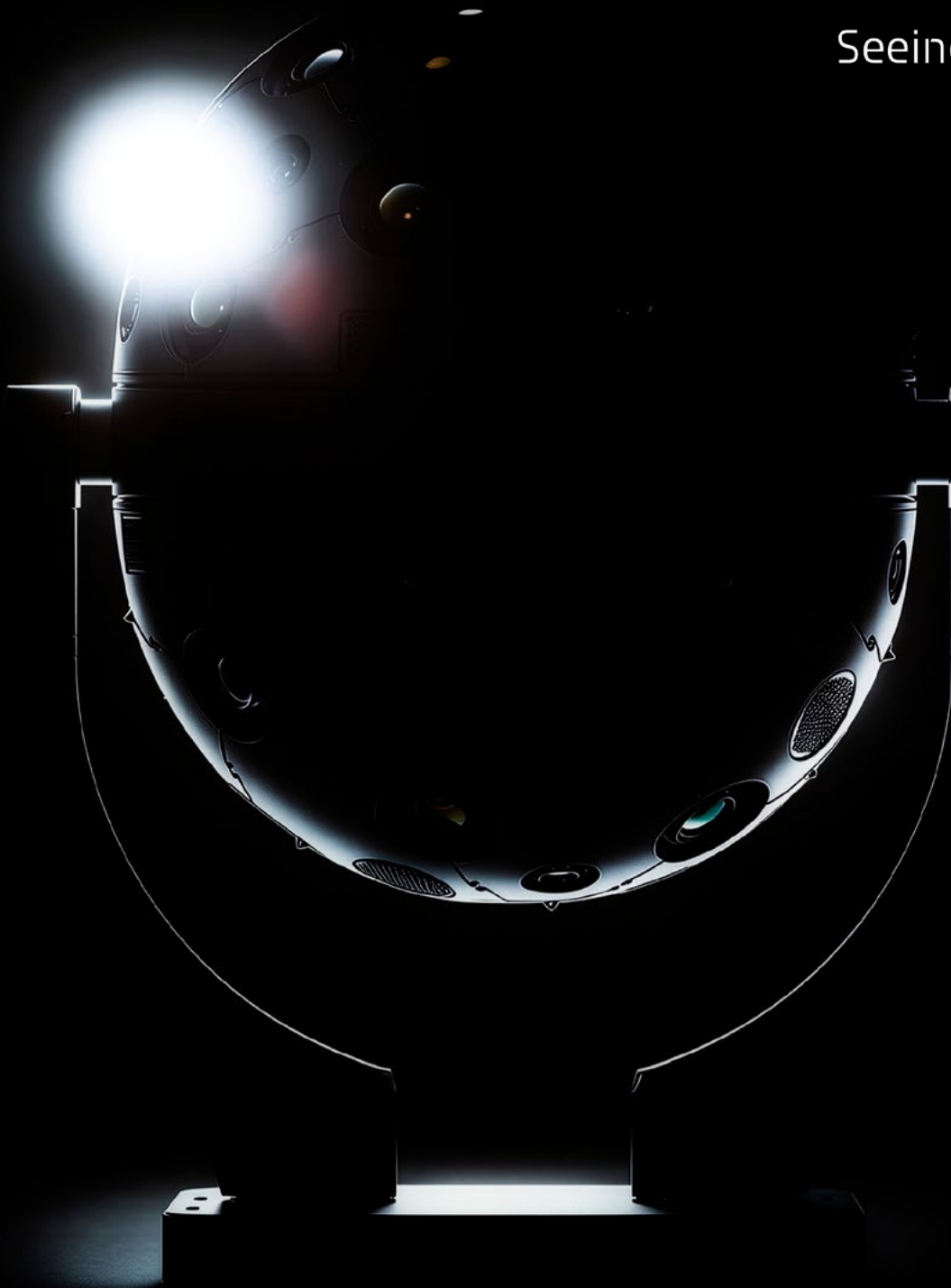
NARRATED BY
VIGGO MORTENSEN



A new star is born

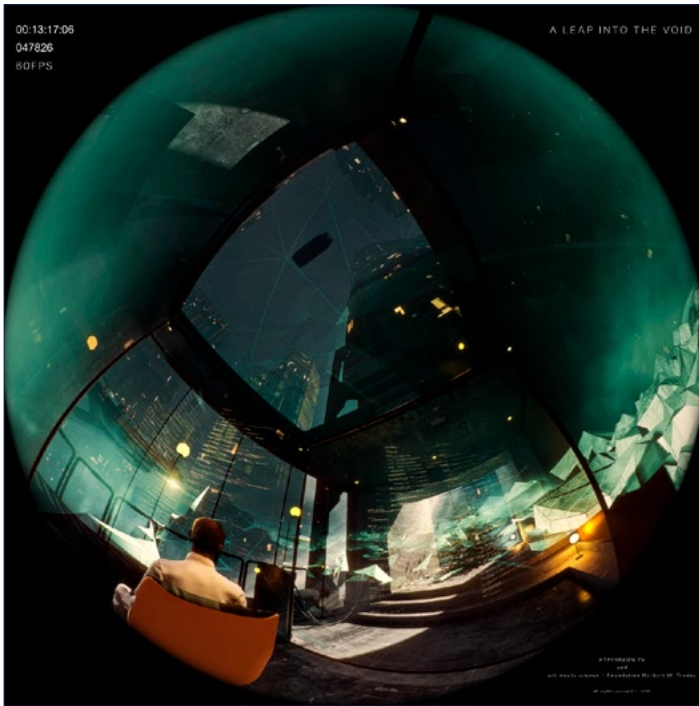


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This still shows the visual concept of the full-dome production opening “A Leap into the Void,” directed by Sergey Prokofyev and produced by the Foundation Herbert W. Franke and HYPERRAUM.TV. Photo by art meets science - Foundation Herbert W. Franke

scholarly manner. The subtitle refers to Konrad Zuse, the German computer scientist who first published the concept of computational space in 1969. Franke expanded upon Zuse’s idea, supplementing it with the latest research on emergence, synergetics, chaos theory, systems theory, and cosmology from the 1990s. According to Franke, we live in a teleologically evolving cosmos in which chaos and order—the genuine random processes of quantum physics and the algorithmic regulatory processes of the laws of nature—appear to be in opposition to one another. Franke resolves this contradiction by embedding both processes within a higher-order framework. Within this framework, processes evolve toward increasing complexity. In his book, Franke intentionally leaves open the question of whether a “Creator” existing outside our world designed this higher-order system. Identifying with the Vienna Circle school of thought, he believed that such questions could not be proven scientifically. To him, these metaphysical concepts defined the limits of research.

SCIENCE FICTION AT ITS BEST – COMBINING EDUCATION AND ENTERTAINMENT

However, this did not stop Franke from breaking boundaries as an artist. As a science fiction author, he creatively explored unknown fictional worlds. He has written around thirty science fiction books, including novels; more than two hundred short stories; and several radio plays. Franke has received numerous awards for his work. In 2017, the European Science Fiction Society honored him as the

first German-speaking author to receive the “European Grand Master” lifetime achievement award. Franke generally considered science fiction to be a valuable means of presenting his readers with visions of the future or scientific scenarios, which were always based on accurate science. According to Franke, good science fiction combines a sense of wonder with an adventurous plot while conveying scientific and technological knowledge. Thus, it is edutainment at its finest, merging education and entertainment to share complex information with a broader audience.

INITIAL IDEAS FOR A PLANETARIUM GAME

Franke was also a pioneer of digital visual art and a visionary in the media world, exploring innovative forms of presentation at the frontier. As early as around 1990, he experimented with using planetariums to create utopian narratives set in space. This resulted in the concept of a space adventure planetarium show with two versions: one featuring live actors and the other with pre-produced scenes. However, at the time, Franke could not find anyone to bring the project to life.

In honor of his legacy, the “art meets science – Foundation Herbert W. Franke” adapted three of his science fiction short stories for the full-dome format, narrated by Eric Ash in 2026. All three stories revolve around Franke’s fundamental philosophical understanding of the universe, derived from “The P Principle”.

ASTROPOETICON – IN HONOR OF THE 100TH ANNIVERSARY OF FRANKE’S BIRTH

Following these three stories, the “art meets science – Foundation Herbert W. Franke” is working on a follow-up project. It is being produced in collaboration with the science channel HYPERRAUM.TV. Generative artists from Europe, the Americas, and Asia are invited to adapt the 16-poem cycle *Astropoeticon* for the planetary full-dome. The world premiere will take place in 2027, during the events commemorating the 100th anniversary of Franke’s birth, in collaboration with the generative art community.

“A LEAP INTO THE VOID”

THE DIRECTOR’S STATEMENT

Working on the film “A Leap into the Void” was a deeply engaging and inspiring experience for me. (Fig. 9)

At the beginning, my process was focused on recreating the immersive 3D architectural space described in the story. This space became the foundation of the film. As I continued working, my understanding of the main idea of the story by Herbert W. Franke gradually evolved. New layers of meaning opened, and this directly influenced the visual language and cinematographic design of the environment.

Once the world was fully developed, I moved on to animating the main characters and shaping the choreography of the camera. This stage was both challenging and exciting. My goal was to bring the audience inside the story, to

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“Knowledge has
to be improved,
challenged, and
increased constantly,
or it vanishes.”

— Peter Drucker

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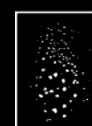
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TALES FROM DOME UNDER NEVER LOOK A (GIFT) DOME...



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Picture 1: On the National Mall side at the dedication of the National Air and Space Museum of the Smithsonian Institution in Washington, DC, on 1 July 1976. Left to right, we can see U.S. Supreme Court Chief Justice Warren E. Burger (1907 – 1995), Vice President Nelson A. Rockefeller (1908 – 1979), President Gerald Ford (1913 – 2006), Apollo 11 astronaut and NASM Director Michael Collins (1930 – 2021), and Smithsonian Secretary S. Dillon Ripley (1913 – 2001) Sitting on the base between them is a back-up Viking Lander arm used, after receiving a signal from the real Viking Orbiter circling distant planet Mars, to cut the horizontal ribbon stretched between Rockefeller and Ford. (Source: Public domain, U.S. National Archives and Records Administration)

When the Smithsonian Institution opened its National Air and Space Museum (NASM) to the public as part of the United States' Bicentennial Celebration on 1 July 1976, it was likened to America giving itself a 200th Anniversary birthday present.

NASA's Viking 1 Orbiter had begun to circle Mars on 19 June 1976, its Lander scheduled to touch down on the planet's Chryse Planitia on 20 July. A signal was sent from the spacecraft, traveling 321,869 km back to Earth, in order to activate a working replicate of the Viking Lander's scooper arm to cut the red, white, and blue ribbon officially opening the museum.

The original National Air Museum had always proved to be popular. Housed two museums up Independence Avenue on the National Mall in the SI's red brick Arts and Industries building, which had opened in 1881, this was in spite of its very limited space to show historical aircraft. Included among them were the Wright Brother's 1903 Flyer (the world's first sustained flight by a manned heavier-than-air powered and controlled aircraft), and Charles Lindbergh's "Spirit of St. Louis," the first to fly solo across the Atlantic Ocean. Now there would be room for everything that had come along since those times in both aviation and space history.

What was then at the time still West Germany had also participated through the donation of a Zeiss Model VIa planetarium projector, the first in the world, which could be completely controlled by automation, Gyroscopes, like the rest of the theater's lighting and special effects. Part of this installation was a special planetarium fund given and monitored by the West German Embassy in Washington, D.C.

I was Acting Chief of the then Albert Einstein Spacearium (later the Albert Einstein Sky Theater, finally settling on the

Albert Einstein Planetarium) in the early 1980s when a call came from the West Germans asking what was to happen with the rest of the money from their country still sitting in that account. Good question, what were we going to do with it? And I had to find a solution.

Fortunately, there was at least one ongoing problem we had where some of that money could be applied. If you have a large planetarium dome, it's very likely that your ventilation system has an air vent system where the air is drawn in at the bottom wall of the theater, run through some sort of filtration, and then blown back into the theater from ductwork above and behind the dome, which directs the airflow down. Not only does it keep the theater's airspace relatively clear of dust and other particulates that could emphasize light beams, it also—unfortunately—deposits a nice layer of dust that slowly accumulates on the back of your dome.

The Spacearium had been using conventional physical barrier-type ventilation screens that had an efficiency of around 30%. Not one of our technician's favorite maintenance tasks, these large screens, fitted into slots along the airpath in the ventilation ducts, had to be changed out twice a year. These were replaced with an active, electrostatic system, which increased the air filtration efficiency to almost 90%; an improvement of about 60%. This took care of a part of the West German's money, but not all of it.

As it turned out—for good or bad—a new need presented itself through an unfortunate accident. The Smithsonian Institution, of which NASM was one of its ten bureaus on the National Mall alone in Washington at the time, had a regularly scheduled check of the safety systems within the various museum buildings. These included any water sprinklers in the case of fire.

Besides those within the NASM building itself, we also had sprinklers behind the dome in the Spacearium. Due to its high concentration of electric audiovisual equipment, that fire



Picture 2: The Albert Einstein Spacearium/Sky Theater/Planetarium's Zeiss Model V1a star projector after both the dome had been replaced and the control console had been redesigned and been replaced following switching from Gyrosystems to Sky-Skan's S.P.I.C.E. automation. The original left and center panels had been dominated by the original controls for the Zeiss, while the right one was set up for the manual and automatic control of the theater's special effects and lighting via Gyrosystems. After much discussion and evaluating ergonomic ideas for the new layout, we and Sky-Skan came up with the functional design you see here. Again, the Zeiss controls—simplified but just as functional—were to the left and center, while all special effects are to the right along with the PC screen for the newer control system. And, as before with the original Gyrosystems automation, everything in the theater was still completely automated; still the first such planetarium in the world. This workhorse projector was retired in 2019 after serving daily for 40 years and was no longer able to be serviced by Zeiss. It now resides along with this control console at the sprawling NASM annex, the Steven F. Udvar-Hazy Center, at Dulles International Airport. The only other Zeiss V1a I know about was the one built for the planetarium in the Hong Kong Space Museum, which was also automated by Gyrosystems. (Source: Mark Avino, NASM)

suppressing-scenario used what's called a "dry-charge" system. The water pipes where the water goes out to the sprinkler heads scattered around in the theater are all empty until there is a fire alarm triggered in that part of the building and they need to be activated. These pipes were then to be filled, and once reaching their correct water pressure, it would spray out into the Spacearium, extinguishing any flames.

We knew that the safety engineers were going to be in the Spacearium, but didn't think anything of it, since it was a regular procedure carried out on a schedule. Or it wasn't a concern until we got a very frantic phone call upstairs in the office from our technicians we had an emergency.

Running down the back emergency stairs that could be used as a non-public way to access the Spacearium, we came through the entrance ramp's heavy, light-tight curtains and into the theater. There we were greeted by a large waterfall-like stream of water shooting straight out of the side of the dome opposite the control console, landing down onto the seats below. When the safety people had taken the end cap off of the main pipe of the dry-charge sprinkler system to inspect its interior, they didn't get it screwed on right. When they test-charged it with water, the cap blew free, ricocheted off the back of the dome, with the now outpouring water free to go wherever it wanted; straight out under pressure through the holes in the perforated aluminum dome.

It didn't take the SI engineers long to shut the water supply off, but the damage was already done. The special effects projector gallery directly under the water pipe had been flooded out as were the seats on the inside of the theater directly in the path of the waterfall. A larger issue was the broad, rust-colored streak running about 3 meters down the white interior projection surface of the dome. It looked like

someone had taken a really big, wide handful of mud and wiped it straight down until it reached the springline.

So, like I said, this emergency presented itself as a way to use up the remainder of the West German's planetarium fund, but there was a twist. You would normally think, "Clean that part of the dome and then repaint the whole thing with non-bridging paint," but in this instance it turned out to be an impossibility. An inspection of the dome showed that it could no longer be painted because the holes in it were already starting to partly bridge-over (i.e., fill-in) from past paintings, so this wasn't an option. How many times had it been painted in the past? Seven, but they weren't done during the then approximately six or seven years the Spacearium had been open since 1976.

Think about it; how many times does a planetarium dome get painted during its lifetime (and I'm not talking about the latter-day powder-coated ones from the early 1990s, or those using LED panels today). The dome would originally come from the manufacturer with a first coating of paint on the individual gores, they'd be installed on the framing ribs, and then a second coat would be applied. The Albert Einstein Spacearium's dome had seven(!) coats of paint on it the day the theater opened to the public along with the rest of NASM. If you're wondering how this could possibly be, I'll wait a minute while you try to puzzle, or rationalize, this out.

Here's the reason. The dome came from contracted supplier AstroTech (hats off to Clayton Hopper for those of you who remember him) with one coat of paint, it was installed, and then a second coat was applied. Inspection by the then planetarium staff with an array of powerful spotlights set up in the theater showed, to them anyway, that the paint was uneven, and therefore needed repainted in order for the supplier's contract to be completed. This went on for another

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INTERNATIONAL NEWS

Dear fellow planetarians...

Below you'll find news from around the globe on new shows, events, free resources for planetarians and important anniversaries. For this section I'm indebted to contributions from Amie Gallagher, Andrew Kerr, Ignacio Castro, Alex Delivorias, Loris Ramponi and Andreas Schmidt.

Let's start this tour around the world on the American East Coast.

MIDDLE ATLANTIC PLANETARIUM SOCIETY

MAPS members met for the annual conference on 13-16 May 2026. Their host was Patty Seaton, of the Howard B. Owens Science Center in Lanham, Maryland. An optional tour of the Goddard Space Flight Center, just across the street from Patty's science center, was included. Participants on the tour got to see the Nancy Grace Roman Space Telescope in the Clean Room. v

The conference was full of fantastic programming. Participants beta-tested activities about the doppler shift

during the mini-LIPS workshop, experienced sensory-friendly activities used during an autism-friendly program and they heard about a planetarium's plans for America 250 programs. At the banquet, MAPS's past-president Noreen Grice gave the prestigious Margaret Noble Address.

PACIFIC PLANETARIUM ASSOCIATION

An activity or program idea is the: Top Tourist Sights of the Solar System. A fun culminating activity for a planetary science unit or show can be to ask the students to imagine a future when interplanetary tourism is common, and to select the top ten tourist sights of the Solar System. Andrew Fraknoi wrote this up as an activity years ago, but now The Earth Scientist magazine has published an updated and beautifully illustrated version of this activity. They have given permission

MAPS. (Clockwise from left) Group photo from the annual conference in Maryland; Courtesy of Adam Thanz. Visit to the Roman Space Telescope at Goddard Space Flight Center; Courtesy of Amie Gallagher. Noreen Grice giving the Margaret Noble Address. Courtesy of Patty Seaton; LIPS workshop at annual conference. Courtesy of Adam Thanz; The MAPS's executive committee. Courtesy of Adam Thanz.



to disseminate it and you can find and download it at: <http://bit.ly/touristsights>.

Andrew Fraknoi's latest published science-fiction story is about love at a time in the distant future when all the stars have gone out, and the remaining life-forms are desperate for energy. Entitled *Elegy*, it has just been published in *Penumbra Magazine* for June 2026: <http://bit.ly/elegystory>. Links to all 13 of his published stories, including *I Swallowed a Martian*, can be found at: <http://bit.ly/sfbyfraknoi>.

ASSOCIATION OF MEXICAN PLANETARIUMS

The Papalote Children's Museum Planetarium is going to be modernized after 14 years of operation. The 23-meter dome will be renovated with five 4K-projectors and the latest Digistar System is to be installed by Planetarios Digitales. The reopening is due next October.

EUROPEAN/MEDITERRANEAN PLANETARIUM ASSOCIATION

CROATIA

June was a particularly busy month at the Rijeka Astronomy Centre, featuring numerous organized visits from schools, kindergartens, students, tourists, seniors, and various other groups. Every Thursday and Saturday, the evening planetarium schedule was enriched by the *Starry Nights* tourist program, which changes monthly throughout the summer season. The program features fulldome film screenings, laser-guided night sky presentations, guided telescope observations, and refreshments on the panoramic terrace overlooking Kvarner Bay.

The RAS also organized *Space Nights – The Universe in the Palm of Your Hand*, a two-day event marking the conclusion of the *Hello Universe Project 2026*. Held in collaboration with the European Space Agency and supported by the Ministry of Science, Education and Youth, the event featured special programming at both the planetarium and the observatory. A highlight of the event was a series of public lectures. Prof. Dr. Sc. Rajka Jurdana-Šepić, an astronomer and dean of the Faculty of Physics at the University of Rijeka, presented *A Journey Through the History of Astronomy: From Ancient Myths to Artificial Intelligence*. Additionally, Ante Radonić, a well-known educator, astronomy populariser, and founder of the astronomy show *Andromeda* on national radio station HR2, delivered a lecture titled *Artemis II*.

The center also celebrated International Asteroid Day on 30 June with a special thematic program organized in cooperation with the Academic Astronomical Society Rijeka. On this occasion, Prof. Dr. Marin Karuza, a professor from the Faculty of Physics and the Vice-Rector of the University of Rijeka, delivered a public lecture on spin lasers and the European project *Spin DataCom*, in which the Faculty of Physics is actively involved.

In July, the Rijeka Astronomy Centre launched its summer family programme, featuring the live planetarium show *A*

Guide to the Summer Night Sky, the short film *Losing the Dark* and evening telescope observations. In cooperation with the Croatian National Theatre Ivan pl. Zajc, the Centre's garden hosted the premiere of *Summer Night Serenade*. Described as a “composition for five friends and an orchestra” by writer and director Karlo Hubak, this performance brought together professional and amateur ensembles in a unique artistic collaboration.

The Centre also prepared a special programme to commemorate the anniversary of the Apollo 11 Moon landing. Throughout July, the Centre welcomed numerous organised groups from Croatia and abroad, particularly young people participating in sports clubs and summer camps. The month also saw a significant number of bookings for birthday celebrations held in the Planetarium, the Observatory, and on the Centre's terraces.

Looking ahead, three special cultural and scientific programmes are planned for August and September, dedicated to the Perseid meteor shower, the autumn equinox, and the International Day of Peace. The special live planetarium programme *Prepare, Beware, Perseids!* will



EMPA. Organisers of the “Space Nights” event (left to right): Amra Fajić, Elio Janko, Rajka Jurdana-Šepić, and Andrea Cvitan. Courtesy of Rijeka Sport Ltd.

introduce visitors to one of the year's most spectacular meteor showers. On the night of the peak, an evening programme will be organised across both the Planetarium and the Observatory. To celebrate the autumn equinox, the Centre will host a family evening featuring live planetarium presentations, film screenings, and guided observations of the night sky. To mark the International Day of Peace, visitors will be able to enjoy the live planetarium programme *Life*

Aboard the ISS and attend the public lecture: ISS: The Largest Peacetime International Endeavour in Human History.

GREECE

This year, the Eugenides Foundation in Athens celebrates 70 years of dedicated contributions to education and the dissemination of knowledge to the wider public. The celebrations will culminate in a two-day open science festival held on the Foundation's premises on 18 and 19 September, with contributions from all of its core activities: the Planetarium, the Science and Technology Centre, the Library, the UTech Lab, and the Autonomous Systems Laboratory (AI). In particular, on 18 September, the Eugenides Planetarium will present its trilogy of fulldome shows on space exploration. The first show, *From Earth to the Moon*, produced in 2007 to celebrate the 50th anniversary of the launch of Sputnik 1, highlights the Soviet and American efforts to send astronauts to the Moon. The second part of the trilogy, titled *The Great Adventure* and produced in 2009, highlights the exploration of our solar system that commenced just after the completion of the Apollo programme. The trilogy concludes with the 2017 production titled *The Future in Space*. This show attempts to answer fascinating questions regarding the future of space exploration—including the possibility of the first crewed mission to Mars—as well as the ultimate question: will we ever escape the confines of our solar system, or will interstellar travel remain in the realm of science fiction forever? On 19 September, the audience will enjoy at least three live presentations featuring the Eugenides Planetarium's space flight simulation software, during which its director, Dr. Manos Kitsonas, will present a fascinating journey through space and time, from our solar system to the edge of the observable universe.

ITALIAN ASSOCIATION OF PLANETARIA

During the last Italian Planetarium Conference (Ravenna, April 2026), the framework agreement between the Association of Italian Planetariums (PLANit) and the National Institute for Astrophysics (INAF) was announced, formalizing a strategic collaboration between astronomical research and dissemination. The agreement promotes joint projects, training, and innovation in planetariums, strengthening their role in disseminating scientific culture. Planit's new headquarters and the National Planetarium Archive will be located within the historic Padua Astronomical Observatory.

Furthermore, during the Planit 2026 national meeting, Paolo Morini (ARAR APS Association / Ravenna Planetarium / Italian Amateur Astronomers' Union) presented a paper inviting Italian Planetariums to recount the life of Eratosthenes and his famous experience, and to organize its performance at their facilities. During the last summer solstice, the operators of Italian planetariums that have joined the Eratosthenes UAI network organized meetings and workshops on the topic, inviting their audiences to measure

the Earth's radius on the days when the Sun shines longest above our horizons.

Among the new content that PLANit has made available to its



IAP. The “Safety in primis” logo is dedicated to the document, which describes a guideline to promote safety, responsibility, and best practices in traveling planetarium activities. Courtesy by PLANit.

members through the pages of the website www.planetari.org, is a detailed document containing guidelines to promote safety, responsibility, and best practices in activities with traveling planetariums. PLANit commissioned a technical consultancy to explore the safety criteria and operating procedures applicable to traveling planetariums, with particular reference to fire prevention and personal safety. The outcome of the consultancy constitutes a guideline that PLANit encourages participants to follow when conducting activities at traveling planetariums. This is not simply a technical document, but a professional responsibility tool, i.e. an invitation to carefully plan each activity, verify every detail, and to give importance to safety aspects. PLANit has also launched a collaboration with the Catholic University of Milan and the Infini.to planetarium (Turin) to rigorously evaluate the emotional impact experienced by planetarium visitors.

The following fulldome products have also recently been added to PLANit's online archive: material on the rollout and launch of Artemis II; a 5-minute short film on the mechanisms by which we perceive color and light; and a journey through the Universe to compare the sizes of stars.

The recent passing of Professor Luigi Antonio Smaldone, a lecturer at the University of Naples Federico II, who always supported the creation and activities of the Caserta Planetarium, has sparked an initiative to honour his memory: naming the Caserta Planetarium after him. For

this reason, the Caserta Planetarium has launched an official petition to name the facility after its founder.

Last May, the 25th National Gnomonics Seminar was held in the town of Matelica. The seminar represents one of the key events in Italy for scholars, enthusiasts, and professionals involved in the study and promotion of sundials and gnomonics, a discipline that combines astronomy, mathematics, history, and scientific dissemination. Further information is available on Sundial Atlas. Among the initiative's protagonists is Luigi Marcon, who, in addition to being a member of PLANit, is President of the Italian Gnomonic Coordination and coordinator of the Sundial Section of the Italian Amateur Astronomers' Union (UAI). His participation demonstrates the strong connection between the world of planetariums, observational astronomy, and the gnomonic tradition, fields that share the common goal of making the apparent motion of the Sun and the celestial mechanisms that regulate time understandable and tangible.

Likewise on the subject of sundials, a 27-page manual entitled *Equatorial Sundial: Theoretical Elements, Graphics, and Construction*, edited by Gian Nicola Cabizza and Nicola Scarpel, has been published on www.planetari.org. The construction of a simple equatorial sundial requires knowledge of some basic astronomical concepts, particularly that of the horizon and its relationship to spherical astronomy. The manual has also inspired a new issue of the interview series *Voices from the Domes*. The protagonist was one of the manual's two authors, Gian Nicola Cabizza. The second part of the video mentions the *Shadows of Time* project, which takes its name from the international



IAP. Here is an example of “naturalistic” sundials, like the one created by Francesca Righetto, that shows plants and animals associated with the season lines. Courtesy of the authors.

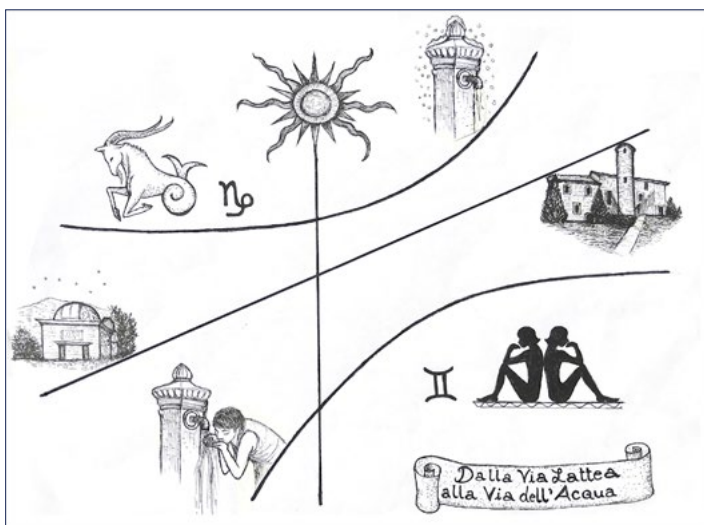
competition for sundial builders that the Serafino Zani Observatory organized for over a decade.

The project's goal, which was presented for the first time on the occasion of the Chaco Canyon lecture by Professor Maureen Hintz (Utah Valley University), is to promote the creation of an easy-to-make sundial containing only the midday line and the solstice and equinox lines, sufficient to stimulate understanding of time measurement and more, through the observation of solar shadows. The seemingly concise nature of the information displayed on the dial leaves wide space for pictorial representations. This sundial, easy to make for everyone, is a tool that does more than simply serve as a timekeeper; it can also help give a new face to a building or an urban area. In particular, designers specialized in natural sciences are involved, to create examples of sundials where the positions of drawings of animals and plants are in connection with the lines of the seasons. Additionally, street artists are involved, to create “solar” graffiti on a wide variety of themes. For example, the drawings combined with the lines of the sundial entitled *From the Milky Way to the Waterway* are in connection with the seasons and the itinerary of the ancient Roman aqueduct. The “Waterway” was the route that two thousand years ago brought water from the springs of the Gobbia Valley, where the Serafino Zani Observatory and the Lumezzane Planetarium (see detail of the drawing to the left of the equinox line) are now located. Instead, the historical tower (see drawing to the right of the equinox line) represent the top of the hill in the centre of the Brescia city. Infact, the Roman aqueduct connected the Lumezzane springs, 20 kilometers away, to the Roman city of Brixia.

SOCIETY OF GERMAN SPEAKING PLANETARIA

The year 2026 marks the tenth anniversary of Stiftung Planetarium Berlin (Berlin Planetarium Foundation) which looks back on a remarkable success story with more than 3.5

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IAP. The drawings, edited by Sara Rossetto help to “read” the sundial entitled *From the Milky Way to the Waterway*. For example, the fountain from which a boy is quenching his thirst is drawn on the curved line representing the summer solstice, while the frozen fountain is drawn on the winter solstice line. Courtesy of the authors.

UNDER THE CLASSDOME

QUALITY OF STUDENT QUESTIONS & THE REFLECTIVE TOSS TECHNIQUE

Mark Percy has begun his retirement journey, and Ken is taking over as the writer of this column. Godspeed, Mark! For those of you who don't know Ken, he is a fellow of the IPS and directs a small school-district based planetarium in Robeson County, NC. He is also a member of IPS' education committee.

INTRODUCTION

If you interact with your students at all, you'll no doubt be answering questions of varying levels of cognition. This article delves into these levels, and how you can ascertain the level of a question, as well as potential strategies for answering these different types of questions.

In my research currently underway, questions were recorded from groups who had previously submitted written questions at the outset of their visit to the planetarium. These questions were audio-recorded, transcribed, and sorted according to their characteristics, as outlined below.

For our purposes, we'll divide the questions asked into two broad categories: type of information requested, and higher-order nature of the question. This notion of sorting questions was first proposed by Baram-Tsabari, et al. in an article about the questions students asked on an "ask a scientist" webpage from 2006. This is an example of the type of site where the public can ask a scientist: <https://science.nasa.gov/engage/ask-a-scientist/>.

[The notion that Reflective Toss can be a meaningful method of interacting with your students was proposed by Anderson, et al. \(2001\).](#)

TYPES OF INFORMATION REQUESTED

There are five types of information that can be requested: a general request for information, factual information, explanatory information, methodological queries, and predictions.

An example of a general request for information: "Is the gift shop open?" In this case, no information is requested about content, or science. These are usually procedural in nature. A straightforward answer which only you know doesn't call for much interaction, other than answering the question itself.

An example of a request for factual information: "How many years does it take to get to Venus?" These are normally short answers, without a great deal of explanation on the part of the facilitator. Typically, these fall under the lower levels of Bloom's taxonomy. You can ask the students if anyone has a guess for the answer.

An example of an explanatory question: "How were stars made?" Explanatory questions usually feature "how" or "why" in the body of the question asked. Explanatory

questions can be higher-order thinking questions. Here, you have an opportunity to do what's called a Reflective Toss—sending that question back as "does anyone want to explain how they think it works?"

An example of a methodology question: "How would you make a black hole?" Methodology questions are almost exclusively in the upper tiers of Bloom's taxonomy. It almost always calls for a higher-order thinking response from you. You can reflectively toss this back out to your students, "Does anyone know the ingredients for making a black hole?"

Then, there is an example of a prediction question: "What will happen when the Sun runs out of fuel?" Prediction questions are just that. Here, you have an opportunity to display solid scientific thinking as you answer this question. Again, the Reflective Toss could also prove useful.

ORDER OF INFORMATION REQUESTED

There are three categories of order of the information requested. These are properties, comparisons, and causal relationships. These represent increasing levels of higher-order thinking, according to Baram-Tsabari, et al. (2006).

Properties of the questions asked include the lower levels of Bloom's taxonomy of higher-order thinking. An example of a properties question is, "how far is Jupiter away from the Sun?" Here, a direct answer is what's called for. However, you have the opportunity to reflectively toss that question to the rest of the students: "Does anyone think they know this?"

An example of a comparisons question is, "what's the difference between a regular star and a shooting star?" Two or more items are compared or contrasted in this type of question.

An example of a causal relationships question is "what would happen if the Sun got five times more massive than it is now?" Causal relationships questions represent the highest levels of Bloom's modified taxonomy. Again, at least two variables are required for this type of question. You can reflectively toss this out to your students as well: "Many things would happen. Who thinks they can identify one effect of the Sun being five times more massive?" Note that the question gets restated for the students to consider, since they may not have heard the initial question.

CONCLUSION

Students often arrive at the planetarium with questions about space science and astronomy that they'd like you to answer. Fielding questions from your students is one fundamental way to increase interaction with your students.

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SEEKING WHAT WORKS SPACE TO THINK

Dr Jenny Shipway, with contribution from Paul Cornish

1. MEMORY IS THE RESIDUE OF THOUGHT

Planetarium presentations can be packed with exciting visuals, ideas and concepts which make the audience “ooh” and “aaah” with amazement. There’s nothing more rewarding than a sea of wide-eyed faces with jaws that have quite literally fallen open in amazement.

Your audience will go home excitedly saying how amazing the planetarium was, and how much they loved the experience. They will tell their friends about the exciting visuals they experienced (“we flew past Jupiter!”, “we saw the galaxy!”, “all the stars moved!”).

However, if your objective is for them to remember any new astronomical concepts past the short term, you will need to encourage them to think a little more deeply.

Cognitive Psychologist Prof. Daniel Willingham gives us his famous quote “Memory is the Residue of Thought” [1]. He reminds us that long-term memory is only formed when we mentally process ideas and concepts.

2. IN ONE EAR AND OUT THE OTHER

It’s very easy to take in information, have a momentary pleasure, and then let it drop from our minds. Scrolling short-form video is a great example of this. Scrolling for half an hour can speed us through a dizzying variety of emotionally-engaging topics, but do we learn more than we would from watching a half-hour documentary? How much do we remember from the short-form videos an hour later? A day later?

Similarly, I’ve been to lectures with fantastic speakers where I’ve hung on their every word and been utterly entranced. But then the next day I realise I can’t remember anything substantial from their talk.

3. THE IMPORTANT BIT HAPPENS INSIDE THE LEARNER’S HEAD

Observing a school planetarium show, what do you look for to judge its educational impact?

Marketing images for school planetariums show happy, awestruck audiences looking at the dome. Anyone popping their head into the planetarium and seeing a scene like that would be satisfied that things were going well.

But what none of us can see is what’s going on inside the learners’ brains. And the most important thing is for them to be thinking about the information that they’re receiving.

Fiorella & Mayer (2015) put it like this: “Learning involves actively constructing meaning from to-be-learned

information by mentally reorganizing it and integrating it with one’s existing knowledge “ [2].

This is something different from comprehension - they’re not just understanding the information, but actively using it.

This means that good learning might look like mental struggle, as learners process difficult concepts. Or confusion, as they deal with ideas that challenge prior beliefs. It might even look like disengagement, as they stare off into space to minimise visual input while processing difficult thoughts, or as they rekindle memories to use as anchors for long-term memory.

5. MAKING SENSE OF THINGS

Imagine you were trying to process a new idea and work



Hang on give me a moment here!

out how it fits in with your prior beliefs and knowledge. Maybe someone has told you that sharks don’t have bones (it’s true).

When you read that sentence, what did you do?

I’m going to guess that most of you stopped reading for a moment to think about it. Maybe you were able to recall hearing that

sharks don’t have bones but instead use cartilage for a similar purpose. Maybe you reconsidered your definition of ‘bone’. Or maybe you couldn’t make sense of it given your prior knowledge and just felt confused.

Either way, you were taking a moment to reorganise and integrate the information with your existing knowledge, as Fiorella & Mayer describe.

But what if, instead of being able to pause for a moment, you had immediately been presented with another twenty amazing facts. Oxford University is older than Angkor Wat! The Basque language is unrelated to any other language! You can taste garlic through your feet! Bananas are berries!

You have enough time to understand and be amazed by each fact in turn, but without time to think and integrate them with your prior knowledge you are much less likely to remember them in future.

6. SPACE TO THINK

So, we need to provide learners with the opportunity to process the information we’ve presented. And that means we sometimes need to stop talking.

This can be done by leaving a long pause after asking questions [3], by letting them have a quiet moment to themselves, or by letting them chat with each other.

Leaving children to their own thoughts in a normal classroom can quickly lead to distraction, but planetariums are a perfect environment for this. They can provide calm, predictable, on-topic visuals, preventing distraction by keeping the visual part of the learner's brain engaged. Just make sure you keep the visuals as simple as possible to avoid the need for lots of cognitively-draining visual processing. This type of quiet, introspective thinking time is ideal for creating connections to prior knowledge and personal memories.

Chatting is another great way for learners to process their thoughts. Putting things into words demands that wobbly thoughts are processed into organised ideas. And as a bonus, learners can remind each other of information the other may have missed. To show respect for their thoughts, and to make it easier to recapture attention, I always signal to learners when time is nearly up, allowing them a little time to finish what they're saying.

7. SHUTTING UP IS HARD TO DO

It's only natural to feel the urge to make the most of our time in the dome by sharing as much information as possible. It's very counterintuitive to think that we can teach more by saying less.

Also, in many cultures, standing in silence can feel socially awkward.

We might worry that the audience will start chatting with each other and it will be hard to get their attention back. Or if we want them to chat, that they won't stay on-topic.

But still, our audiences do need time to process new information. So it's important we find ways to create space for them to think.

I recently went to the planetarium at We The Curious, a science centre in Bristol, UK. I was struck by how well the live presenters incorporated pauses for people to think their own thoughts. After my visit, I had an interesting chat about this topic with the Planetarium Content Creator, Paul Cornish. Here's what he has to say:

8. YOU CAN DO IT! – ADVICE FROM PAUL CORNISH

When I'm training new Planetarium presenters at We the Curious, one of the first things I ask them to do is to embrace pauses. I tell them that they are only ever really co-presenters. They share the spotlight with the visuals and the music and need to give their partners a chance to shine.

Pausing their delivery gives the audience a chance to soak in the visuals. Slightly louder music during these moments enhances the immersive effect, so our presenters have easy access to volume control on their presenter iPads.

Pauses can give a presenter more control over the pacing and energy of their show. They can help to create an

authentic, emotional experience for the audience.

At particularly dramatic moments – at the climax of a scene for example – I often find it useful to leave a long pause. In addition to giving the audience time to enjoy the visuals and to digest the information you've shared, this long pause can lend weight and gravitas to your delivery.

I usually time these pauses by slowly counting to five in my head, although a particularly dramatic moment may require a few more seconds.

For a calmer energy I recommend short pauses every few sentences or so. These usually last about the time it takes to take a breath. They will slow down your delivery, creating a peaceful atmosphere. Shortening, or even removing these pauses during more dramatic moments in your show's narrative will increase the pace.

These energy changes improve your storytelling and make for a compelling show. They are also a good way to grab the attention of your audience after a long pause. If you begin speaking again with a quieter, slower energy than before, or a louder, faster energy, then you are signaling to your audience that a new chapter in your story has begun.

Pauses can also be a bit of a presenter cheat. Perhaps you're not sure how to deliver the next section of script. Maybe you've even forgotten what comes next. Pause for a moment and take a deep breath. Give yourself time to collect your thoughts. It's very likely that the audience will either assume it's a natural pause or they'll be too immersed in the visuals to notice. The pause will seem twice as long to you as it does to them.

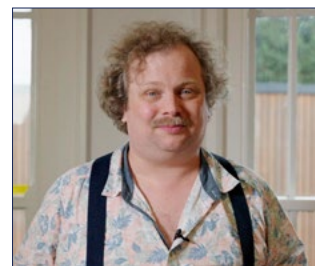
Silence isn't something that comes naturally to a professional communicator. Any pause in my delivery, whether intentional or otherwise, seems like an eternity to me. I often find it useful to record my shows. Listening to these recordings always helps to restore my faith in the power of the pause.

If the silence ever seems too deafening, remember that you can trust your audience – they are with you. You can trust that it's not all on you – the visuals and music are playing their part to captivate the audience. And you can trust your judgement – you know your show, and you know your audience. Have enough faith in yourself to stop talking!

9. CONCLUSION

Well-designed pauses are a key tool for anyone wanting to teach facts and concepts in the planetarium. But they also offer a wide variety of additional benefits, including

Continued on pg. 53



Paul Cornish, Planetarium
Content Creator at We The
Curious, UK.

A DIFFERENT POINT OF VIEW

A LITTLE BIT OF EVERYTHING



Ron Walker

The Star Barn Planetarium
P.O.Box 161
Cave Creek, Arizona, 85327
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Time marches on:

My first thought is what happened to my seventies. Next month I celebrate my eightieth birthday. I also celebrate my fortieth wedding anniversary. Married now as long as I was single. Celebrating my thirteenth year of giving planetarium shows. Thirteen is a special number because the last show the Minolta IIB gave in San Antonio was on June, Friday the 13th of 2008 and then gave its first show in Cave Creek on June, Friday the 13th of 2014. November our family celebrates my mother in law's 99th year on this planet and I am so blessed as to spend this July 4th with four generations of ladies, mother in law, my wife, my daughter, and my grand daughter.

But not all is good news. Starting about thirty years ago there was an outbreak of individuals obsessed with planetarium projectors. Unfortunately time moves forward and we all continue to age. One of these original amateur planetarians suffered a series of strokes and can no longer live alone. Circumstances dictate that his entire collection dissolved so his house can be sold. Thankfully all of his collection has found a good home.

Am I becoming a curmudgeon?

"Inevitable Doldrums", a phrase originally coined by the president of "The Home Planetarium Association" appears to hit (me at least) every few years. It's when you start wondering if what your doing, are thinking about doing, have been doing is still worth doing. Not that I'm about to go back to my old profession as I've been away for over fifteen years and the technology has passed me by. Also I've noticed the my mind can not grab on to new ideas and technologies as well as it once did.

So what about my second life? I've been happily doing planetarium shows for some time now. Am I starting to tire of this as well? No, I think not. But I must admit that I am not as fond of people as I once was. Especially when they RSVP and then never show up. Bah humbug, I could have been doing something else,,,something more constructive.

Not enough time to get everything done:

So what would I have been doing if I wasn't waiting for people who never show up? Fix things, that's what. Living in my home of fifty plus years things start to go wrong. Things need fixing. Like a pipe leak. Thank goodness it was outside. Look it's in a galvanized pipe connection. Trouble is I can't see the leak through the rust. Higher a plumber my friend says, write a check. Social security doesn't allow for too many extra luxuries and it certainly doesn't include a \$500 valve replacement.

So, off to Home Depot (first trip) for parts as I have some good pipe wrenches and I actually find them. A bit of muscle power (not much left at my age) and the fitting doesn't budge... but the pipe does. Rusted away to almost nothing. Glad I

turned off the water. Back to Home Depot (second trip). From the hall..."can I use the toilet yet?" Sure fine, but don't flush yet...remember, if it's yellow, let it mellow. Wife comes down the hall, "It flushed fine, I guess you got the water back on".

Thankfully I have enough parts to close off this section of pipe and get the water back on. Yes, we will need to run a hose to get water to the horses but they are new enough to not leak yet. Plan for enough pipe to replace all of the outside outlets on the way to the corrals. The next day back to Home Depot (third trip).

I remember it was not long ago that I could go all day in 110° F. Now I'm lucky to do twenty minutes every hour so the project takes a week. But I saved \$3400. Bah Humbug! I think I'll go to the dome and set up for today's show. Perhaps no one will come and I can take a nap under the stars. I know I built this for a reason.

Keith's Captured Quips ~ Chapter Thirty- Six...What... No...Sorry there is no chapter 36. we have come to the end of Keith's Quips. The only thing to do is go back to the first chapter of these gems. That would take you back to 2017, at least for the beginning of the second incarnation.. Thank You again Keith for allowing me to reproduce your Quips!

10 YEARS AGO (SEPT 2016):

Our president at the time, Joanne Young, makes a statement,"The future belongs to those who are creative, not to those who merely follow instructions and act on command." I couldn't agree more, but it brings up the interesting subject of AI. I just saw a demonstration on the web of a person totally generated from scratch that looked totally real. How long until one could carry on a conversation in real time. Give a script to a computer and the movie is done. Better yet, let the AI write the script as well, just give it the idea. Will the creative people be passed over or will they be the code writers of the future.

Fred Espenak talks about the rarity of solar eclipses in the United States. Want to know when the next blocking of the sun will be? It's all here, or at least far enough into the future that you will care about.

Where will the next generation of planetarians come from? Anna Green explains in her article, "Encouraging The Next Generation Of Planetarians". You can put me in her listing of "Who is the next generation?" "as "a retiree who always wanted to work in a planetarium but never knew how". I did it by building my own.

25 YEARS AGO (SEPT 2000):

One of my favorite columns from a quarter of a century ago is Steve Tidey's "Forum". Here he asked questions of the planetarium community. This issue he asks,"If you

could keep only one piece of equipment, inside or outside of the dome (apart from your star projector) simply for its proven educational and/or inspirational impact among your audiences, which would it be and why? The two most common answers are the arrow pointer and the slide projector. I am guessing that while the technology might have changed, the use of similar equipment would be the same.

Something you don't see very often is a complete script for a planetarium program. Back in time before there was a big green start button, planetarians had to present live shows. Back at the turn of the (year...century...millennium...take your pick) Margie Walter was busy writing "Davy Dragon And The Planets" which took first place in the Eugenides Script Contest. I would guess this program would time out at around a half hour which is perfect for kids visiting a planetarium. One wonders if program visuals are still available. This is doubtful as they would be slides and would need to be converted to full dome video and then it would look better if animated and the dialog presented with the various voices synced to the visuals. OK...OK... just press the big green start button.

45 YEARS AGO (SEPT 1980):

"Jane's Corner" could certainly be a replacement for "Keith's Captured Quips", however Jane's are more stories rather than one liners. I will present one to whet your collective appetites. The complete set of stories can be found on the Planetarian website.

"Diana Knapp, assigned to pick up several airline passengers arriving in Jackson, Mississippi to attend planetarian Richard Knapp's June, 1980 SEPA conference, waited until they had all settled in her VW bus with their luggage, then glanced back and noticed an unfamiliar face. "Are you one of the planetarium conferees?" she asked. The man looked startled and said, "No! I thought this was the airport limousine." Jack Horkheimer, planetarian arriving from Miami, Florida, leaned back from the front seat: "I didn't think you were one of us. You're wearing white shoes! "

Frank R. Engler, Jr. article "A Commercial Message" looks at program length to the short TV ad length of ten to thirty seconds. A program of ten to thirty minutes is more than enough to get any idea across. I'm not sure I can agree with that as much of my audience (like me) is, (how should I put it), long in the tooth, so to speak. Also my eyes need a good thirty minutes just to adapt to the dark. My two most popular programs run two and a half to three hours (depending on how much I remember at the time. Even my program for kids runs an hour as I know they can see sixth magnitude stars immediately at the beginning of a show when I can only see second.

Speaking of children's programs, I must admit I don't have enough letters after my name to truly understand John R. Nevius, Jr.'s treatise entitled "The Planetarium And Young Children's Assumptive Philosophies"

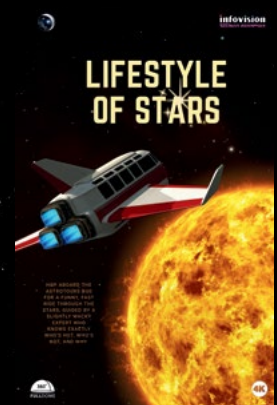


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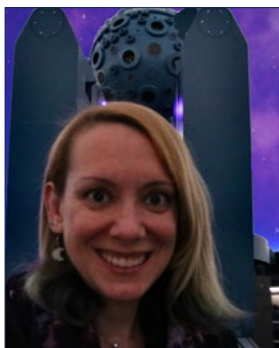
IPS members around the world will soon be voting for candidates in the 2026 elections for President-Elect, Executive Secretary and Treasurer. The position will be held by each winning candidate beginning on 2027 January 1 and ending on 2028 December 31. The President-Elect will be IPS President in 2029-30 and Past President in 2031-32.

Voting will be conducted online and will commence on 2026 September 30 at 12h UT and conclude on 2026 December 2 at 12h UT.

All IPS members are encouraged to read the candidate statements below, which will also appear on the IPS Website together with a short video statement from each of the candidates.

This year we have four candidates for President-Elect, one for Executive Secretary and three for Treasurer. Please vote for all three positions! The Executive Secretary position will ask for an approve/disapprove decision.

PRESIDENT-ELECT CANDIDATES



ANNA GREEN STATEMENT

I am humbled to stand for election as International Planetarium Society President-elect.

IPS has been a part of my entire career. As a long-time member, I have served on numerous committees, completed two terms as European Board Representative, and hosted both the 2017 Pleiades Conference and the IPS 2024 Conference. I have also remained active in several regional organizations (GLPA, GDP, BAP, APLF). These experiences gave me the opportunity to work alongside global colleagues and to better understand both the diversity and the shared purpose of our worldwide community.

One of IPS's greatest strengths is that we are truly international. Having lived and worked in multiple countries, I have experienced firsthand how much stronger we become when we combine different perspectives, cultures, languages, and ideas.

Over the past several years, IPS has made tremendous progress in becoming more welcoming, accessible, and connected. I am proud to have contributed to initiatives that expanded conference accessibility, virtual participation, sustainability efforts, and programs for students and first-time attendees. These are not simply logistical improvements; they remove barriers so that more people can participate, contribute, and find a place within our community.

If elected, my goal is not to reinvent IPS. We have strong leadership, a clear strategic direction, and an engaged membership. Instead, I want to build on that solid foundation while ensuring IPS continues to evolve to meet the changing needs of our members, preserving the institutional knowledge that has brought us this far while empowering the next generation of leaders who will shape our future.

As President-Elect, I will work to:

- strengthen communication and collaboration between IPS, our affiliates, and global members
- reduce language, financial, and participation barriers so more people can engage with IPS
- expand opportunities for early-career professionals through networking and leadership development
- support conferences and programs that foster meaningful connections, collaboration, and the exchange of ideas across our entire community.

These goals cannot be achieved alone. I believe the best solutions come from listening carefully, collaborating openly, and empowering members to get involved.

Hosting IPS 2024 was one of the greatest privileges of my career because it reinforced what makes this organization so special. Beyond the presentations and workshops, it was working with you all—getting to know you better and making lasting connections.

The more barriers we remove, the more people can participate and benefit from everything IPS offers. That is how we make a worldwide organization feel like a close community.

Ultimately, people remain involved because of the relationships they build and the experiences they share. As planetarians, we spend our careers inspiring wonder and connecting people with the universe. IPS succeeds when we create that same connection with one another.

My goals are to listen, to serve, and to make IPS more accessible and valuable to members around the world. I believe deeply in this organization and the people who make it extraordinary, and that in the future, we can continue building together.

It would be an honor to have your support.



SUSAN MURABANA OWEN STATEMENT

I still remember my first visit to a planetarium in Italy, an experience that transported me across the cosmos and ignited a lifelong passion for sharing the wonders of the Universe. Today, that same sense of awe continues to guide my work as I strive to make astronomy accessible, relevant, and inspiring to diverse audiences around the world.

Over the past decade, I have dedicated my career to expanding access to astronomy education across Africa and beyond. Through The Travelling Telescope, we have reached hundreds of thousands of learners in remote and underserved communities, using the night sky as a gateway to science, curiosity, and imagination. As a planetarian and science communicator, I have contributed to global conversations on public engagement with science, collaborating with institutions, educators, and media platforms to bring the Universe closer to people from all walks of life.

Africa's planetarium landscape is evolving. While there are now a few fixed planetaria in East Africa, the Nairobi Planetarium stands as a premier facility in the region—serving as a hub for education, inspiration, and innovation. This growth signals an important moment for our global community: one where we must actively support emerging regions while strengthening the legacy and excellence that define the International Planetarium Society.

If elected as President-Elect, I am committed to honouring the rich history and enduring impact of IPS while helping position the organisation at the forefront of science communication during this critical stage in humanity. As we navigate rapid technological change, global challenges, and renewed interest in space exploration, planetariums have a vital role to play in fostering scientific literacy, curiosity, and hope.

My vision is to cultivate a diverse, equitable, and inclusive IPS—one that is vibrant, collaborative, and growing. I am particularly passionate about increasing representation from Africa and other underserved communities, ensuring that more voices, perspectives, and stories are reflected in how we share the cosmos. By strengthening partnerships, expanding access to training and resources, and supporting both established and emerging institutions, we can build a truly global and interconnected planetarium community.

Together, we have an opportunity to inspire the next generation, bridge cultures through science, and reaffirm the power of planetariums as spaces of wonder, learning, and possibility. I would be honoured to serve and to contribute to shaping the future of IPS alongside this incredible community.

Susan Murabana Owen

CEO & Co-Founder, The Travelling Telescope | Planetarian, Nairobi Planetarium | Founding President, African Planetarium Association



BJÖRN VOSS STATEMENT

Dear Members of IPS,

Last year we celebrated the 100th anniversary of the planetariums. Now, as we embark into the second century of the planetarium, the world has changed – it is not “our parents’ planetarium” anymore; new challenges as well as new opportunities abound. I believe that IPS can assist even more than now in navigating the sometimes difficult landscape of promising new opportunities and treacherous obstacles that may arise.

Some might think of relevant opportunities mostly as arising from the technical realm – A.I., LED domes, and more. However, I am convinced that our most important basis of future success is ourselves: Our unique skill set as planetarians. We are educators and producers, or we work to enable education and production in planetariums. It is our common mission to present mankind's place in the cosmos, to teach and promote our science-based view of the world, and to convey the relevance of science in general. Recently, the German branch of UNESCO recognized this specific value of our work by adopting “the immersive teaching of nature and the universe in planetariums” as a new item of its intangible (immaterial) cultural heritage. By extension, this recognition should apply to all planetarians in all countries, and it should be a task of IPS to achieve such a UNESCO recognition on the global scale as well.

We planetarians are not just educators, producers, or other specialists, but more importantly we are all “Inspirators”. Our greatest “superpower” is to inspire people of all ages, to convey awe and wonder of our cosmic history and our place in the cosmos, and to allow persons from all countries, from all walks of life, from all cultural backgrounds, to experience themselves as the common citizens of this “one pale blue dot”, as Carl Sagan expressed it. I believe that today our “superpower”

is more needed in the world than ever. It should be IPS's main mission to help develop and refine this power. What I believe IPS does best, and should focus to improve on, is in two words: connect and empower.

My starting point to further advance IPS's services in connecting and empowering will be the strategic goals that IPS already laid out for itself in the last year; I had the privilege of helping to draft these goals as a past member of the IPS board. An important first step into IPS's future will be the realization of these plans, which will provide a comprehensive framework to build on, such as engaging with science institutions, providing new professional development initiatives and networking opportunities, and more.

This is my vision for the future of IPS: It should be so good at connecting and empowering that each and every new planetarian will want to become a member, and that planetarium leaders will want their team members to actively engage with IPS.

It will be my aim to work towards this vision, and I would be honored to work with you, my fellow IPS members, on the future of IPS!

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APRIL WHITT STATEMENT

I am April Whitt, and I am honored to be a candidate as the International Planetarium Society's President-Elect. My first IPS conference was in 1980, at the Adler Planetarium in Chicago, where I made new friends and colleagues. What a creative group!

I have always been passionate about education, particularly astronomy education. A few years before that IPS conference, I was in undergraduate school, looking for a class in the wrong building, and saw a "help wanted" sign near something called the "Planetarium." I needed the money, and I was fortunate enough to have grown up under a dark sky.

I figured I knew enough constellations for the "planetarium" job, and, after locating the correct class in the correct building, applied for the post.

A little nine-meter dome, a little Spitz star projector and a few concentric bench seats at a teacher's college in western New York, and I was hooked.

Several years later, finishing up a teaching degree, a mailing from Morehead Planetarium in Chapel Hill, North Carolina came across the planetarium desk. A graduate school internship! I was accepted as Junior Intern in the Morehead Scholarship program in Planetarium Education and Administration. The program was relatively new. Jim Manning, Senior Intern, was a great example to follow.

When the Education coordinator position opened as I was completing the internship, I was privileged to stay at Morehead for several more years, meeting planetarium colleagues at conferences, learning and improving presentation skills. My commitment to the profession grew.

Moving to different parts of the United States, I've served as regional president in the Great Lakes Planetarium Association ("the first girl" as Gary Tomlinson put it), the Southeastern Planetarium Association and, most recently, the Middle Atlantic Planetarium Society. In every post, I've shared ideas with amazing colleagues and friends, working to improve astronomy education.

I've contributed to IPS on the Education and Publications committees, and served as an Associate Editor for the Planetarian.

Relationships are so important in our profession. So many times, looking for some resource or needing some bit of information, just knowing who to ask has been a literal Godsend. We are a generous group, willing to share solutions we've found.

If elected, I'd like to further those relationships. IPS already posts groups and resources on web sites and in social media. I believe that by mentoring new colleagues and utilizing useful new technology, we can achieve significant progress and continue to grow as a community.

Thank you for considering my candidacy. I've gained so much from this profession, and want to return the favor. It would be an honor and a privilege to serve as your President Elect.

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EXECUTIVE SECRETARY



DEREK DEMETER STATEMENT

Hi everyone, my name is Derek Demeter, and I'm the director of the Emil Buehler Planetarium at Seminole State College in Sanford, Florida, near Orlando. Since 2023, I've served as IPS's Executive Secretary, and I'm honored to stand for one final term.

Since my first term, we've celebrated the planetarium centennial, hosted two successful conferences, and built a strategic plan that charts a clear course toward a stronger, more connected IPS. Because this will be my final term, my goal for the next few years is simple: finish what we started. I want to see every goal in that strategic plan carried through to completion by 2028. I currently manage the strategic planning schedule and have taken the lead in keeping us accountable to those goals, and I intend to keep pushing until they're done.

Just as important, my job these next two years will be to prepare our Google Drive, archives, and records so the transition to the next Executive Secretary is seamless and starts strong instead of starting from scratch.

I'm thrilled for the chance to work alongside Estefania's team at the Galileo Galilei Planetarium in Buenos Aires Argentina, to help deliver another outstanding IPS conference. Serving this organization has been one of the great privileges of my career. As IPS continues to grow into new corners of the world, our mission stays the same: to inspire, build science literacy, innovate, and make a better world for all of us.

If I have the privilege of continuing in leadership, my number one priority will be to keep that mission moving forward, with the same energy, , dedication, and gratitude I've had since day one. Thank you again for the opportunity to serve.



TREASURER



ANN BRAGG STATEMENT

I have been a member of the International Planetarium Society, as well as the Great Lakes Planetarium Association, since 2008. That year, I joined the planetarium community after accepting my current job as both a physics professor at Marietta College, in Marietta, Ohio, and the Director of the College's newly constructed Anderson Hancock Planetarium. IPS and GLPA have been important sources of ideas and professional friendships throughout my career in astronomy and planetarium education. I especially value the Society's role in bringing together the international planetarium community.

I previously served as IPS Treasurer from 2015 to 2020; I understand both the challenges and the rewards of the position. As Treasurer, I kept accurate financial records, organized IRS filings and an annual review of IPS finances, ensured that bills were paid on time, and supported the Society's programs and activities as a part of the IPS Council, and later the IPS Board. In my professional role

at Marietta College, I have experience with faculty governance, having served on our Faculty Council (an elected position) for five of the past thirteen years.

If elected, I would bring both my previous experience as IPS Treasurer and my professional experience to the position. My goals would be to provide careful financial stewardship, maintain clear and accurate financial records, and support the Board in advancing the Society's mission.



ERIC EDELMAN STATEMENT

My first point of introduction to the inner workings of the International Planetarium Society occurred when I brought up the question of money in planetariums to IPS leadership. As I proceeded in my career, I noticed the financial roadblocks myself and others were experiencing in the field, and I was curious about the stance related to these matters held by the global professional organization for planetarians.

Asking this question related finances in domes opened a massive rabbit hole of support and empowerment to make things happen. Under the broad wings of the IPS's Equity, Diversity, and Inclusion (EDI) Committee, I was able to lead the charge on the creation and implementation of *A Survey of Finances in the Planetarium Field*, gathering quantitative and qualitative data on the ups and downs of finances for dome professionals—with the results thereof eventually being peer-reviewed and published in the Planetarian.

Through this experience, I found the IPS to be an organization that can be open to the tough questions and pursuits of its members, which is why I have chosen to run for IPS Treasurer. I would like to be a part of the organization's supportive lattice that platforms the professional voices and projects of its membership.

Of course, many projects need money, and money is not always reasonably supplied via the IPS. The first layer of treasurer support must come in the form of meticulous financial and membership management, ensuring the smooth day-to-day functioning of the IPS organization. While I have never been in the role of a treasurer, as the director of a planetarium for almost ten years now, I currently oversee expense, revenue, and philanthropic budgets, so the conscientious attention to detail needed for money matters is not unfamiliar to me.

However, once the foundational financial needs of the IPS are met, there comes the potential to explore this organization as a supportive force for those who want to research, reach out to their colleagues, hone their skills, or otherwise do well by the field. Through the creation of a new Development Committee, the IPS seems uniquely poised to reconsider its own identity as a resource in the professional planetarium landscape—to do determine the grounds upon which it might attempt to pursue funding and why.

I believe it is the role of IPS leadership to work with the membership to define goals and ideals on this front. Not all hopes and dreams may be feasibly reached, but they should all at least be heard and considered. With the aspirations of its membership in mind, leadership can proceed with a dedicated forward motion—making it so a couple years from now the IPS is positioned a bit further along than it was before as a resource and organization.

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PAUL KRUPINSKI STATEMENT

Greetings, friends and colleagues of the International Planetarium Society!

Thank you for the opportunity to run for the position of Treasurer of the IPS Executive Committee in this election cycle.

Allow me to introduce myself. My name is Paul Joseph Krupinski, and I am from Cheektowaga, New York, a large suburb located just 10 miles east of Buffalo—known as both the “Nickel City” and the “City of Good Neighbors.”

For the past 33 years, I have proudly owned and operated Mr. K.'s Mobile Dome Planetarium. I have also served as a presenter at the world-renowned Strasenburgh Planetarium of the Rochester Museum & Science Center since 1995, and since 2015, I have been the planetarium teacher at the Maryvale Union Free School District Planetarium in my hometown of Cheektowaga. In addition, I am a co-founder of the Challenger Learning Center of Lockport, New York. Collectively, these roles have given me a unique perspective within the planetarium community by allowing me to work in large, small fixed, and portable planetarium environments.

As a member of the Middle Atlantic Planetarium Society (MAPS) since 1990, I have been fortunate to meet countless outstanding professionals in our field and to build lifelong friendships through our annual conferences. It is remarkable to reflect that I have now served on the MAPS Executive Committee and Board of Directors for 22 consecutive years.

During that time, I had the privilege of serving as President-Elect, President, and Past President from 2000 through 2006—an experience that was both rewarding and professionally enriching. Throughout my years of service, I have remained committed to supporting our membership by contributing to the Strategic Planning, Elections, Audit, Website, Memorial, and numerous other committees.

As a longtime member of the Strategic Planning Committee, I worked alongside fellow members to revise and modernize several of our Society's foundational documents, including the Executive Committee Calendar and Procedures, Conference Guidelines, Vendor Policy, and the MAPS Executive Handbook, including its most recent 2023 revision. I also participated in a Focus Group established through the Strategic Planning Committee to evaluate areas where the Executive Committee believed our Society could be strengthened and improved.

Today, I continue my service as Chair of the Memorial Committee and as a member of the newly formed MAPS Communications Committee.

In addition to my professional experience, I have a long history of financial stewardship. As an avid ten-pin bowler who wanted to give back to my local bowling community, I was elected Treasurer of my bowling league by its Board of Directors. I have proudly served in that position for more than 25 consecutive years, responsibly managing league finances with accuracy, transparency, and accountability.

I believe my decades of leadership experience, committee service, organizational knowledge, and financial responsibility have prepared me well to serve the International Planetarium Society as Treasurer. If elected, I will work diligently to support the Society's mission, safeguard its financial health, and serve our membership with integrity and dedication.

Paul J. Krupinski

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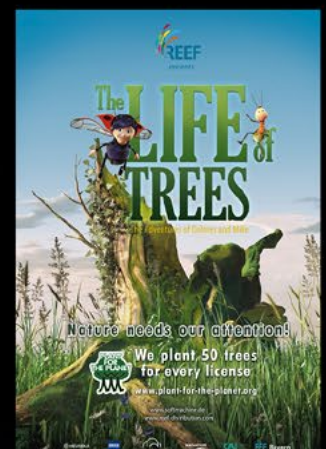
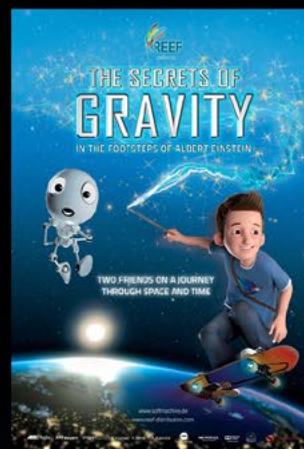
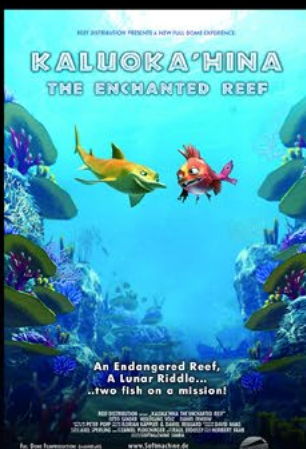
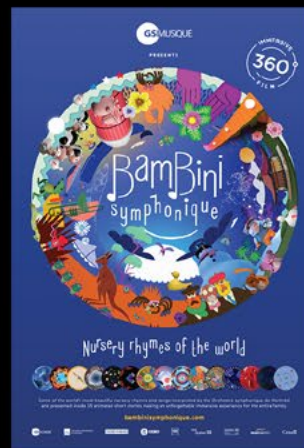
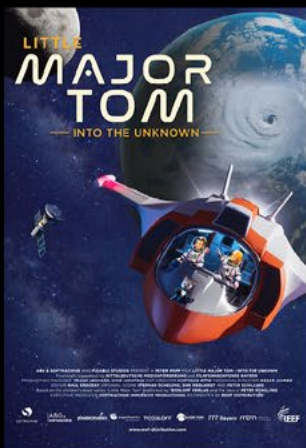
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Emotional Interactions... (con't.)

org/10.4135/9781529757989

- Christensen, L. and Russo, P. 2007. "Communicating Astronomy with the public" in *Future Professional Communication in Astronomy*, edited by A. Heck and L. Houziaux. 171-190. Mémoires de l' Académie Royale Belgique.
- Cohen, L., Manion, L. and Morrison, K. 2010. *Research methods in education*. 6. ed. London: Routledge.
- Davies, S. 2019. "Science Communication as Emotion Work: Negotiating Curiosity and Wonder at a Science Festival." *Science as Culture* 28, 4:1-23. <https://doi.org/10.1080/09505431.2019.1597035>
- Falchi, F., Barà, S., Cinzano, P., et al. 2023. "A call for scientists to halt the spoiling of the night sky with artificial light and satellites." *Nature Astronomy* 7:237-239.
- Falk, J. and Gillespie, K. 2009. "Investigating the Role of Emotion in Science Center Visitor Learning." *Visitor Studies* 12, 2:112-132. <http://dx.doi.org/10.1080/10645570903203414>
- Jefferson, G. 2004. "Glossary of transcript symbols with an introduction". In *Conversation analysis: Studies from the first generation*, edited by G. Lerner, 13-31. John Benjamins.
- Keltner, D. 2023 *Awe: The transformative power of everyday wonder*. Pinguin Books.
- Kessler, E. 2012. *Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime*. Minneapolis: University of Minnesota Press.
- Luna, D. S., and Bering, J. M. 2020. "The construction of awe in science communication." *PublicUnderstanding of Science* 30, 1: 2-15. <https://doi.org/10.1177/0963662520963256>
- Marchant, J. 2020. *The human cosmos: a secret history of the stars*. Canongate Books, Edinburgh.
- Marques, J. B. V, and Carlin, A. P. 2025. "Wonder and disappointment observing the sky: how emotions shape astronomy communication interactions." *Journal of Science Communication* 24, 06:A03.<https://doi.org/10.22323/154020250918221515>
- Marques, J. B. V., Carlin, A. P., and Gomes, M. 2024. "Wonder and awe observing the sky." *AstronomyEducation Journal*. <https://doi.org/10.32374/aej.aecon.2023.97aert>
- Marques, J. B. V, Carlin, A. P., Gomes M. and Moutinho R. 2021. "Periodicity and change: Talking about time inside the planetarium dome." *Science Education* 105, 6:1252-1284. <https://doi.org/10.1002/sce.21681>
- Marques, J. B. V., Carlin, A. P., and Moutinho, R. 2020. "Seeing by proxy: a detailed analysis of an educational interaction at the telescope." *Revista Brasileira de Ensino de Física* 42, e20190354-15.
- Marques, J., Costa, I. and Gomes M. 2024. "What Do People Really Talk About Inside the Dome? A Detailed Look at Planetarium Communication Topics." *Proceedings of 5th Shaw-IAU Workshop (2023)*: 126-129, OAE – IAU.
- Sacks H. 1995. *Lectures on Conversation*, Vols I-II. Oxford: Blackwell.
- Slater, T. and Tatge, C. 2017. *Research on teaching astronomy in the planetarium*. Springer.
- Valdesolo, P., Shtulman, A., and Baron, A. S. 2017. "Science is awe-some: The emotional antecedents of science learning." *Emotion Review* 9,3: 215-221. <https://doi.org/10.1177/1754073916673212>
- Walker, C. (Chair) 2021. *Dark and Quiet Skies for Science and Society: Report and Recommendations*. United Nations OOSA, IAU, Instituto de

Astrofísica de Canarias, Noir Lab.v

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Under the Classdome (con't.)

This article described ways to categorize these questions, as well as involving the students in coming up with the answer. Sorting your students' questions into some sort of classification scheme may help steer your interactions into more higher-order questions from your students, and more opportunities for student engagement.

REFERENCES:

- Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.
- Baram-Tsabari, A., Sethi, R. J., Bry, L., & Yarden, A. (2006). Using questions sent to an Ask-A-Scientist site to identify children's interests in science. *Science Education*, 90(6), 1050-1072. <https://doi.org/10.1002/sce.20163>
- Poarch, E. K. (2014). *Chatting about science: A qualitative study on increasing the number and depth of science-based conversations among aquarium visitor groups* (Publication No. 29121900). [Doctoral dissertation, Louisiana State University], ProQuest Dissertations and Theses Global.
- Van Zee, E., & Minstrell, P. (1997). Using questioning to guide student thinking. *The Journal of the Learning Sciences*, 6(3), 227-269. doi.org/10.1207/s1532690xjls0603_1

Science Fiction (con't.)

create a strong sense of physical presence, while carefully synchronizing the visuals with the narrator's voice. It was important to maintain a balance, so that the narration remained the central element of the film.

Throughout almost the entire process, I stayed immersed in this world through the lens of the virtual camera. I even learned the story almost by heart. This helped me to translate its atmosphere and meaning into visual images, rhythm, and movement.

I am very grateful to The Foundation Herbert W. Franke and Susanne Päch for the opportunity to create such a significant story in a new immersive format.

Sergey Prokofyev

Seeking What Works (con't.)

the opportunity for your audience to enjoy the planetarium visuals and music, and for you to catch your breath.

Mastering pauses should be of interest to all planetarium presenters, no matter their objectives.

Finally, before we finish, a quick question: how many of those 'fun facts' from section 5 can you remember?

10. REFERENCES & ACKNOWLEDGEMENTS

Thanks to Ken Brandt, Jean Creighton, and Katy Downing of the IPS Education Committee for helpful comments on the manuscript.

1. Willingham, Daniel, T. (2009): Why don't students like school? Jossey-Bass
2. Fiorella, L., Mayer, R.E. (2016): Eight Ways to Promote Generative Learning. *Educ Psychol Rev* 28, 717-741. <https://doi.org/10.1007/s10648-015-9348-9>
3. Rowe, M. B. (1986). Wait time: Slowing down may be a way of speeding up! *Journal of Teacher Education*, 37(1), 43-50. <https://doi.org/10.1177/002248718603700110>

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OBITUARY

AAGE “SANDY” SANDQVIST (1939 – 2026)

BY TOM CALLEN

FORMER ASTRONOMER/PROGRAM PRODUCER, COSMONOVA

Research astronomers worldwide lost a colleague and Cosmonova at the Swedish Museum of Natural History (*Naturhistoriska riksmuseet*, or NRM) a friend and strong supporter with the passing of Professor Emeritus Aage Sandkvist on 21 June 2026.

“Sandy,” once you got to know him, was born in Denmark on 1 June 1939, grew up in Canada, earned his PhD in Astronomy from the University of Maryland, then returned to Scandinavia and settled in Sweden in 1971.

He joined with NRM’s Public Department head, Kjell Engström, the following year as part of Engström’s task force and his 25-year effort to bring a major planetarium to Stockholm. The initial concept evolved to an Omnitheater with a starball projector and Omnimax (known as IMAX Dome today). The completed theater, named Cosmonova and equipped with Europe’s second Digistar I digital star projector system, premiered to the public on 16 October 1992. Even though the project was finally completed, Sandy remained on its Steering Committee for decades.

I first met him during my job interview in March 1991 for my position as Astronomer/Program Producer for the Stockholm Omnitheater Project, later known as Cosmonova, and we remained good friends ever after.

Not only did Sandy do research on how stars and planets form as well as in astrochemistry using some of the largest telescopes associated with European astronomy, but he was also deeply involved with Sweden’s Odin, a research satellite working in both astronomy and aeronomy.

Although retired, Sandy was still active in the astronomy community, and a person who continued to come to his office at Stockholm University’s AlbaNova University Center, often riding his bicycle from his home in Saltsjöbaden, a one-way distance of about 20 kilometers.

One project of deep personal meaning to him was a book he authored about his father, “Pilot in the Danish Brigade in Sweden during the Second World War,” which was eventually published in both Swedish and English.

Sandy is survived by his wife, Karin, three children, and grandchildren. He will be long-remembered for his good humor, kindness, support, and generosity to those he came into contact with.



Source: Karin Sandkvist

Women of the Allegheny Observatory... (con't.)

large telescope and dome in operation for work that night” (Wagman, n.d.).

FOR THE RECORD

The parallax program at the AO effectively ended in 1985 when electronic detectors took the place of photographic plates. However, the parallax program and the computers who sustained it are an enduring legacy.

Although the contributions of the women computers at the AO are preserved in the published record, the cumulative effect of those contributions was waiting to be noticed. A total of 1,628 parallaxes comprised the Allegheny Observatory catalog (Hanson, 1980). That's the starlight of 1,628 stars captured on more than 110,000 glass plates across more than 70 years. It's a record that would not exist if it weren't for the women computers at the Allegheny Observatory.

REFERENCES

- Beardsley, W. R. (1981). The Allegheny Observatory during the era of the Telescope Association, 1859-1867. *Western Pennsylvania History*: 1918-2023, 213-236.
- Crissman, B. G. (1934). Photographic determinations of the parallaxes of twenty-three stars with the Thaw refractor. *Astronomical Journal*, 43(1006), 110-111.
- Crissman, B. G. (1957). Photographic determination of the parallaxes of 55 stars with the Thaw refractor. *Astronomical Journal*, 62, 280-281.
- Curtis, H. D. (1922). Report of the director for the year July 1, 1921 to June 30, 1922. Box 25, Folder, 601. Allegheny Observatory Records, 1859-1967, UA.5.1, Archives & Special Collections, University of Pittsburgh Library System. (Hereafter referred to as Allegheny Observatory Records.)
- Curtis, H. D. (1924). Report of the work of the Allegheny Observatory during the biennium 1922- 24. Box 25, Folder, 602. Allegheny Observatory Records.
- Curtis, H. D. (January 10, 1927). Letter to Miss Bretney. Box 18, Folder, 441. Allegheny Observatory Records.
- Curtis, H. D. (February 19, 1928). Letter to B. G. Crissman. Box 19, Folder 455. Allegheny Observatory Records.
- Hanson, R. B. (1980). Systematic effects in trigonometric parallaxes-I. The distribution of observed parallaxes. *Monthly Notices of the Royal Astronomical Society*, 192(3), 347-357.
- Hoffleit, D. (2014). "Jenkins, Louise Freeland," In Thomas Hockey et al., *Biographical Encyclopedia of Astronomers*, 1126-1127. https://doi.org/10.1007/978-1-4419-9917-7_720
- Jordan, F. (June 30, 1918). Report to chancellor. Box 46, Folder 5. Allegheny Observatory Records.
- Lauterbach, T. (1950). Letter to H. DeFrance. Theodora Lauterbach Papers, UA.91.10, Archives & Special Collections, University of Pittsburgh Library System. (Hereafter referred to as Theodora Lauterbach Papers.)
- Lauterbach, T. (1951). Note to N. E. Wagman. Wagman, Box 27, Folder 675, Allegheny Observatory Records.
- Lauterbach, T. (January 26, 1952). Letter to H. DeFrance. Theodora Lauterbach Papers.
- Lauterbach, T. (May 26, 1952). Letter to K. Burns. Burns, Box 41, Folder 67, Allegheny Observatory Records
- Lauterbach, T. (January 28, 1952). Responses to questions from editor. Wagman, Box 24, Folder 701, Allegheny Observatory Records.
- Lauterbach, T. (1959). *The Allegheny Observatory of the University of Pittsburgh*. Observatory of the University of Pittsburgh.
- Lauterbach, T., & Wagman, N. E. (1952). Photographic determinations of the parallaxes of 52 stars with the Thaw refractor. *Astronomical Journal*, 57, 123-124.
- Musto, D. F. (1967). A survey of the American observatory movement, 1800-1850. *Vistas in Astronomy*, 9, 87-92. *New York Times* (November 27, 1937). Parallax record set at Pittsburgh, 1.
- Rossiter, M. W. (1982). *Women scientists in America: Struggles and strategies to 1940* (Vol. 1). Baltimore, MD: Johns Hopkins University Press.
- Schlesinger, F. (1915). The determination of star places with a wide-angle camera. *The Observatory*, 38, 129-133.
- Schlesinger, F. (1919). Photographic determinations of the parallaxes of fifty stars with the Thaw refractor," *Publications of the Allegheny Observatory of the University of Pittsburgh*, 4(1), 1-67.
- Schlesinger, F., & Hudson, C. J. (1916). The determination of star positions by means of a wide-angle camera. *Publications of the Allegheny Observatory of the University of Pittsburgh*; 3(9), 59-75.
- Schlesinger, F., & Jenkins, L. F. (1935). *General Catalog of Stellar Parallaxes* (2nd Ed.) New Haven, CT: Yale University Observatory.
- Schlesinger, F., & Nail, M. (1919). Photographic determinations of the parallaxes of thirty stars. *Publications of the Allegheny Observatory of the University of Pittsburgh*, 4(4), 153-183.
- Schlesinger, F., & Knudsen, H. (1919). Photographic determinations of the parallaxes of twenty-five stars. *Publications of the Allegheny Observatory of the University of Pittsburgh*, 4(5), 185-210.
- Schlesinger, F., & Stocker, F. (1920). Photographic determinations of the parallaxes of twenty-eight stars. *Publications of the Allegheny Observatory of the University of Pittsburgh*, 5(1), 1-27
- Schlesinger, F., Denton, L., & Bender, M. (1920). Photographic determinations of the parallaxes of forty-nine stars. *Publications of the Allegheny Observatory of the University of Pittsburgh*, 5(3), 53-101.
- Sieminski, A. E. (November 11, 2025). Forest Hills history: More physicists next door;" *Forest Hills Connection*. <https://www.foresthillsconnection.com/news/forest-hills-history-more-physicists-next-door/>
- Sobel, D. (2016). *The glass universe: How the ladies of the Harvard Observatory took the measure of the stars*. New York: Viking.
- Strand, E.A. (January 22, 1952). Letter to N. E. Wagman. Wagman Box 15, Folder 378. Allegheny Observatory Records.
- Wagman, N. E. (1951). Report of the Allegheny Observatory 1950-51. Jordan, Box 26, Folder 643. Allegheny Observatory Records.
- Wagman, N. E. (March 16, 1973). Letter to G. L. Plavetich. Wagman, Box 74, Folder 3. Allegheny Observatory Records.
- Wagman N. E. (n.d.). An observatory vignette. Theodora Lauterbach Papers.
- Wagman, N. E., & Crissman, H. L. (1957). Photographic determination of the parallaxes of 35 stars with the Thaw refractor. *Astronomical Journal*, 62, 279-280.
- Wagman, N. E., Daniel, Z., & Crissman, G. B. (1963). Photographic determinations of the parallaxes of 60 stars with the Thaw refractor. *Astronomical Journal*, 68, 352-353.
- Wagman, N. E., & Jameson, E. (1950). A comparison of present and earlier Allegheny parallaxes. *Astronomical Journal*, 55, 185.
- University of Pittsburgh, (1917). *The Owl*.
- University of Pittsburgh Department of Physics and Astronomy, "Allegheny Observatory," <https://www.observatory.pitt.edu/about>
- Zrull, L. S. (2021). Women in glass: Women at the Harvard Observatory during the era of astronomical glass plate photography, 1875-1975. *Journal for the History of Astronomy*, 52(2), 115-146.

International News (con't.)

million visitors. On 15 June, representatives from politics, science, and culture gathered for an exclusive reception to celebrate the Foundation's tenth anniversary. Among the guests were the Governing Mayor of Berlin Kai Wegner, Senator for Education, Youth and Family Katharina Günther-Wünsch, and Germany's first female astronaut in space, Rabea Rogge. The event highlighted the Foundation's central role within Berlin's educational and cultural landscape. Rabea Rogge said about the Foundation's role: "Planetariums have always been places of inspiration for me. Looking up at the stars and looking back at Earth evoke the same feeling: awe and wonder. I continue to find that sense of wonder in Berlin's

planetariums, and I hope every visitor has the chance to experience it".

With the new fulldome production *Time – In the Flow of the Universe* by the award-winning Polish studio Creative Planet, Stiftung Planetarium Berlin presents another highlight of its anniversary year. The immersive, live-narrated program celebrated its world premiere at Zeiss-Großplanetarium on 15 June and has been shown there regularly ever since. It explores one of the fundamental questions of modern physics: What is time? From humanity's earliest calendars to Einstein's theory of relativity, audiences embark on a visually stunning journey through a universe without an absolute present, ultimately reflecting on how we experience our own moment within the cosmos.

Under the motto "Kurz mal Kosmos" (literally: A Quick Moment of Cosmos), Stiftung Planetarium Berlin also invited visitors on 4 July to enjoy discounted short-format programs

Tales from Dome Under (con't.)

five paintings until there was now a build-up of seven coats of paint. At that point in time, it was decided that perhaps they should take some field trips to other major planetariums—complete with said array of powerful spotlights in tow—to see if they could perceive any difference in their domes as compared to the Spacearium's.

Surprise, surprise. Setting up the spotlights in these other domes in the same way they had been set-up in the Spacearium showed the same sort of effect the NASM staffers thought was a defect in the paint. As it turns out, it wasn't a case of bad painting, but one originating with the spotlights. So, in essence, the dome was ready to use, but now with five-too-many coats of paint. Case closed, though we now knew we would have to come up with another solution than repaint it again. Replacing the whole dome was our only option, which led to another set of problems.

Removing all of the 233 seats and storing them proved to be too expensive (not to mention the nightmare of re-installing them all again afterwards), which is when I hit upon a possible solution. Why not cover all of the seats with protective plastic sheeting, then build a wall-to-wall, false floor via metal scaffolding on top of them. This could then be covered over with sheets of plywood, which would allow AstroTech to use the rolling towers originally planned to run around on the carpeted floor as if all the seats had been removed. Plastic sheeting was also applied throughout the special effects projector areas behind the dome, thereby reducing the amount of clean-up needed there.

This proved to be what worked. AstroTech came in with their rolling towers, drilled out all the tens of thousands of rivets holding the dome's gores up, and then lowered them to the floor using a rope with a pair of vise-grips holding them on the way down. I will never forget how these tall towers

would lean as they stood at the edge of the work platform on top as they did so. Once all of them were removed, it just left the dome's supporting frame standing, which vibrated back-and-forth like a giant lump of Jello gelatin when you touched it. In fact, it oscillated so much that it actually took time for them to die down again.

The gores, with one coat of paint from the supplier, were installed, riveted into place, and then the new dome was given a second spray coat of paint. The plywood decking was removed as was all the plastic sheeting over the chairs. This then left only vacuuming up any paint dust left in the projection gallery areas not protected by the plastic sheeting installed and removed from this part of the theater.

As luck would have it, the final cost of the dome replacement project ended up being about the same as the amount of money still remaining in the West German planetarium fund. Everyone involved ended up happy. The money was used to the West German government's satisfaction so they could close the bank account, and the Spacearium solved two real problems that were for its improvement; a win-win situation. And, in spite of how things feel in the world nowadays, isn't that the way it's supposed to be?

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On August 5, Cosm hosted its first live, interactive Domecast, using Digistar's newly enhanced functionality. Live multi-feed video communication let viewers in different domes interact with the discussion and ask questions directly. The Domecast focused on the Dark Energy Spectroscopic Instrument (DESI) Survey, the largest map of the universe ever made. DESI scientist Dr. Kyle Dawson of the University of Utah guided audiences through billions of light-years of cosmic structure, tracing dark energy's influence across time.

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INTERNATIONAL PLANETARIUM'S CALENDAR

COMPILED BY: LORIS RAMPONI

2026

- **11-13 September.** 5th Festival FullDome. Different French planetariums are involved in the initiative
Contact: Fabien FM. Marquet, f.marquet@centre-astro.fr
- **14-16 September.** Association of French Speaking Planetariums, APLF Annual Conference, Vulcania Planetarium, Saint-Ours, France.
Contact: nicolas fiolet. nfiolet@lacoupole.com (APLF) www.aplf-planetariums.org
- **16-19 September.** Association of Science and Technologies Centers, ASTC Annual Conference, Phoenix, Arizona Science Center, Arizona, USA.
<https://www.astc.org/>
<https://www.astc.org/astc-2026/>
- **18-19 September.** British Association of Planetaria (BAP), 2026 Conference, Sherwood Observatory, Sutton-in-Ashfield, United Kingdom.
<https://www.planetaria.org.uk/>
- **19 September.** 12th Worldwide Meeting online dedicated to traveling planetariums and in particular to operators, producers and sellers. Begin at 14:00 Universal Time UTC.
The yearly calendar for the mobile planetariums online meeting, setting it, usually, in January, May and September.
Contact: Susan Reynolds Button, sbuttonq2c@gmail.com;
Marco Avalos Dittel, info@planetarioaventura.com
<http://www.ips-planetarium.org/>
- **4-10 October.** World Space Week 2026. Theme of the year: Rocket Revolution.
- **Contact:** Milica Milosev, mmilosev@worldspaceweek.org
- <https://www.worldspaceweek.org/>
-
- **12-16 October.** Digistar Users Group, Strassenburgh Planetarium, Rochester, New York, USA.
<https://digistarusersgroup.wildapricot.org/conference>
<https://rmisc.org/events/dug/?cn-reloaded=1>
- **20-24 October.** Great Lake Planetarium Association, Pacific Planetarium Association, GLPA+PPA conference, Grand Rapids Public Museum, Grand Rapids, Michigan (USA).
<https://glpa.org/annual-conference/>
<https://www.ppadomes.org/events/conferences>
- **November.** Viva Inmersiva Film Festival, Planetario Medellín, Medellín, Colombia.
<https://www.vivainmersiva.com/>
[https://colombiacrea.org/proyecto/viva-inmersiva-](https://colombiacrea.org/proyecto/viva-inmersiva-international-fulldome-festival-festival-internacional-de-arte-ciencia-y-tecnologia-en-formatos-inmersivos/)

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- **18-20 December.** Workshop of Planétariums Interactif Associés francophones (PIAf), Marseille, France.
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Free inscription: <https://groups.io/g/lss-plane>
<https://planetariums-interactifs.org/>
- **31 December.** Deadline for the contest "A week in the United States". For information and application requirements go to: www.ips-planetarium.org/?page=WeekinUS
- **31 December.** Deadline for the contest "A week with the GDP". Gesellschaft Deutschsprachiger Planetarien e.V., (GDP) is the Society of German-Speaking Planetaria.
Contact: mail@tilohohenschlaeger.com
<https://www.ips-planetarium.org/page/WeekwithGDP>
- **31 December.** Deadline of the prize "Page of stars" organized by IPS Portable Planetarium Committee in collaboration with Serafino Zani Astronomical Observatory.
Contact: Susan Reynolds Button, sbuttonq2c@gmail.com;
<http://www.ips-planetarium.org/?page=pagesofstars>

2027

- **20 March.** The Best of Earth Fulldome Awards 2027. The Best of Earth Awards Show is a coalition of fulldome film festivals around the world (Jena, Los Angeles, Plymouth, Melbourne, Canada, Brno) to celebrate the innovation and magnificence that fulldome provides. The event will be streamed.
<http://bestof.earth/>
- **31 March.** Deadline of 15th PLANit Prize for an original video production, organized each year by Italian Association of Planetaria (PLANit), Italy. The prize is open to everyone. First prize 500 euro.
Contact: segreteria@planetari.org
<https://www.planetari.org/premio-planit/>
- **April.** Italian Association of Planetaria (PLANit), 42nd National Conference of Associazione dei Planetari Italiani.
Contact: segreteria@planetari.org; Dario Tiveron, dario@fddb.org
<https://www.planetari.org/meeting-dei-planetari/>
- **April.** Gesellschaft Deutschsprachiger Planetarien e.V., (GDP), Annual Conference of the Society of German-Speaking Planetaria.

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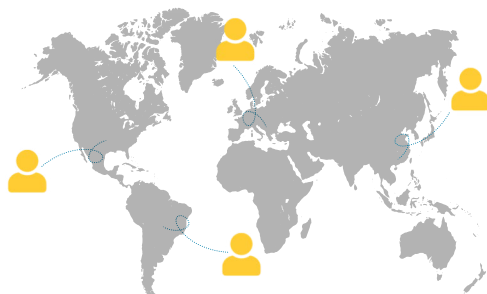
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Contact: [Voss, Björn Dr., bjoern.voss@bkm.hamburg.de](mailto:bjoern.voss@bkm.hamburg.de)
www.gdp-planetarium.org

- **7 May.** International Day of Planetariums
ips-planetarium.site-ym.com/?page=IDP
- **18 May.** International Museums Day,
<http://icom.museum>
- **May. 12th** Fulldome Festival Brno, Brno Observatory and Planetarium, Brno, Czech Republic.
 Contact: director@fulldomefestivalbrno.com
<https://www.fulldomefestivalbrno.com/>
- **8-10 June.** European Network Science Centres & Museums (ECSITE), Annual Conference, hosted by Universcience (Palais de la Découverte et Cité des Sciences et de l'Industrie). The Conference site will be Cité des Sciences et de l'Industrie, Paris, France.
<https://www.ecsite.eu/Ecsite-2027>
- **30 June.** Asteroid Day. <https://asteroidday.org/>
- **31 July.** Deadline for applications for "Two weeks in Italy" organized, with the support of International Planetarium Society, by PLANit in collaboration with IPS Portable Planetarium Committee and Serafino Zani Astronomical Observatory.
 Contact: Susan Reynolds Button, sbuttonq2c@gmail.com
ips-planetarium.site-ym.com/?page=Italy
- **2 August.** Total solar eclipse: southern Spain, Gibraltar, Morocco, Algeria, Tunisia, Libya, Egypt, Saudi Arabia, Yemen, and Somalia.
<https://www.helioclipse.com/en/eclipse/2027-august-2-total-solar-eclipse/>
https://en.wikipedia.org/wiki/Solar_eclipse_of_August_2,_2027
- **10-19 August.** XXXIII IAU General Assembly, International Astronomical Union, Rome, Italy.
<https://www.iau.org/IAU/IAU/About/Calendar.aspx?hkey=a5f8fbe5-31c8-41cd-a691-83ec7d16db25>
 Access to virtual platform available. See as example:
<https://astronomy2024.org/registration/>
- **Early Autumn.** Nordic Planetarium Association, NPA meeting, Heureka Science Center, Vantaa, Finland.
<https://www.npa-planetarium.org/>

2028

- **26 January.** Annular solar eclipse: Ecuador, Peru, northern Brazil and French Guiana, Atlantic Ocean, southern Portugal and Madeira islands, northern Morocco and southern Spain.
<https://nso.edu/for-public/annular-solar-eclipse-map-january-26-2028/>

29TH INTERNATIONAL PLANETARIUM SOCIETY CONFERENCE, PLANETARIO GALILEO GALILEI, BUENOS AIRES, ARGENTINA.

- **17-18 June.** Fulldome Festival.
- **19-23 June.** Open Ceremony, Sessions and workshops, Sponsor Exhibition, General Meeting, Keynote. Post Conference Tour.
<https://www.ips-planetarium.org/news/705534/>

2027 ANNIVERSARIES

50 YEARS

50th anniversary of the invention of the Starlab mobile planetarium.

40 YEARS

John Meader (Maine, USA) turning 40 years with his mobile planetarium, being the longest operating mobile planetarium.

IS THE NIGHT SKY TRULY BLACK?

A very faint glow from countless stars covers the entire sky

Photo by Takayuki Ohira | Hateruma Island, Okinawa, Japan



MEGASTAR-IIA
with SWING AXIS & GIGAMASK
Dome: 15-25 m, flat / tilted



MEGASTAR-IIA
Dome: 15-25 m, flat / tilted

MEDIUM & LARGE DOME

NEW MODEL



MEGASTAR-IIC
*Up to 20 m (optional)
Dome: 10-18* m, flat / tilted

MEDIUM DOME



Grand Reopening in April 2026
Kumagaya City Culture Center, Japan



MEGASTAR-Neo II
Dome: 4-10 m, flat / tilted

SMALL DOME





American Museum
of Natural History

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Journey through our stellar neighborhood to witness some of the chance encounters that have shaped the destiny of the cosmos.

Available in 8K and 4K, 60 fps and 30 fps.

Contact Matt Heenan at mheen@amnh.org for more information.

amnh.org/fulldome

Encounters in the Milky Way was developed with the major support and partnership of the National Aeronautics and Space Administration (NASA).

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