

Vol. 55, No.2

June 2026

PLANETARIAN

Journal of the International Planetarium Society

As realistic as possible

Starry Sky with Landscapes

Stars at the zenith shine brightly, while stars near the horizon are hazy in the atmosphere
Stars at the zenith are still, while stars near the horizon are more twinkling

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SMALL DOME





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ON THE COVER

The Sonoran desert, with east Tucson in the background, as hints of an aurora peek down during a solar storm in January 2026.

Have an image you would like to see on the cover of the Planetarium? Submit your photos to editor@ips-planetarium.org with the subject line "Cover Submission". We love to showcase the work that our fellow planetarians are doing!

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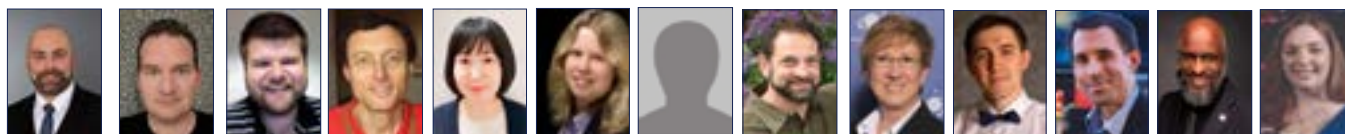


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We are gathered together from all corners of this globe, inspired by the world and the universe we inhabit. Our society draws its strength from our predecessors and from the wide diversity of our present membership. Building on our past heritage, we are inspired to dream of future accomplishments, working together as a worldwide society.

IPS President Dave Weinrich
Welcome to the 2012
IPS Conference
Baton Rouge, Louisiana

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HELLO FELLOW PLANETARIANS!

A MESSAGE FROM THE PRESIDENT



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Greeting Fellow Planetarians~

This is a bittersweet letter, as this issue of *The Planetarian* is the last issue that will be regularly printed for members. While the print copy will be available for those who wish to opt in, our default after this issue will be a digital copy.

This move to primarily digital copies of *The Planetarian* will not change the the journal, but will allow for quicker access to the journal for our members, more features such as direct links and embedded videos to accompany articles and sponsor advertisements, and it allows IPS to save funds that would normally have gone to printing and shipping. That will allow us to fund projects that directly benefit and support members. As mentioned in the last issue, these savings have already allowed us to offer stronger support for the "Week In..." that directly support professional development of planetarians through networking and cultural exchange. And we were able to fund a second Planetarium Education Research Fellowship that provides data that supports all planetarians in finding best practices.

I would like to take this opportunity, as well, to give a big shout out to the editor of the the *Planetarian*, Shiloe Fontes. She has been a steadfast caretaker of this journal for years. This is a volunteer position that takes a lot of care and work to put together an issue. Shiloe spends countless hours every issue laying out the journal and making it look polished. This is on top of her job managing the planetarium at the Flandrau Science Center & Planetarium and working on her graduate degree. Please thank Shiloe the next time you see her at a conference or a virtual meeting for her amazing work.

The IPS does the work it can do because of its amazing members. IWe have dedicated committee chairs and members who are passionate and true believers in the power of planetariums. But it is not only our belief in domes, but in each other. We want to support one another and serve others in our field. Please take a look at all the names in every issue of the *Planetarian*. Those folks listed are serving the organization and putting in a ton of time and effort behind the scenes on top of having demanding day jobs.

If you are interested in supporting IPS as well, consider joining a committee or running for office. We are all in this together and many hands make for light work.

Now, by the next issue, we will have wrapped our conference in Fukuoka, Japan. I can't wait to see all of you and learn from you at the conference. And be sure to thank our hosts for their immense work behind the scenes as well to make that conference a wonderful experience.

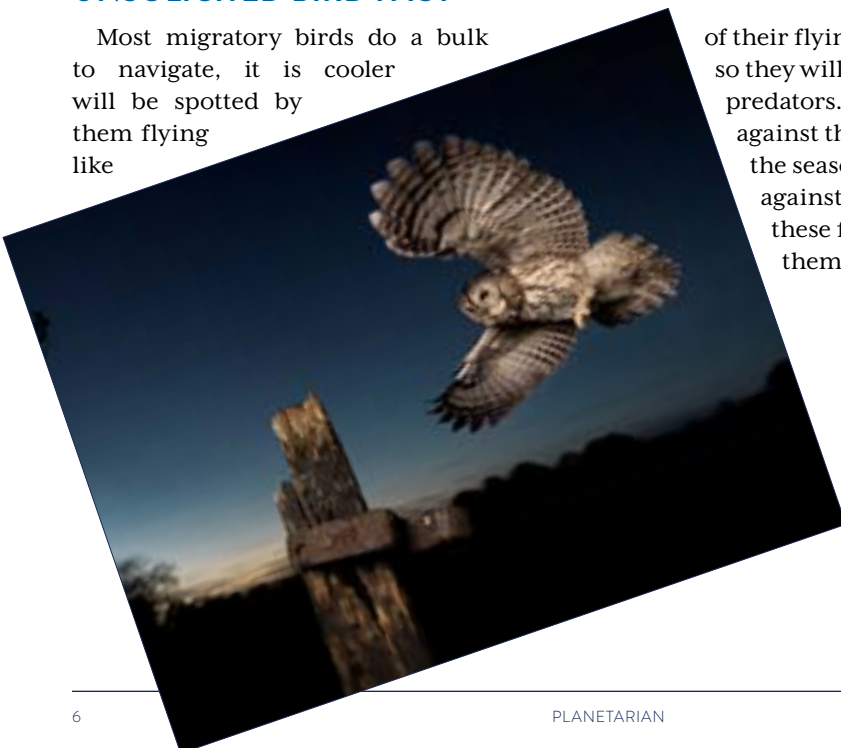
With gratitude to all my fellow planetarians,



Shannon

UNSOLICITED BIRD FACT

Most migratory birds do a bulk to navigate, it is cooler will be spotted by them flying like



of their flying at night. This is for many reasons. They do use the sky so they will not overheat, the air is calmer, and it is less likely they predators. So, when you are out stargazing, listen for birds. Look for against the light of the moon. Look for their seasonal patterns much the seasonal patterns in our constellations. And if you are fighting against light pollution for astronomy, know you are also helping these feathered friends as well as light pollution can disorient them on their flights.

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Seeing beyond

MYSTERIES OF THE COSMOS IN FRONT OF THE CONSOLE



Shiloe Fontes

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impossible not to wonder whether life exists beyond our own world.

One of our goals with this exhibit was to create a space where visitors could explore not only how scientists study these distant worlds, but also how they search for signs of life. We wanted to encourage curiosity and imagination - to invite people to ask big questions. Transforming what is generally one of the smallest areas of the science center into a space that inspires wonder became an exercise in imagination for our team as well.

Working at the University of Arizona gives us access to an incredible community of researchers who are eager to share their work with the public. The challenge is rarely finding meaningful science to highlight - it's narrowing down which stories to tell. I'm constantly in awe of how effectively our team works together to distill complex research into something accessible, engaging, and inspiring.

I'm especially grateful that so much of this work translates so naturally to the planetarium dome. We were fortunate to premiere "Dark Biosphere" alongside the exhibit, a show that thematically pairs beautifully. It allowed us to visualize research on extremophiles and habitability in an entirely different environment, creating another way for audiences to connect with these ideas.

The response from visitors has been overwhelmingly positive, and I couldn't be happier about that.

At the same time, I can't ignore how much this project demanded. It has been full throttle for months, and while I'm incredibly proud of what we created, I'm also ready for a bit of a mental reset. Sometimes stepping back is part of the creative process too. After all, recharging is often what makes the next big idea possible.

Creating a new exhibit is one of the most time-consuming duties I have at Flandrau, but it's also one of the most fulfilling, right alongside my planetarium hat. Even better is when those two worlds collide!

With "Mysteries of the Cosmos", we had the opportunity to really think about what we wanted a space exhibit to be and how we wanted it to feel different from the more traditional solar system exhibit that occupied the space before. Don't get me wrong, I still love the planets I painted for the previous exhibit, but new research into exoplanets has opened our eyes to worlds humanity is just beginning to imagine.

The rapid expansion of exoplanet discovery has completely changed how we think about our universe. With thousands of confirmed worlds - and many more waiting to be verified - the question of what else is out there feels more immediate than ever. It's a question that lives in the minds of nearly every child who walks through our doors, and honestly, in the minds of many adults too. With so many possibilities, it feels



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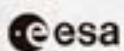
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BETTING ON A LIVING UNIVERSE

DARK BIOSPHERE

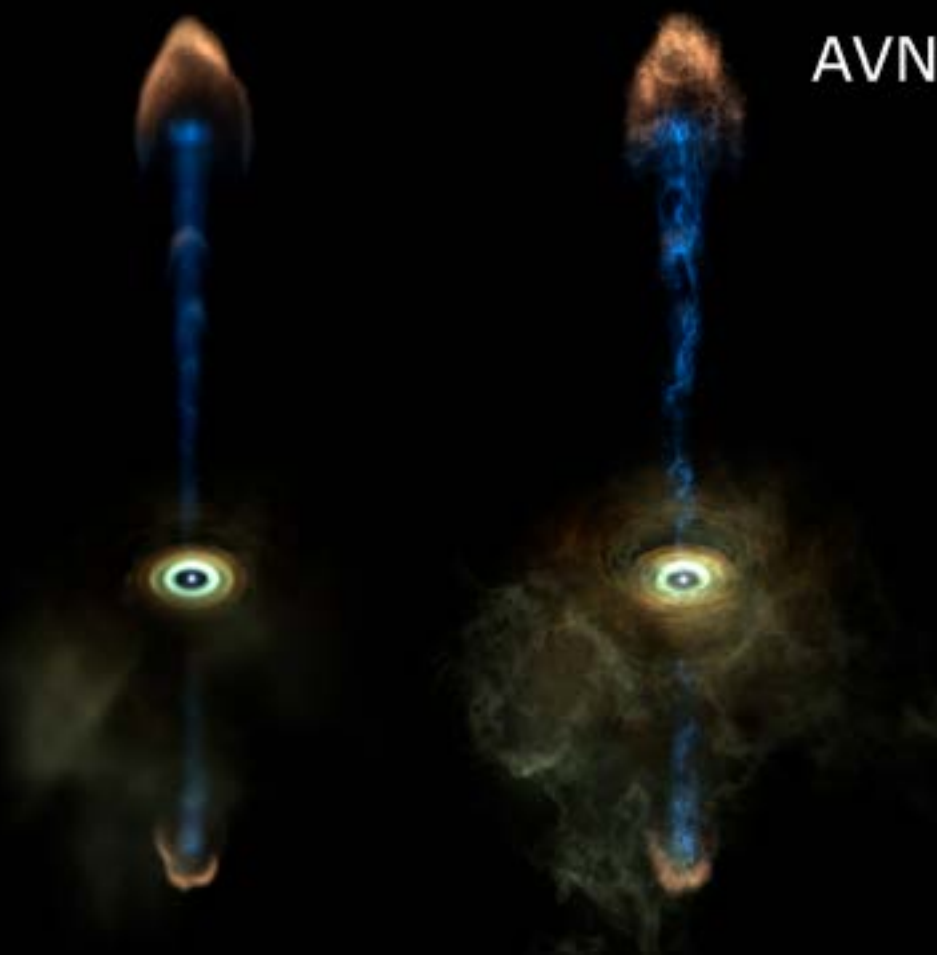
NARRATED BY
VIGGO MORTENSEN



BRIDGING THE REALISM GAP: AUGMENTING VOLUMETRIC NOISE IN THE DOME

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Figure 1: Comparison of a proto-planetary disk before (left) and after (right) the application of AVN. While traditional voxel-based rendering becomes blurry at close range, AVN restores the vibrant feel of the gaseous disk and elongated jet by generating high-frequency detail exactly where the structure requires it. (Image by *ilumbra*)



Step into any modern 8K planetarium, and the stars have never looked sharper. Yet, as we fly into a nebula or a supernova remnant, the illusion often begins to fade. What looked like a majestic celestial cloud from a distance frequently dissolves into a smooth, blurry fog—a well-known limitation of traditional volumetric rendering. To truly immerse an audience, we need more than just high resolution; we need the textures, the filaments, and the chaotic turbulence that define the actual physics of deep space. By integrating advanced procedural noise detail into our volumetric models, we've bridged this 'realism gap,' allowing for interactive fly-throughs that maintain their intricate beauty regardless of scale or distance.

At its core, volumetric rendering depends on an underlying grid of voxels, which store the spatial and colour data for a given point in 3D space. The visual fidelity an audience experiences is a direct product of "spatial frequency"—the finer the grid is sliced, the higher the detail. The problem: as the camera enters a volume, the apparent size of a single voxel increases until the complex nebula dissolves into a sequence of flat, monochromatic blocks.

The intuitive solution—simply increasing the voxel count—immediately collides with the hard ceiling of GPU memory. To circumvent this, we and the industry have turned to volumetric nesting in recent years. By embedding high-resolution textures only within specific regions of interest, we can "cheat" the resolution limit, adding detail where the audience is likely to look without the memory overhead of a universally dense grid.

Yet, nesting is a localized solution for a global problem. It excels for compact regions of interest, but fails when faced with large-scale morphology. For elongated structures—such as relativistic jets or sprawling gaseous filaments that span the entire nebula—nesting becomes inefficient. To maintain

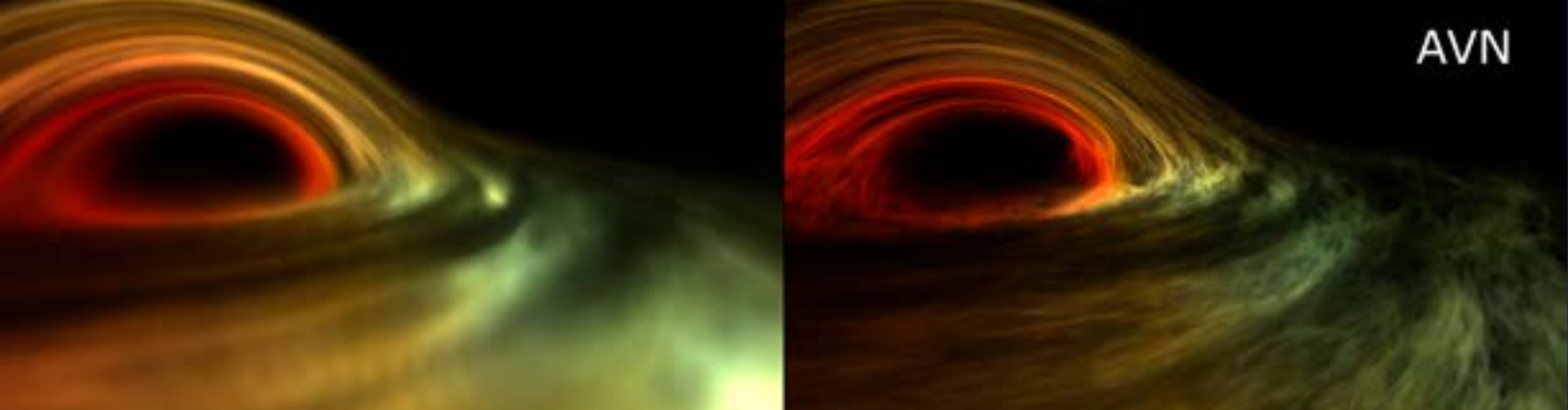


Figure 2: The versatility of AVN allows for seamless integration with complex shaders. In this example, the technique is applied to a black hole accretion disk: the left panel shows the baseline voxel-based rendering, while the right panel demonstrates how AVN introduces the high-frequency turbulence and structural detail characteristic of high-energy environments. (Image by *ilumbra*)

detail along these vast structures, the required spatial coverage of nested regions would eventually encompass the entire volume, effectively defeating the purpose of the technique.

To overcome these structural limitations, *ilumbra* has developed a new approach that enhances the nested voxel solution with procedural noise. This technique—Augmenting Volumetric Noise, or AVN—applies multi-layered noise functions to infuse the underlying volume with realistic turbulence in real-time. By introducing this dynamic layer, the volume gains a detailed, textured appearance without the memory overhead of a higher-resolution grid. Because this detail is added mathematically during the rendering process, it is essentially scale-invariant. Whether the audience is viewing a global vista of the nebula or zooming in on the edge of a gas pillar, the textures remain crisp and sharp, maintaining their integrity regardless of magnification (see Figure 1).

The defining advantage of AVN is the ability to localize noise with precision. While applying procedural noise to volumes is not a new concept, traditional methods often rely on simple mathematical curves or global functions. These are sufficient for generic clouds or galaxies, but they lack the specificity required to model authentic astronomical objects where intricate details must exist in very particular, data-driven locations.

A significant secondary advantage of AVN is its inherent capacity for motion. Because the noise is calculated procedurally in real-time, it can be animated at zero additional computational or memory cost. This allows us to transform traditionally static volumetric models into dynamic, breathing environments. By simply introducing a time-variable to the noise function, we can simulate the subtle roiling of gas clouds or the energetic turbulence of a stellar jet, bringing a level of vitality to the dome that static data-grids simply cannot achieve. A video demonstration of this technique, showcasing dynamic AGB convection, can be viewed at: https://www.ilumbra.com/public/agb_AVN.mp4.

AVN functions by embedding spatial paths and directional data developed by *ilumbra* directly within the volume. The planetarium's rendering engine then decodes these "instruction sets" to apply localized, high-resolution noise on the fly, as demonstrated with a black hole accretion disk in Figure 2. By shifting the focus from static storage to

procedural generation, we overcome the traditional voxel resolution limit.

While applying high-frequency noise requires additional computation—which can be demanding in complex scenes—AVN is optimized to maintain the high frame rates necessary for an interactive dome experience. Furthermore, given the rapid trajectory of GPU development, this computational cost is becoming increasingly negligible, allowing for even more intricate, real-time detail on the current and next generation of planetarium hardware.

As planetarium technology pushes further into the realms of high resolution and real-time interactivity, our methods for representing the cosmos must evolve in kind. The limitations of traditional volumetric rendering have long been barriers to true immersion. Nesting technology has made great strides in this respect, and when paired with AVN, cinematic-quality interactive shows are finally within our reach. By bridging the gap between low-resolution data and high-frequency detail, we can offer audiences a view of the universe that is as vibrant, turbulent, and dynamic as the real thing. This shift from memory-heavy storage to procedural generation doesn't just save hardware resources—it unlocks the ability to fly through a roiling nebula or along the edge of a relativistic jet without the illusion ever breaking. Ultimately, our goal is to ensure that the next time you look up at the dome, you don't see a digital approximation—you see a living, active window into the intricate complexity of our universe.

IMMERSIVE EXPERIENCES BEFORE COMPUTERS

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1. INTRODUCTION

Full-dome film festivals around the world showcase the best in immersive films, with the winners of festival awards pushing the boundaries of the medium and making potent artistic and educational works. The large catalog of full-dome films and virtual reality media suggest that we are in a golden age of immersive experiences made possible by computers, digital projection, and other modern technologies. But as those who have studied the history of media have argued, immersive experiences and immersive art have a history that long pre-dates computers and modern technologies (e.g., Grau 2003, Griffiths 2008). Immersive artwork designed to mimic reality has existed much further back in time (Gombrich 2000). Although these paintings and sculptures were static and may be judged primitive today, they were still highly impactful.

What do we mean by immersion? Janet Murray (1997) uses the metaphor of submergence in water, where someone is surrounded by liquid and cut off from dry land and air. Similarly, immersion by a mediated experience means the viewer is psychologically immersed in an alternate reality beyond their physical reality. Immersion can be highly compelling and meaningful, causing participants to lose themselves in the experience. Inspired by the above studies, I examine three examples of immersive experiences stretching back to our early ancestors. Created using a variety of pre-electronic multimedia, they include: a means for the shamanic transference of knowledge, spectacles for developing devotion in religious pilgrims, and media for mass entertainment. I examine how these experiences impacted their audiences and how understanding them can help inform us today.

2. IMMERSION IN PREHISTORY

Soon after modern humans migrated into Europe 40,000 years ago, cave art started appearing throughout the continent (Pike et al. 2012). Chauvet Cave in the Ardeche region of France, is one of the oldest. Discovered in December 1994, this limestone cave shows evidence for two periods of human occupation based on carbon-14 dating of charcoal, with the earlier one 30,000 years before present (BP), and the older one up to 37,000 BP. Drawings are found throughout the interior of the cavern, with the far end extending roughly 400 meters from the entrance. The locations where most of the art was drawn are in pitch darkness, meaning the artwork was created and viewed only from the light of a flame.

Access inside Chauvet Cave today is highly restricted, but the public can see it via virtual tours, a virtual reality app (Atlas V. et al. 2020), or from Werner Herzog's stereoscopic

3D documentary *Cave of Forgotten Dreams* (2010). These media reveal some of the thousands of individual paintings and drawings in the cave, the most memorable of which are the depictions of animals that include lions, mammoths, woolly rhinoceroses, horses, bison, and reindeer. Drawn with charcoal shading to give them depth, the creatures are often shown in mid-motion, and exhibit recognizable behaviors.

Since the public is unable to visit in person, the virtual reality app and 3D film are the next best ways to view the Chauvet Cave artwork. By means of stereoscopic 3D, the cave walls are not flat surfaces but instead are uneven and undulate. The artists often made use of the shape of the walls to accentuate the three-dimensional forms of the depicted wildlife. In one case, they rendered a bison at the corner where two walls met, with a face-on perspective on one side, and a profile view of the animal on the other (Clottes 1995; Fig. 1). There are also depictions of animals with multiple superimposed legs and horns, which could represent freeze-frames of them in action (Azéma & Rivère 2012; Fig. 2). In his film narration, Herzog imagines that when lit from a flickering lamp, these figures become animated to become “almost a form of proto-cinema.”

We will probably never know what drove ancient artists to create art in Chauvet Cave and on rock walls all over the world. This unfathomability has not stopped researchers from speculating: cave art being used for shamanistic vision quests (Lewis-Williams 2002); connecting to spirit animals to ensure the success of hunts via sympathetic magic (Keyser & Whitley 2006); serving as “social technology” that allows information to be shared (Barton, Clark, & Cohen 1994); drawn to trigger the dopamine-award system after intense observations of animal behavior (Onians 2007); and even recording the sky like a primitive planetarium (Rappenglück 2004)!

Irrespective of the exact reasons why it was created, it was probably unnerving for early humans to travel to locations deep underground to work on or view such art. The artists would have to hike, clamber, and crawl into pitch black environments. Since limestone caves are carved by running water, portions of the interior could be wet and slippery. The light from torches was necessary to find footing in the uneven terrain and to avoid bumping one's head against low-hanging formations. A group traversing into the cavern would cast shifting, chaotic shadows onto the uneven walls as they moved. If the passageway opened up, only the immediate path underfoot would remain illuminated, leaving a vast gloom in all other directions. And once visitors stopped to view a panel, their inconstant lights would not have



Figure 1 – Frame from *Cave of Forgotten Dreams* (Herzog 2010) showing a bison rendered in different views where two walls meet, with the geometry made more visible by the 3D cinematography. Copyright: Creative Differences.



Figure 2 – Frame from *Cave of Forgotten Dreams* (Herzog 2010) showing a reindeer with eight legs (left) and a rhino with multiple horns (upper right). Copyright: Creative Differences.

illuminated very far. A guide could control what everyone saw, by spotlighting one part of a frieze while leaving the rest in darkness.

Borrowing from the shamanistic hypothesis, John Pfeiffer in his book *The Creative Explosion* imagines why a tribe might decide to create cave art and to return to view it (1982; pp. 124-131). Because paleo-rock art was often inaccessible, he argues that members of the tribe viewed them only during special occasions. He surmised that these graphics could be part of a special ceremony to induct the next generation into the full responsibilities of the tribe. The interior of the cave was foreboding and unlike anything in the surface world. A newcomer into the cave would be fearful of their lamp going out or getting separated from the group. Being in this unpleasant, unfamiliar, and dangerous environment would smooth the way for the initiates to enter a communal bonding experience. In confined caves, fires can reduce the oxygen levels to hypoxic levels, which can lead to altered states of consciousness (Kedar, Kedar, & Barkai 2021). Shamanistic religious practices today often involve ingesting hallucinogenic plants, and many researchers assume that Paleolithic hunter-gatherers might have had similar rites (Clottes & Lewis-Williams 1998). Thus, the young tribal members could be led on vision quests by their elders. Via an immersive and all-encompassing experience that engaged not just their senses but their mental states, they were initiated into secret tribal knowledge.

3. IMMERSION AS RELIGIOUS PILGRIMAGE

One of the most remarkable multisensory experiences ever created is at one of the nine Sacri Monti (“Holy Mountains”) in northwestern Italy. These sites were simulations of the Holy Land, which Christian pilgrims could travel to when actual journeys to Jerusalem became more dangerous because of war with the Ottoman Turks. With construction starting

in 1486 and continuing into the 18th century, the first Sacro Monte was located on a promontory overlooking the village of Varallo in the foothills of the Alps. A pilgrim walking through its entrance would find a square anchored by a basilica with the main chapel and 44 smaller chapels distributed among the remaining buildings, all nestled between gardens and connecting paths.

What makes Sacro Monte di Varallo so extraordinary are the 800 life-sized sculptures and 3000 background frescoes that decorate the chapels. Constructed from wood and terracotta and painted in realistic colors, the statues fill out life-like scenes representing the life, death, and resurrection of Christ. Some statues have eyes made from glass, possess hair and beards woven from horsehair, and wear real clothing. There is evidence that sculptors added articulation into the limbs, allowing some of the figures to be repositioned (Terry-Fritsch 2022). Present-day tourists cannot enter the rooms where these scenes are located but can view them through wooden and metal screens. Numerous YouTube videos show what the modern visitor can discover walking through this site.

Our perception of the Sacro Monte today is completely unlike the experience of pilgrims visiting in the early 16th century. Pilgrims took rooms and spent multiple days in a retreat on the mountain. Each day was filled with ritual: fasting, meditation, studying and preparing for confession, with prayers led by the Franciscan friars (Hood 1984; pp. 302-303). The pilgrims would be led on tours through the chapels with scenes matching the contemplative theme of the day. Instead of having to imagine what Christ's life was like, the pilgrims could see it laid out in front of them. And unlike modern tourists who can stand in one spot to view these tableaux, the pilgrims *were encouraged to walk inside them, and touch and interact with the figures* (Bell 2014, p. 307). For instance, in the Nativity Scene, pilgrims were encouraged to touch and caress the Christ child, and to kiss his feet and face. In the chapels showing the passion cycle representing Christ's last days, the pilgrims expressed the emotions elicited by each scene. Pilgrims participated in Christ's suffering, beating themselves while weeping and reaching out to the statues. They joined the prostrating crowds at Golgotha to witness the crucifixion and shared the same emotions as the Virgin upon seeing her crucified son.

Pilgrims were led into the chapels at night, and similar to what likely occurred with paleo-cave art, they saw figures in flickering light that enhanced the illusion of life (Nova 1995, p. 119). The experience also engaged the other senses. The monks leading the tours would say familiar prayers and ask the pilgrims to imagine the noise in each scene, such as the sound of hammers on nails as Christ was being crucified



(Nova 1995, p. 123). There is evidence that smell was an important aspect of the experience (Karmon 2021, p. 107). In the chapel showcasing the Pietà (depicting Christ brought down from the cross and in the arms of the Virgin Mary), the smell of scented oil—used to anoint a body before it is wrapped in a shroud—pervaded the space (Karmon 2021, p. 118). In the Road to Cavalry (Fig. 3), the cross carried by Christ was made of cedar, a strongly scented wood. The fragrances of cedar and holy oil anchored the pilgrims' experiences, so if they came upon these odors in the future, they would be brought back to their personal witness of Christ's suffering (Karmon, pp. 116-118).

One final multisensory experience is worth noting, that of Christ lying in the Holy Sepulchre. To enter, the pilgrim had to crawl in on hands and knees, just like they would in Jerusalem. They found themselves in a windowless chamber that was lit only by oil lamps and candles (Fig. 4). There, they had additional opportunities to touch and

Figure 3 – The Road to Cavalry.
Photograph by Mattana, public domain.

Figure 4 – A modern tourist entering crouched into the Holy Sepulchre at the Sacro Monte in Varallo. Photograph by A. Terry-Fritsch, CC BY-NC 4.0.

caress Christ's body, now adorned with stigmata wounds and a crown of thorns. But since this room had no openings to vent the smoke from the lamps and candles, it was extremely uncomfortable to be in: the "stench of smoke and the blackness of soot evoke the choking grief of the faithful ... prior to the Resurrection" (Karmon 2021, p. 122). As the pilgrims were led out of this chamber, they saw a painting of Christ resurrected and were directed into the next space showing the scene of Mary Magdalene kneeling and weeping before the discovery of the open and empty tomb. By following this path, the pilgrims witnessed Christ's resurrection *before* Magdalene, a psychologically powerful moment that turned each of them into a "witness to the central mystery of the Christian faith" (Hood 1984, p. 301).

The contemporary YouTube videos of Sacro Monte are shot by tourists ambling from one chapel to the next, filming the tableaux that today, appear as dusty lifeless dioramas. The YouTubers often express awe at the craft they see, but this response pales in intensity to how 16th century pilgrims would have reacted. Those pilgrims were not passive observers but were active participants in the life of Christ. Instead of merely hearing or reading about the stories in the Gospels, they reenacted and lived them via powerful, multisensory, immersive experiences. Instead of merely visiting the Holy Land, they had embodied experiences with the major figures from scripture. They engaged these scenes physically and spiritually, creating deeper connections to their faith.

4. "IT IS LIFE ITSELF"

The foundation for cinema is underlaid by a variety of experiments, technical research, parlor room amusements, and even toys (Ceram 1961). This includes the "magic lanterns" first used by entertainers in the 17th century to project glass slides onto walls. By 1891, W.K.L. Dickson, working for Thomas Edison in West Orange, New Jersey, had invented the kinetograph, the first true motion picture camera that recorded live action onto film strips. These short films were shown on the kinetoscope, a separate machine that a customer would lean over to view into a peephole window. By 1894, kinetoscope parlors were spreading through the US and Europe. It was against this success that two brothers in Lyon, France, Louis and Auguste Lumière, invented the Cinématographe, a combination camera and projector. Instead of a person looking through a porthole, the Cinématographe *projected* the film so that it could be witnessed by a seated audience. The Lumière brothers' first screenings to a paying public on 30 December 1895, consisted of 10 films in a 25 minute program and marked the beginning of modern cinema.

It is hard for us today who have more than a century of cinematic history under our belts to imagine what those early spectators felt. Urban audiences were already familiar with the magic lantern shows, now projecting photographic (instead of painted) slides. Someone with a ticket to a Cinématographe show would not be surprised to see a projection on the wall, but they would be flabbergasted when

the image began to move. George Méliès, who later directed the first science fiction movie, *A Trip to the Moon* (1902), had a reaction that was typical of early moviegoers (Toulet 1995; pp. 14-15):

The other guest and I found ourselves in front of a small screen, similar to those we use for ... projections, and, after a few minutes, a stationary photograph showing the Place Bellecour in Lyons was projected. A little surprised, I scarcely had time to say to my neighbour: "Have we just been brought here to see projections? I've been doing them for ten years."

No sooner had I stopped speaking when a horse pulling a cart started to walk towards us, followed by other vehicles, then passersby—in short, all the hustle and bustle of a street. We sat with our mouths open, without speaking, filled with amazement.

A reporter writing in the newspaper *La Poste* is similarly astounded by one of the documentary shorts, *Workers Leaving the Factory* (Fig. 5; Toulet, p. 130):

It is a factory gate, which opens and releases a flood of workers, male and female, with bicycles, running dogs and carriages—all swarming and milling about. It is life itself; it is movement captured on the spot.

Amidst this hype, there was the occasional dissenting opinion. Russian novelist Maxim Gorky complained about the monochromatic look (Toulet, p. 132):

Last night, I was in the Kingdom of the Shadows. If one could only convey the strangeness of this world. A world without color and sound. Everything here—the earth, water and air, the trees, the people—everything is made of a monotone grey. Grey rays of sunlight in a grey sky, grey eyes in a grey face, leaves as grey as cinder. Not life, but the shadow of life. Not life's movement, but a sort of mute spectre.

But for most of the public, photography that moved was magical. There are early reports of audience members panicking when confronted with an approaching train or a gunfighter firing directly into the camera. Despite Gorky's complaint about the gray world depicted by cinema, Cinématographe theaters spread quickly all over the globe. Gorky saw a screening because the Lumière company sent its representatives armed with their lightweight cameras to break into new markets including Russia (Toulet, pp. 23-24). The camera operators shot at these locations and incorporated the new footage into their public exhibitions (Fig. 6; Gilson 1945).

Film continued to evolve in subsequent decades with improvements that increased its immersivity, including color, 3D, multichannel sound, and widescreen. Similar ecstatic reactions can be found after the first screenings of the Cinerama widescreen process in 1952, where audience members felt the film experience was so immersive and visceral that instead of being passive viewers, they were active participants (Belton 1997). Other widescreen formats appeared in subsequent decades, including IMAX system which first appeared in 1970. The 70 mm IMAX projection onto screens up to 24 m (79 ft) wide resulted in viewers losing



sight of the edges of the frame, rendering the screening “frameless” and all-encompassing (Shedd 1997).

5. THE CONTRADICTION OF IMMERSION THEN AND NOW

The reactions to early cinema are eye-opening to the modern reader. Today, these early films do not seem impressive. In fact, none of the media documented here seem particularly immersive or realistic to sophisticated modern audiences, who are inundated with technology-mediated experiences. To understand why those audiences reacted so differently, we need to turn to neuroscience. According to predictive coding theory (Rao & Ballard 1999), our reaction to a new experience is contingent on our expectations. Our brain processes sensory information using simultaneous “bottom-up” and “top-down” approaches. In the former, visual input is decoded by specialized neurons to derive the three-dimensional nature of a scene from the two-dimensional pattern of light detected by our eyes. Conversely, the brain’s top-down processes try to predict what we are seeing based on past experience. If the two processes give results that are a close match within a predictive error limit, then the brain has identified what is observed, incorporates it into its mental image, and proceeds to other tasks. What is identified earlier can prime our expectations of what else we expect to see. However, if there are too many errors between the top-down and bottom-up analyses, then something is amiss and more attention is needed to figure out what is happening.

For George Méliès, the experience of watching the Cinématographe initially matched the expectation of a magic lantern projection. But once the figures on the wall started to move, what he saw no longer matched his expectation. His brain alerted that something was wrong and reacted with surprise. If something even more dramatic occurred such as a train heading towards the audience, then his reaction would be amplified. Not only was the train unexpected, but the natural assumption was that this was a real train, in

Figure 5 – Frames from the Lumière’s *Workers Leaving the Factory* (1895).

Figure 6 – The Cinématographe camera and projector with Francis Doublier, who traveled the world, shooting and presenting short films for the Lumières, including the first ones in Russia. From Gilson (1945).



which case, it’s a good idea to get out of the way. Conversely, for modern viewers who grew up with moving images on screens, the Cinématographe projection does nothing to upend their expectations. Their brains categorize the film as something witnessed countless other times and so, they are indifferent to it.

The predictive coding model also explains why we become habituated to and lose interest in novel technologies. When people are exposed to innovative visual media, such as cinema in the past or virtual reality now, their brains have no prior experience to refer to, and they react in surprise. But after repeated exposure to these media, their mental models are updated and expectations shift, with the surprise response dissipating. We might revive their astonishment by shifting to ever more novel experiences. In the case of VR or fulldome, this might mean better immersion by increasing the display resolution, having more spatialized audio, or more interactivity. But further refinement may not lead to increased uptake or engagement, especially once financial and usability costs are factored in. There was great hope in the 2010s that virtual reality had come to stay with the

popularity of the first Oculus headset. But by the end of the decade, journalists were noting that this latest wave of virtual reality still failed to become mainstream because of cost and lack of compelling content (e.g., Fogden 2018, Roose 2020). In 2021, Facebook was renamed Meta as the company committed to building a “metaverse” that would be accessed through virtual reality. Yet, after spending close to \$80 billion, the company stepped back from this goal (Levi 2026). Despite this vast effort, why were people not convinced to join in?

6. LESSONS FOR CREATING IMMERSIVE EXPERIENCES TODAY

Cave art and the Sacro Monte are examples of immersive experiences that were low-tech and low fidelity compared to the technologies of today. These experiences do not have high *system immersion* that can be objectively measured and quantified, like the resolution of a display or the number of audio channels. However, they have *narrative immersion*, defined as how well the storytelling, aesthetics, and interaction with the medium engaged the viewer with meaning and emotional resonance (Nilsson, Nordahl, & Serafin 2016). It seems that a low system immersion experience can grab participants and keep them hooked if the narrative engagement is high.

The fact that the public is uninterested in the metaverse and Gorky was unimpressed by the Cinématographe suggests that the narrative immersion of older media was perfectly acceptable to them, while the drawbacks of the new media made them not worth the effort. Strong narrative immersion beats high system immersion. For planetarians, this is similar to the maxim that has floated around for decades: story and emotional connections are more important in planetarium programs than the technical brilliance of the production (e.g., Buckley 1983, McColman 1990, Davenport et al. 1991, Weinrich 2012, Brandl & Popp 2017, Kundert 2024). If you have effective storytelling, you do not necessarily need sophisticated visuals—or any visuals at all if your story can trigger the audience’s imagination (Meador 1993).

The paleo-cave art and Sacro Monte experiences offer one final intriguing lesson. We know that certain categories of experiences are amplified and do not fade away from repetition. Think of the religious ritual whose meaning does not diminish no matter how many times you participate in it, or the favorite movie that you can watch repeatedly and still enjoy. Those experiences are important because of how they make us feel, and because they have meaning for us. We are affected by our religious practice because they make us feel closer to the divine. We return to the same beloved film because its themes reinforce our own values and beliefs. One can imagine that the rituals involving Paleolithic cave art or the chapels at Sacro Monte did not diminish in power to those who experienced them more than once. Is it possible to create a dome experience that can drive similar reactions in our audiences?

I do not think anyone is close to finding a magic answer to this question, although many have thought about what

makes effective storytelling in planetariums (Tidey 2005).

Many of the recommended tips are what one would expect for any type of science communication, such as knowing your audience, using analogies in explanations, and minimizing technical jargon. However, because the immersive encounters examined in this paper had such enormous personal impacts on their participants, it’s worth reviewing two final “tips.”

In writing about the type of fulldome films he wrote and directed at the California Academy of Science, Ryan Wyatt describes two important rules of the “Academy Style” (2019). The first is *to create human- and audience-centered content*. This means the show must be relevant to its audience in some way or they will be less likely to care. Because astronomy is a science where it is easy to remove people from the story, a conscious effort must be made to include humans at some level. Second, the show should *start at human scale*. This provides a visual entry point to the story that is welcoming to an audience member, before the cinematography and the narrative move on to scales and phenomena far outside our everyday life. There is no guarantee that following these guidelines will result in you creating an all-compelling planetarium experience, since many more steps of the production must succeed. But surely, no production can hope to have a meaningful impact on the audience unless you make an effort to put people first.

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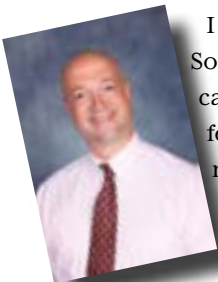
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THE DOME THAT CHANGED MY LIFE

Dr. Brian Hart
University of California, Irvine

INTRODUCTION



I recently joined the International Planetarium Society as an individual member under the category of professional astronomer, and it felt fitting to introduce myself not first with a resume, but with a story. Planetariums have been woven through my life for a very long time. They helped shape me as a child, they helped focus me as a scientist, and they

now sit very near the center of a major motion picture – featuring Dr. Neil deGrasse-Tyson – I have been developing for many years. If I have one theme to offer the readers of *Planetarian*, it is this: public engagement with science is not a side activity. It is part of the work itself.

I can trace much of this back to a book at a bookstore, and to a subsequent planetarium visit.

The year: 1990. I was ten years old. It was a Saturday. I was following my father through a Borders bookstore. Saturdays were often “Brian and Dad day.” We would roam through bookstores, electronics shops, ham-radio events, and anywhere else curiosity seemed to be on sale. On one shelf I saw a copy of Terence Dickinson’s children’s astronomy book, *Exploring the Night Sky*, open on a display to a beautiful picture. The page showed an image of the Vela supernova remnant. I had never seen anything like it. It was not a tiny point of light in the sky. It was not an abstract textbook diagram. It was an intricate tapestry, beautiful and violent at

the same time. I stopped walking. My father kept going for a few steps before realizing I had fallen behind.

That picture did something to me. It was probably the first moment in my life when I felt, in a conscious and lasting way, that astronomy was not just information. It was beauty. It was mystery. It was a doorway.

Not long after that, my parents took me to the Minneapolis Planetarium at the Minneapolis Public Library. I can still see the room in my mind. The lights went down. The stars came up. Before the main show, the presenter pointed out Betelgeuse in Orion and explained that the light we were seeing had taken centuries to reach us. He explained, in wonderfully plain language, that a star could already have exploded and we would not know it yet because light needs time to travel. To a child, that was an astonishing idea. The sky was no longer a ceiling. It was history arriving late. It was distance made emotional.

I remember when the planetarium presenter first showed us the night sky as it typically looked during a night of the year 1990 in the Minneapolis/Saint Paul area. “If you’re in the city,” the presenter explained, “because of the bright city lights, this is what we typically see. But, if you were to go out to the countryside, you could see a lot more.” Suddenly, the dome darkened, the Zeiss projector in the middle of the room turning slowly. And a carpet of stars carved new wonders in the dark, with the glowing, white, speckled river of the local arm of the Milky Way (which we professionals dub “the Galaxy,” for short) dominating the scene. It was incredible. Of course, my speculation is that by “countryside,” if the presenter were to present now, he would mean, “the top of

Mauna Kea,” or some similar mountain region...given that light pollution has, sadly, taken over much of our view of the night sky.

Then came the line that truly altered the course of my life. The presenter said that there were people who studied these things for a living. They were called astrophysicists.

I remember walking down the stairs after the show thinking, with the complete seriousness available only to a child, that this was what I wanted to be. That decision was not the result of a long strategic plan. It was the result of wonder. A planetarium had taken the night sky, which I thought I already knew, and turned it into a place where marvelous and terrifying things happened. It made the universe feel inhabited by questions. I have never really recovered from that experience, and I mean that in the best possible way.

From then on, I wanted all of it. I read astronomy books constantly. I learned the planets and their moons, the life cycles of stars, the Galaxy, other galaxies, black holes, and whatever else I could lay my hands on. Every answer only generated more questions. For me, astronomy was not a school subject. It was an appetite.

LEARNING TO COMMUNICATE

There was another influence on me as well, and it came from my father. In 1993, when Congress canceled funding for the Superconducting Super Collider, I remember listening to the news with him in the car. He was deeply upset. He believed, rightly or wrongly, that one reason the project failed was that too few scientists had explained its meaning to the public in language that ordinary people could carry into civic life. He turned to me and said something that stayed with me for decades: “Brian, if you ever become a scientist, I want you to do better.” In other words, I was not to hide inside expertise. I was to communicate. Make science clear, relatable, understandable, tangible.

That charge stayed with me through my graduate years at the University of California, Irvine, where I pursued my doctorate in astrophysics. In 2005, while still in graduate school, I founded the outreach program called “SoCal Science Café”¹ (on the web at <https://science.meetup.com/32/>) as a way of bringing science out of the lecture hall and into ordinary public life. It became officially sponsored by UC Irvine. The idea was simple: bring together science, art, culture, and life. The mindset in forming the group was, people are curious, but they do not always want, or have time for, a formal lecture in an intimidating setting. So why not meet in bookstores, Cafés, restaurants, and coffeehouses, plus other informal venues, and talk about science in plain English? UC Irvine covered the group in a various campus-newsletter stories, and we also won media coverage from the The Orange County Register newspaper and KOCE-TV (PBS) Orange County, and the project later took on a life of its own, with support connected to UCI and Sigma Xi, The Scientific Research Society (on the web at <https://www.sigmaxi.org/>).

Even now, the SoCal Science Café remains active on Meetup, where its description still invites schoolkids, parents, retirees,

students, and hobbyists to join “the journey of discovery.”¹ That phrase matters to me. It captures something I learned early in outreach. People do not need science to be made smaller. They need it to be made human. They need an invitation. They need a story they can enter.

FROM DISSERTATION TO MOTION PICTURE

That lesson deepened after I defended my PhD dissertation in 2007 and my degree was conferred on me in 2008, the following March. To attend UC Irvine, I was awarded a Regents Fellowship funded jointly by the NASA Astrophysics Data Program and the Smithsonian Astrophysical Observatory at the Center for Astrophysics | Harvard & Smithsonian. My dissertation is titled *Evolution of Substructure in Clusters of Galaxies as Observed in X-Rays*. It's on www.arXiv.org. I admit, it does not represent my best writing work – I was pretty burned-out at the time, having done all my schooling each year in a row with no breaks, from Pre-Kindergarten to Ph.D. In practical terms, I used data from ROSAT and NASA's Chandra X-Ray Observatory to study the large-scale morphology, or shapes, of the X-ray emission from the hot gas between the galaxies of galaxy clusters and compare those observations against cosmological simulations.

It was exacting, statistical, highly technical work. But the emotional result of doing that research was not technical at all. I came away awestruck. I had spent years looking at some of the largest gravitationally bound structures in the universe. I had, in a sense, gone on tour through the cosmos.

And I kept asking myself one question: why does it seem like so few people know how astonishing this is?

That question is the deepest origin of my upcoming feature film project, *Galaxy Clusters: Giants of the Universe*. I have been developing the picture since 2008, when I was twenty-eight years old. It has never been just a content idea to me. It has been a labor of love: an attempt to take the wonder I encountered in professional astrophysics and translate it into something that a general audience can feel. Not just understand. Feel. We are actively fundraising to bring it to the silver screen in major movie theaters worldwide, planetaria, and “The Sphere” in Las Vegas.

That distinction is important. As a scientist, I care very much about accuracy. But as someone who has spent years trying to engage the public, I also know that many documentaries, however worthy, can feel like homework. They may be informative, but they do not always feel like events. They do not always leave behind the kind of emotional afterglow that makes someone change behavior, seek out a museum, attend a talk, buy a book, or take a child to a dome show. I wanted to pursue something more cinematic and more emotionally charged without sacrificing scientific seriousness.

That is why I sometimes describe the film, carefully, as a “science opera.” I do not mean that as a gimmick. I mean that the project is designed to treat science as something grand enough, sweeping enough, epic enough, strange enough,

¹“SoCal Science Café,” Meetup, accessed March 31, 2026, <https://www.meetup.com/SoCal-Science-Cafe/>.

and beautiful enough to sustain a feature-length public experience. The goal is not to water down astrophysics. The goal is to give awe a proper dramatic container.

The current version of the film features Dr. Neil deGrasse Tyson, front-and-center. For readers of *Planetarian*, there is a pleasing symmetry in that. Tyson has said that as a child he first glimpsed the magic of the universe at the Hayden Planetarium and was hooked; today he serves as the Frederick P. Rose Director of the Hayden Planetarium at the American Museum of Natural History.² I like that continuity very much. Planetariums are not merely exhibition spaces. They are ignition spaces. The involvement of Tyson came about in early 2024. I wrote letters back and forth to him, as a fellow professional astronomer, in the U.S. Postal Service mail, sharing about my project, the charge my Dad gave me at age thirteen, and asking him whether he would like to be involved. He agreed, and then signed our Talent Release Form. I am humbled and truly honored to get to work with Dr. Tyson. I've always looked up to him as a role model for a large portion of my professional career.

I have been speaking publicly about versions of this project for a long time. In early 2013, for example, astronomy-club newsletters in both Orange County and San Diego advertised public presentations of *Galaxy Clusters: Giants of the Universe*, describing it as a documentary project that followed the story of NASA's Chandra X-Ray Observatory space telescope, dark matter, dark energy, and the quest to understand the universe.³ I mention that not to make a grand claim for endurance, but to underscore that this has been a long road. The idea has been maturing in public, in conversation with audiences, for years.

A WEEK AT JOHNSON SPACE CENTER

One of the most meaningful chapters in that road came in April 2014, when my team and I were invited to NASA Johnson Space Center to film interviews with two extraordinary astronauts: Eileen Collins and Catherine “Cady” Coleman. Eileen is famous for being the first woman to have commanded and piloted the Space Shuttle. We were there from April 6 through April 11. For me, as someone whose scientific life had been shaped by data from Chandra, the emotional force of that week is difficult to overstate.

(FYI, why the italics in the names, Chandra and Space Shuttle etc.? Professional astronomers see spacecraft as equivalent to sailing ships on the sea – of space – and Naval convention is to italicize the names of ships. Of course, in the



case of a space telescope or satellite, the italicized name refers to the spacecraft bus, i.e., the vehicle that holds the fuel and thrusters for maneuvering the satellite.)

Collins, of course, was the first female commander of a space shuttle mission --- she commanded mission STS-93 (the “STS” stands for “Space Transportation System,” the formal name of the Space Shuttle, covering the Orbiter, taken together with its external fuel tank and solid-rocket boosters) the mission that deployed NASA's Chandra X-Ray Observatory space telescope. Coleman flew on the same mission as a Mission Specialist – she actually “flicked the switch,” so to speak, that launched the Chandra. NASA's historical record of that mission notes not only that STS-93 carried the observatory into orbit, but that Coleman had prime responsibility for deploying it.⁴ To sit down with those astronauts and hear them talk, not in the abstract but as people who had lived that history, was profoundly moving.

NASA's Chandra X-Ray Observatory, in my personal opinion, is one of the “unsung heroes” of the astrophysics fleet. The Hubble Space Telescope and the James Webb Space Telescope often steal the show. Their beautiful images capture the imagination of the public in ways never before possible. They've become household names. The Chandra X-Ray Observatory is the same “class” as Hubble – the Flagship Class of space observatory. Yet, it strikes this astronomer as if Chandra has not been able to get the same “hero story” as have Hubble and JWST. It is not apparent that Chandra has quite the same name recognition as its more famous cousins. And why shouldn't it? It's among the most powerful – in terms of spatial and energy resolution – space-based X-ray telescopes ever launched. In fact, it was also the largest and heaviest payload ever launched by the Space Shuttle in its entire history of operation, being 45 feet long and weighing 25 tons. Chandra is also notable as being the only other space telescope among the four initial Great Observatories – Hubble, the Compton Gamma-Ray

²“Neil deGrasse Tyson,” *OLogy Card 073*, American Museum of Natural History, accessed March 31, 2026, <https://www.amnh.org/explore/ology/ology-cards/073-neil-degrasse-tyson/>; “Hayden Planetarium Staff,” American Museum of Natural History, accessed March 31, 2026, <https://www.amnh.org/research/hayden-planetarium/staff/>.

³“Sirius Astronomer,” *Orange County Astronomers*, January 2013, announcing Dr. Brian Hart's presentation of *Galaxy Clusters: Giants of the Universe*, <https://www.ocastronomers.org/wp-content/uploads/2019/01/OCA-Sirius-Astronomer-Newsletter-SA201301.pdf>; “San Diego Astronomy Association News and Notes,” February 2013, announcing Dr. Brian Hart's presentation on the same project, <https://sdaa.org/wp-content/docs/Newsletters/2013-02.pdf>.

⁴“STS-93,” NASA, accessed March 31, 2026, <https://www.nasa.gov/mission/sts-93/>; John Uri, “25 Years Ago: STS-93, Launch of the Chandra X-Ray Observatory,” NASA, July 24, 2024, <https://www.nasa.gov/history/25-years-ago-sts-93-launch-of-the-chandra-x-ray-observatory/>.

Observatory, the Spitzer Space Telescope, and Chandra – to still be flying and operational.

We were also allowed to shoot principal photography inside the cockpit mockup of Space Shuttle Columbia in the Space Vehicle Mockup Facility at Johnson. NASA describes that facility as a world-class training environment built around high-fidelity hardware for mission support and crew operations.⁵ I can tell you what the official description does not capture: the feeling of standing there as a cosmologist whose own research life had been so deeply entangled with the observatory those astronauts launched. It was one of those rare moments when scientific history, public storytelling, and childhood wonder all collapsed into the same emotional point.

That week at Johnson Space Center deserves its own article someday. For now, I mention it because it strengthened my conviction that public engagement is not ornamental. If you want people to care about science, you must give them human beings, places, voices, risks, triumphs, and stakes. You must let them feel the chain that runs from imagination to institution, from a child in a planetarium seat to a telescope in orbit.

WHY PLANETARIUMS MATTER

And that brings me back, once again, to planetariums.

I do not think planetariums are merely useful. I think they are culturally precious. They are one of the few places where the public can encounter science communally, ceremonially, and emotionally. A good planetarium show does more than transfer information. It rearranges scale inside the mind. It lets a person feel both smaller and larger at the same time: smaller in relation to the cosmos, larger in relation to what the human mind can know.

That was true for me as a child. It is still true for me now.

There is a practical reason I am sharing this in *Planetarian*. I do not see a tension between cinema and domes. I see a relay. A film can create an initial burst of attention, but a planetarium can deepen and localize that attention. A movie may send someone home thrilled; a planetarium can turn that thrill into a habit. It can become the place where families return, where teachers bring classes, where communities gather after a big mission or discovery, and where a child learns that science is not just something done by distant experts on television. It is something done by people, in institutions, with tools, discipline, and imagination, and perhaps someday by that child too. It would mean very much to me personally, to get to bring astrophysics to the big screen someday.

It is also why I believe planetariums matter so much in the ecosystem of public science. A classroom can teach. A book can explain. A documentary can inform. But a dome can transport. It can create that delicate mix of humility and exhilaration that often precedes a genuine intellectual

commitment. For some children, that feeling becomes a hobby. For others, it becomes a vocation. For still others, it simply becomes a lifelong affection for science. All of those outcomes matter.

CONCLUSION

In the years ahead, I hope to write more specifically for this community about galaxy clusters themselves, because I do believe they deserve more attention in planetarium programming. They are among the true “giants of the universe,” and yet they are too often treated as brief waypoints on the road to some other topic. I would also love to write, at some point, about Chandra as one of the “unsung heroes” of NASA’s original Great Observatories.⁶ If you want to understand the hot, violent, high-energy universe, you need X-rays, and if you want to understand why clusters of galaxies matter for cosmology, you need to make that invisible universe visible to the public.

But for this first piece, I wanted simply to introduce myself and say thank you.

Thank you to the planetarium professionals who create first encounters with wonder. Thank you to the presenters who can turn a projected star into a life decision. Thank you to the dome theaters that give families, schoolchildren, and ordinary citizens a place to rehearse astonishment together. I want to not understate the magnitude of importance of the planetarium in the lives of the lay public.

One of those theaters changed my life. I have been trying, in one form or another, to repay that gift ever since.

If *Galaxy Clusters: Giants of the Universe* succeeds, I hope it will do for some child in the audience what that planetarium did for me many years ago: make the universe feel not remote, but alive; not abstract, but personal; not closed, but open. And if that child then asks to be taken to a local planetarium, or begins checking out astronomy books, or looks up and sees the night sky differently, then I will know the work is pointing in the right direction.

Public engagement with science begins in many places. For me, one of them was a bookstore. Another was a planetarium. I have been following the light from those two places ever since. *Ad astra!*

⁵ “Space Vehicle Mockup Facility,” NASA, last updated January 21, 2026, <https://www.nasa.gov/johnson/space-vehicle-mockup-facility/>.

⁶ “About Chandra,” Chandra X-Ray Observatory, accessed March 31, 2026, <https://chandra.harvard.edu/about/>; “Chandra Mission,” Chandra X-Ray Observatory, accessed March 31, 2026, https://chandra.harvard.edu/about/axaf_mission.html.

UNDER THE CLASSDOME FINAL REPORT

One year ago, I wrote about a new lesson I was developing for the Next Generation Science Standards approach. To sum it up, there is less “telling them stuff” and more working with data that (hopefully) leads them to understanding. My article described the experience, the data to be collected and the instructional goals. We used the standard approach last year because this was in development. We got to try it out with real live students this time around. I promised that I’d let you know now it worked, so here is the final report.

[Please provide link to article from June 2025 edition]

Visually, I’m pretty happy with the results. We began in a slowly rotating star forming nebula 3-D model. The five stars emerged from the nebula and formed a line above the spring line. Accompanying text gave them the initial mass, luminosity and temperature data. I modified each star’s color and scale to illustrate the changes in the data that they recorded for each elapsed time. The biggest star’s transformation into a black hole got actual “oohs” and “aahs” from the kids as did the second biggest star’s change into a neutron star. The remaining three stars become red dwarfs which isn’t quite as exciting, but the kids stayed engaged as they recorded the rest of the data. All of that didn’t take the full class period, so I developed a series of graph images. I modeled how to plot the data for the smallest star. With logarithmic scales and “backwards” temperatures, these are not easy to plot.

Students worked on plotting the remaining data sets and answering the questions the following day in their regular classroom. I discussed the results with the teacher and she reported that it worked very well. The relationships were very obvious for all of the kids, not just the high achievers. This also occurred without us telling them the relationships. I will share some images of their responses. I have to say, looking at their H-R diagrams filled me with joy. Seeing kids grasp a difficult concept and demonstrate comprehension is the best part of being a teacher.

This is also my final report from under the ClassDome. 34 years of teaching and 25 years as Planetarium Director will be ending not long after this edition is published. I am filled with mixed emotions because I did so much, but there were many more good ideas that I couldn’t see through to completion. Every conference, meeting and seminar filled my brain with possibilities. Most of those never came to be and it’s hard not to think of what could have been. But that’s how life works. If you achieve every goal you set out, then you didn’t aim high enough. I hope that all of you keep chasing more possibilities than you can really complete.

I want to thank Sharon Shanks for asking me to write this column. It has helped me to become a better writer as well as provided an opportunity to give a little something back to the community that supported me in so many ways. It is time



Mark Percy

Willaimsville Space Lab
Planetarium...

counting the days now

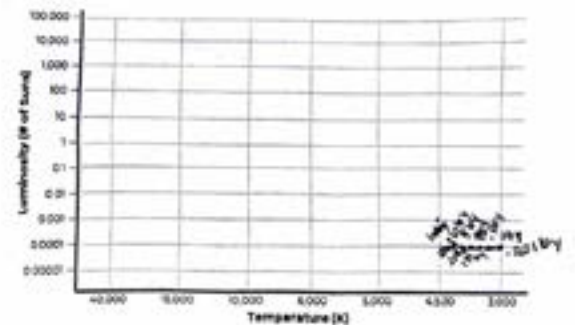
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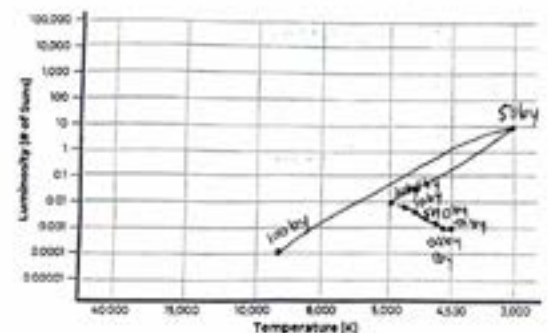
to pass the torch now to another school teacher who works under a ClassDome. Ken Brandt is the Director of the Robeson Planetarium in Lumberton, North Carolina (USA). Ken is a member of the IPS Education Committee and is also a fellow of the IPS. He has directed the Robeson Planetarium for 22+ years, and will be moving into a new planetarium this August! He is also a volunteer in NASA’S Solar System Ambassador program. He is currently writing his dissertation: Discourse in the Planetarium. I am thankful that he is willing to continue providing perspectives from a public grade school based planetarium. Thanks Ken!

3. What is the relationship between the initial mass of the star and the lifespan of the star?
As the initial mass increases, the life span of the star decreases.
6. What will happen to a hot, blue star (> 10 solar masses) during its entire lifetime?
It will start as a protostar, turn into a Red supergiant, then explode as a supernova then either become a black hole, neutron star, or go to the planetary nebula.
7. What will happen to a cool, red star (< 0.5 solar masses) during its entire lifetime?
It will start as a protostar then expand to a red giant and at the end become a white dwarf.

Star #1

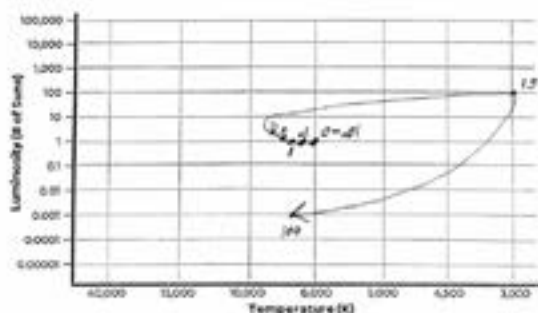


Star #2

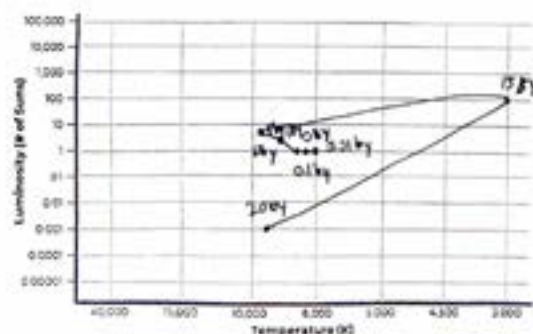


Above and on following page: examples of questions and exemplar student responses.

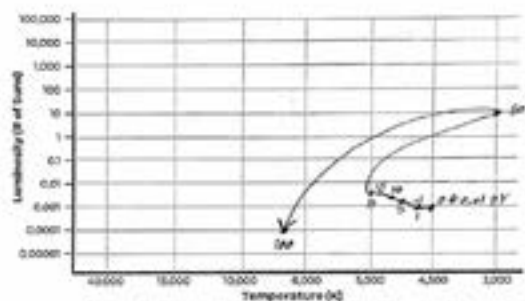
Star #3



Star #3



Star #2



A WEEK WITH THE GDP 2025/26

The Society of German-speaking Planetariums e.V. (GDP) in association with the International Planetarium Society (IPS) is pleased to announce the name of the winner of its fifth "A Week with the GDP" professional development competition which is open to planetarians from around the world.



This year's winner is Jason Trump from the United States of America. Jason Trump, head of education at the Clark Planetarium in Salt Lake City, Utah will spend a week working with students, teachers, and the public as the guest of the Austrian Planetarium Association. As a former education program specialist and outreach program manager of the NASA's PUNCH Mission, he is very engaged in

education and outreach projects. Mr. Trump will spend a week with his host on dates to be determined in 2026, when he will teach lessons to students on a topic of his choice in astronomy and/or space science. He also will make public presentations to general audiences.

Dr. Peter Habison is president of the Austrian Planetarium Association. The Austrian Planetarium Association (GÖP) is a non-profit organization based in Tyrol. The association's history dates back to 2001, while the current society exists since 2006. The purpose of the association is to promote collaboration and cooperation between Austrian planetariums, to provide educational and training opportunities for all age groups in the fields of astronomy, natural sciences and space sciences, and to carry out national and international projects in the field of astronomy and related fields of knowledge. Renowned members of the Association of Austrian Planetariums include the Judenburg Planetarium, YourDome Schwaz and the Mobile Planetarium Public Space in Vienna.

Email: office@stemandmint.com

Website: <https://www.planetarien-oesterreich.at>

IPS professional development opportunities, titled "A Week in the United States," and "A Week with the Society of the German-Speaking Planetariums" are modeled after a long-running and successful program called "An Astronomical Experience in Italy for an American Planetarium Operator," also supported by the IPS. The IPS hopes that these initiatives will serve as models for other countries to follow and, as the years pass, evolve into a broader cultural and professional development exchange for planetarians around the world.

The global association of planetarium professionals, IPS has nearly 700 members from 35 countries around the world. They represent schools, colleges and universities, museums, and public facilities of all sizes, including both fixed and portable planetariums.

The primary goal of the Society is to encourage the sharing of ideas among its members through conferences, publications, and networking. By sharing their insights and creative work, IPS members become better planetarians.

CONTACTS:

For more about "A Week with the Society of the German-Speaking Planetariums" or the program logo contact Tilo Hohenschläger at mail@tilohohenschlaeger.com.

To contact the winner: Jason Trump, jtrump@saltlakecounty.gov

For additional information about the IPS, contact Shannon Schmoll president@ips-planetarium.org You also are invited to learn more from our website at www.ips-planetarium.org.

INTERNATIONAL NEWS

Dear fellow planetarians...

Below you can delve into history of some affiliations, welcome a new one and witness, that planetaria are not only sky theatres filled with planets, stars and galaxies but have truly become cultural centres serving the community with art, music and multifaceted shows.

For this section I'm indebted to contributions from Rodrigo Miranda, Ignacio Castro, Andreas Schmidt, Alex Delivorias, Loris Ramponi and Anna Arnadottir. Let's start this tour around the world in Chile.

LATIN AMERICAN AND CARIBBEAN PLANETARIUM ASSOCIATION

Every two years, planetariums across South America gather to reaffirm that access to culture and science is a human right, and that making scientific knowledge accessible to all is a fundamental obligation. Between 1-6 December 2025, the 14th Meeting of the South American Planetarium Association (APAS) took place in Santiago, Chile. The event was organized by the Planetarium of the University of Santiago de Chile (USACH), which assumed the presidency of the association as it expanded from South America to Latin America and the Caribbean, becoming Latin American and Caribbean Planetarium Association (APALCA). From a continental perspective, the work of planetariums is more vital than ever. Science communication is an essential component of society. Without it, there can be no democratization of knowledge nor any true sense of ownership and belonging to scientific understanding.

The USACH hosted 50 representatives from planetariums in Argentina, Brazil, Colombia, Peru, Paraguay, and Uruguay.

APALCA. The 14th Meeting of the South American Planetarium Association (APAS) took place in the Planetarium of the University of Santiago de Chile (USACH), where it expanded to Latin America and the Caribbean, becoming APALCA. Courtesy of Planetario USACH.



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Participating institutions included planetariums from Buenos Aires, Rio de Janeiro, Montevideo, Asunción, Cusco, Rosario, La Plata, Medellín, Cali, Goiânia, and Bagé, as well as guest institution Morelia, Mexico. On this occasion, the association welcomed new members: the Felipe Rivera Planetarium of Morelia (Mexico); the Huechuraba Planetarium and the Ocoa Planetarium (Chile); the Aventura Mobile Planetarium (Costa Rica); Fundación Universo (Uruguay); the Yawa Planetarium of Cali (Colombia); and the re-entry of the Rio de Janeiro Planetarium (Brazil).

The meeting also included activities in the city of Vicuña, in the Elqui Province of the Coquimbo Region, Chile. Representatives visited the Gabriela Mistral Museum, the Cerro Tololo Observatory, and the Mamalluca Observatory, which opened in 1995 and has included a planetarium since 2022.

The meeting also provided a valuable opportunity for peers to share experiences, projects, and fulldome films. The planetarium of USACH presented their three latest fulldome productions, which were enthusiastically received. Several South American planetariums are interested in screening *Dinosaurs: An Adventure from Another Era*, *The Stars of Van Gogh* and *Heights of Machu Picchu*. The idea is for the latter to be screened at the Cusco Planetarium - a meaningful location for this work inspired by the Chilean musical group Los Jaivas and the poet Pablo Neruda - and in Montevideo, home to the first planetarium in Ibero-America.

The APAS meeting brought together planetariums united by the conviction that astronomy is a powerful vehicle for children, young people, and the public at large to engage with science and knowledge. The high regard that science and astronomy enjoy today is the result of sustained efforts to reach new audiences. Planetariums have undoubtedly played a crucial role in this transformation. It is no longer surprising to see hundreds of people attending talks by scientists and astronomers, or to see their books quickly become bestsellers.

Chile is expected to host around 70% of the world's astronomical observation capacity in the coming years. In 2026, the Vera C. Rubin Observatory was inaugurated on Cerro Pachón in Elqui Province. In 2029, the Extremely Large Telescope will begin operations in the Atacama Desert, in the Antofagasta Region. Finally, by 2030, the Giant Magellan Telescope is projected to be completed in the Coquimbo Region. Chile is consolidating its position as the world capital of astronomy. These new observatories — our eyes toward the cosmos — will capture essential data and images of the universe and will require future generations of professionals to operate them. That is why it is so important to spark children's interest in this field from an early age through planetariums. Moreover,

astronomy in Chile is also a source of tourism development, entrepreneurship, and new business opportunities.

While welcoming APALCA, let's look a little back in history as well. Planetariums emerged in Ibero-America in 1955. 70 years ago, the Montevideo Planetarium, inaugurated on 11 February 1955, became the first in the region. In 1967, the Buenos Aires Planetarium opened, followed in 1969 by the Bogotá Planetarium. Finally, Planetario USACH was inaugurated on 14 March 1985 featuring its distinctive

APALCA. Inside and arial view of the Planetarium of the University of Santiago de Chile. All Courtesy of Planetario USACH.



truncated cone design inspired by the Mayan observatory of Chichén Itzá and designed by architect Oscar Mac-Clure.

The APAS meeting - the South American Planetarium Association - has been held since 1975 at various planetariums across the continent: Montevideo (1975, 2005, 2016, and 2023), Porto Alegre (1997), Santa Maria (2003), Buenos Aires (2007 and 2014), Malargüe (2012), Goiânia (2017), La Plata (2019), Bogotá (2021), and Santiago (2010 and 2025). "For the International Planetarium Society, Latin America and the Caribbean are grouped within the broader Latin American region, where APAS, the Brazilian Planetarium Association (ABP), and the Mexican Planetarium Association (AMPAC) were already active", explained Paulo Azevedo Sobreira, professor at the Juan Bernardino Marques Barrio Planetarium of the Federal University of Goiás (UFG), Brazil. "This significant expansion of APALCA's regional scope begins with 50 years of history, from 1975 to 2025. The goal is for planetariums across the region to join this continental effort to integrate shared initiatives and collaborative actions", concluded Paulo Azevedo Sobreira.

ASSOCIATION OF MEXICAN PLANETARIUMS

The new Nuevo Laredo Planetarium, expected to open this year, is to be set in a unique world setting as it will be installed inside a specific purpose-renewed +50- year-old steel water tank downtown. A whole project was born around it as it will be part of a five-floor museum. The top floor will lead to the access to the theater itself. It includes a 10 m Spitz dome and a state-of-the-art Digistar 2026 with two laser projectors

AMPAC. Enrique Fonte, Planetarios Digitales CEO and museographer Ismael Meixueiro in front of the Nuevo Laredo Planetarium. Courtesy of Planetarios Digitales.



providing +25,000 lumens and 4K resolution, auto-aligned and auto-blended.

The project has been carefully taken care of by local authorities and developers along with Planetarios Digitales re-known Mexican representatives of Cosm/Evans & Sutherland to make this a remarkable and iconic site, being also responsible for the Planetario de Morelia design and upgrading project, as mentioned in the International News in the December 2025 *Planetarian* issue, to be inaugurated this year.

EMPA

GREECE

The year 2026 marks a milestone for the Eugenides Foundation and its Planetarium, as it celebrates 70 years of dedicated contributions to education, the dissemination of knowledge to the wider public and the development of skills among young people in Greece. The celebrations will culminate in a two-day open science festival held on the Foundation's premises and in the surrounding area, featuring a comprehensive showcase of all its core activities: the Planetarium, the Science and Technology Center, the Library, the UTech Lab, and the Autonomous Systems Laboratory (AI). The program will include fulldome planetarium shows, performances, lectures, robotics and technology activities, as well as discussions on critical thinking and pseudoscience, with more details to come in future *Planetarian* issues.

At this point, however, it is worth mentioning the signing last February of two Memorandums of Understanding (MoU), between the Eugenides Foundation and two historic and iconic institutions, marking the beginning of strategic partnerships, focused on education, social initiatives, and digital innovation. The first MoU was signed between the Eugenides Foundation and the National Observatory of Athens, the first research institution established in Greece in 1842. The MoU establishes the framework for the joint implementation of educational, research, and social initiatives, with an emphasis on the following:

- educating students, young people, and educators on issues related to science, the environment, and digital technologies, using modern and interactive tools,
- making valid and evidence-based scientific knowledge accessible to vulnerable social groups, people with disabilities, and residents of remote and rural areas in Greece,
- the development and implementation of inclusive Citizen Science initiatives.

Also in February, in Geneva, at CERN's headquarters, another MoU was signed between the Eugenides Foundation and CERN, formally establishing a strategic partnership that has already been forged through many years of collaboration and coordinated efforts. The agreement establishes a stable and structured framework for cooperation in the field of education, with the Eugenides Foundation serving as the point of contact for CERN's scientific activities in Greece.

The collaboration between the two institutes focuses on communicating cutting-edge knowledge to the Greek public, and especially to young people, highlighting the path from fundamental research to application. The implementation of this collaboration will lead to the organization of various events, conferences, and thematic workshops, the hosting in the Eugenides Foundation premises of CERN interactive exhibitions and hands-on activities, student visits to the CERN facilities in Geneva, as well as to the development of a dedicated website to inform and engage the educational community in Greece with CERN's activities.

Apart from those key developments, the Eugenides Planetarium has scheduled for the spring and summer seasons repeated screenings of beloved past in-house productions, including the following: *The Story of Earth*, highlighting the birth of our planet and its evolution through plate tectonics, *The Centre of the Cosmos: from the Geocentric system to the expansion of the Universe*, narrating the fascinating tale of the continuous displacement of Earth, and hence of humankind, from the center of the Cosmos and *Voyage through the Galaxy*, a tour-de-force of the Milky Way focusing on star formation, evolution and eventual demise, including red giants and white dwarfs, supernova explosions, neutron stars, pulsars, and black holes. It has also included in its program for the younger audiences *Legends of the Starry Realm* by Fulldome DN. Finally, the Eugenides Planetarium's *Space Series* sequence of short videos on various astronomy topics has been further expanded with the addition of two episodes, the first of which focuses on stellar systems and clusters, and the second on planet Saturn.

CROATIA

Further north, the Astronomical Centre Rijeka (ACR) scheduled in February its traditional and beloved Valentine's Day in the Planetarium, featuring a guided tour of the night sky focused on mythology tales of various constellations with a romantic theme. Supported by the European Space Agency and the Croatian Ministry of Science, Education and Youth through the Hello Universe! project, ACR also organised the *Little Astronauts – Big Missions* program, designed to bring space-related topics closer to the general public and demonstrate how space technology is part of everyday life.

Also in February, two planetarium programs were presented, the first which was *Our Moon*, designed for schools and general audiences, focused on observable lunar features, daily motion, Moon phases, and human exploration. *Life on the ISS*, on the other hand, was aimed for the general public, and highlighted the challenges of living in a microgravity environment, including scientific research, maintenance, spacewalks, exercise, and more. For younger audiences, ACR organised a Space Quiz and the Rocket Man workshop, where participants created rockets from eco-friendly materials.

In March, with the aim of promoting nature preservation, as well as celebrating the International Day of Forests and the spring equinox, once again ACR organised its traditional park and forest clean-up activity around the planetarium,

involving local schools, the City of Rijeka's cleaning and maintenance services, and the Rijeka Fire Department. This time, however, the Učka Nature Park joined the program with a presentation on the different types of forests found in the region and the projects implemented for their preservation. On 28 March, ACR once again honoured the Earth Hour, organizing a one-hour lights-off event, accompanied by planetarium show *Dark Side of Light*.

On 13-20 April, the ACR planetarium hosted special short programs dedicated to light pollution. On 17 April, ACR hosted a special *Hello Universe* program focusing on protecting the dark sky, including workshops, lectures on light pollution, and stargazing activities. In particular, the program consisted of an interactive workshop titled *Gastronomy*, two public lectures titled *Many Wavelengths, One Sky* and *CTAO: A High-Energy Observatory for the Northern and Southern Hemisphere Sky* by astrophysicists Marina Manganaro and Josiah Olumuyiwa Faniyi from the Faculty of Physics, University of Rijeka, as well as *Poetry under the Dome*, featuring famous poetry and lyrics interpreted by Josiah Olumuyiwa. The program also included the planetarium show *Planets in Sight* and sky observation with telescopes, organized in cooperation with the Academic Astronomical Society Rijeka.

On 20-25 April, for the annual Festival of Science, ACR prepared the special program, *Hello Universe: Discover the Planetarium*, combining a planetarium show on dark skies with the main theme for the 2026 festival, which is "Energy". Morning and evening sessions aimed to raise awareness on the widespread use of excessive light energy and to present planetariums as ideal classrooms for astronomy in urban environments, through the planetarium show *Excessive Light Energy & Astronomy Classrooms*. For the same occasion, students of Gornja Vežica Elementary School made a public presentation titled *From Tesla's Energy to the Networked World*. The program also featured the planetarium show *The Ten Most Beautiful Constellations*, as well as guided night sky telescope observations.

At the time of writing, the ACR plan to join the festive activities for the International Planetarium Day (6 May), to

celebrate Space Nights at ACR (7-8 May), and are preparing the special program *The Light of the Universe* for the International Day of Light (16 May), a global initiative celebrating the role of light in science, culture, art, education, and sustainable development. ACR planned activities for this event include light installation, workshops, expert lectures, and thematic planetarium screenings. The program is organized by ACR in collaboration with the Centre for Popularization and Promotion of Science of the University of Rijeka, the Glowing Globe Association, and the Hello Universe! ESA project.

ITALIAN ASSOCIATION OF PLANETARIA

Forty years ago, in June 1986, began the Italian Friends of the Planetariums Association (A.A.P.). The meeting took place at the Museum of Natural Sciences in Brescia and is documented in the photograph below. In the image from left, are Gianantonio Milani (back turned), representing the Venice Lido Planetarium; Loris Ramponi (back turned); Riccardo Gianni (representative of telescopes and planetarium manufacturers); Mario Cavedon (standing to the left of the blackboard) from Milan Planetarium; Vasco Frati (centre of the table), recently deceased, councillor for Culture for the Municipality of Brescia, whose role in local culture has been the focus of a series of meetings and conferences held in recent times. To the right of Professor Councillor Frati are Raoul Valentini (Milan Planetarium) and Dr. Technau, representing the Zeiss company. The last person to appear on the right is Franco Gabici, then director of the Ravenna Planetarium, preceded by Michele Morgese, president of the astronomical association based at the Museum. In the centre, at the end of the table, is Franco Potenza (Milan Planetarium). Thus, three well-known speakers from the great Hoepli Planetarium were present. The fortieth anniversary of the national association coincides with the first national meeting of planetariums, which the Friends of the Planetariums organized at the Ravenna Planetarium in October 1986, just a few months after the founding in Brescia. Finally, A.A.P. promoted in 2009 the now exiting national association PLANit.

During this year's meeting in April in Ravenna the winners of the PLANit Award and the 2026 Lara Albanese Award was



EMPA. Učka Nature Park's presentation on regional forests and their protection. Courtesy of Rijeka Sport Ltd.



IAP. Photo from Brescia (June 1986) when Italian Friends of the Planetariums Association (A.A.P.) was started. Courtesy of PLANit Archive.

announced. The PLANit Award, which continues to increase the collection of videos available to members, was awarded to Michelangelo Rocchetti (Planetario del Bali), who created a film on art and astronomy about the reconstruction of Queen Nefertari's tomb, inspired by an idea by Nino Ragusi. The Lara Albanese Award, awarded to the best educational proposal, was assigned to AstroOfficina Association that works in the Milan Planetarium. AstroOfficina created a kit for children to search for micrometeorites. The collected material is carefully selected and carefully preserved in small containers that the children take home.

The first day of the meeting was dedicated to the workshop on the sonification of data between art, inclusiveness, and science, led by Sandro Bardelli (INAF) and Giorgio Presti (University of Milan). The presentations were presented in the conference room of the Ravenna Art Museum. Speakers included Umberto Rossini of the Lilio Study Center for Science and Astronomy in Crotona (*the Lilio Stargazer Festival 2025 as a model for widespread astronomical dissemination*), Paolo Morini of the Ravenna Planetarium (*an experience on Eratosthenes' shadow*), Angela Maria Zavaglia of the Lilio Study Center (*Luigi Lilio and the reform of time*), and Walter Riva of the Righi Astronomical Observatory, the Antikythera Committee, and the Imperia Planetarium (*the 27 Hindu Nakshatras under the planetarium dome*).

In the session on Astronomy, History and Culture the following speakers were Aldo Pegoraro from the "G.B. Quadri" Scientific High School in Vicenza (*How a planetarium can be integrated into a secondary school*) and Chiara Simoncelli together with Martina De Maio from the Rovereto Civic Museum Foundation (*The evolution of a planetarium as a key place for teaching in a science museum*), Dino Pezzella who described the innovations of the Sormano Observatory and Planetarium, Gianpietro Ferrario and Marco Colombo from the Lecco Planetarium (*Physics laboratories for a more interactive planetarium*), Laura Saba from Florence, who proposed a communication about astronomy as a tool for cultural and relational stimulation into residential health care facilities. This rich session ended with Nicole Sacco from the Clément Fillietroz Foundation, Lignan Planetarium (*The planetarium as a tool for inclusiveness*) and Federico Di Giacomo from INAF – IAU (*Under the same sky: the commitment to Inclusive and Accessible Astronomy in Planetariums*).

The presentations of commercial interest were presented by RSA Cosmos, SkyPoint, Sky-Skan International, ZEISS. The second day concluded with a roundtable discussion about *Integration of Planetariums into Other Facilities: Inclusion and Accessibility*.

The third and last day of the meeting began with presentations by Ilaria Della Torre and Andrea Frigo of Casina delle Api in Nocciano (*How to Talk About Bees in a Planetarium*), and Emanuele Balboni Infini.to, Turin Planetarium (*The planetarium as an educational tool for understanding the seasons*), Eleonora Diletta Sarcinella, Catholic University of the Sacred Heart of Milan (*the wonder generated by the planetarium experience*), Luca Nobili, Padua Planetarium (*Radio and planetariums*), Michelangelo Rocchetti, Museo del Bali



IAP. Group photo during the national meeting of Italian planetariums (Ravenna). Courtesy of the Ravenna Planetarium.

(*Babelfish project: languages 'on demand'*), Valentina Alberti, Padua Planetarium (*Digital strategies for astronomical outreach in planetariums*) and finally Balázs Forgács, Utazo Planetarium, who suggested how to choose a new fulldome film for a traveling planetarium and discussed planetarium marketing.

The last three speakers were Stefano Giovanardi and Gianluca Ranzini, who described the work of the PLANit working group dedicated to preparing a national planetarium event on climate, while Federico Di Giacomo (INAF, IAU) discussed the goals and strategies of the national outreach coordination plan. Peter Benkovic presented the News from Kvant with a demo laser show.

Professor Maureen Hintz (Department of Physics, Utah Valley University), winner of the Two Weeks in Italy 2026 program, also attended the meeting in Ravenna. She presented the activities covered during her tour of various Italian locations. The photograph below shows the American teacher with the poster that indicates the sunrise points as seen from the Chaco Canyon archaeological and astronomical site, built by the ancestral peoples who lived in New Mexico. At the end of the lesson, the students were

IAP. Professor Maureen Hintz, winner of the Two Weeks in Italy 2026 program, presented the lesson about the Chaco Canyon archaeological and astronomical site (New Mexico). Courtesy of Starlight – a planetarium between your fingers Association.



directly involved. Each student placed a coloured adhesive strip corresponding to the point on the horizon where the Sun rises on their birthday. The cities where Prof. Hintz met student classrooms were: Perugia and Assisi (Association “Starlight – a planetarium between your fingers”), Ravenna (Civic Planetarium and Ravenna Association of Amateur Astronomers Rheyta), Bolzano (Museum of Natural Sciences), Vicenza (Liceo “Quadri” Secondary School), Lumezzane (Serafino Zani Observatory and Planetarium), Florence (Chianti Multipurpose Observatory).

SOCIETY OF GERMAN SPEAKING PLANETARIA

BERLIN

Stiftung Planetarium Berlin can look back on a highly successful year in 2025, with a total of 429,107 visitors – more than 22,200 people more than the previous year's figure. The Zeiss-Großplanetarium – one of the foundation's four facilities – experienced a record year for the fourth consecutive time with 370,120 visitors, maintaining its position as the most visited planetarium in the German-speaking countries (2024: 357,060 visitors). Due to its historical, architectural, and urban planning significance, the Zeiss-Großplanetarium was also designated a protected monument in 2025. Since its opening in 1987, it has captivated over 5.6 million people with astronomy and science, diverse cultural programmes, spectacular fulldome productions and a curated film programme. For the first time in 2025, the Zeiss-Großplanetarium's cinema was also awarded the Film Programme Prize from the Federal Government Commissioner for Culture and Media (BKM) for its outstanding selection of documentary films.

In 2025, the Archenhold-Sternwarte (Archenhold Observatory) celebrated its busiest year since 1988, welcoming 50,880 visitors, an increase of approximately 35% compared to the previous year (37,816). One highlight was Einstein's 110th anniversary on 11 June. Under the motto »Everything is relative«, Albert Einstein's first public lecture on the General Theory of Relativity was commemorated at this historic site. The Planetarium am Insulaner has been closed since

GDP. Einstein's 110th at the Archenhold Observatory. Courtesy of Pedro Becerra.



the summer of 2023 and is currently being converted into a modern educational centre. The neighbouring Wilhelm-Foerster-Sternwarte welcomed 6,097 visitors in 2025, more than doubling in the previous year.

Thanks to the mobile science theatre INTENSE, 2,010 kindergarten, primary, and secondary school pupils across Berlin were able to engage with astronomical topics first hand. Another highlight was the opening of the Helleum II Youth Research Centre, a new extracurricular learning centre run by the foundation to reinforce young STEM talent and further expand the promotion of young astronomers in Berlin.

The growing interest in astronomy is also reflected in the podcasts produced by Stiftung Planetarium Berlin. In 2025, they recorded over 1.8 million streams, including the popular bedtime story series *Einschlafen mit Weltall* (*Falling Asleep to Space*), which launched its third season in January 2026, and the *Cosmorama* podcast, which offers exciting insights into the cosmos, as well as *Abgespaced – Weltraumschlau in 15 Minuten* (*Spaced Out – Space Smart in 15 Minutes*) for children.

Other highlights of the year included the second nationwide Long Night of Astronomy on 13 September, as well

GDP. Long Night of Astronomy at the Zeiss-Großplanetarium. Courtesy of Pedro Becerra.



as the foundation's acclaimed premiere nights – most notably the world premiere of its own fulldome production *Major Tom (Coming Home)*, featuring music icon Peter Schilling, which has been sold out regularly ever since.

The popular podcast *Einschlafen mit Weltall*, produced by Stiftung Planetarium Berlin in cooperation with Schönlein Media, has released its third season. It shares fascinating insights into the universe and helps listeners relax and fall asleep. Launched in November 2023, it has already recorded over 3.1 million streams. In a total of 15 new episodes, every Tuesday, the podcast explains complex topics relating to astronomy and space travel, from comets and constellations to life on space stations, in a calm and composed style. The scripts are written by Dr. Felix Lühning, an astronomer at Stiftung Planetarium Berlin, and are read by Dr. Monika Staesche, deputy board of Stiftung Planetarium Berlin.

»The great success of the first two seasons of *Einschlafen mit Weltall* shows just how much interest there is in cosmic topics – not merely at bedtime. That's why we're continuing our journey through the Universe with exciting new topics«, says Dr. Monika Staesche, deputy board of Stiftung Planetarium Berlin. The first episode of the third season focuses on the planet Venus.

With its new programme *Cosmic Opera*, Stiftung Planetarium Berlin has been presenting an immersive fulldome production at the Zeiss-Großplanetarium since 21 February 2026, combining grand operatic music with cosmic imagery. *Cosmic Opera* is part of the successful *Cosmic* series initiated by Stiftung Planetarium Berlin. Alongside formats such as *Cosmic Rock*, *Cosmic Jazz* and *Cosmic Movie Melodies*, this programme also combines musical masterpieces with impressive visualisations under the planetarium dome. The programme is accessible regardless of language proficiency. At the heart of *Cosmic Opera* lies the fusion of great operatic art with astronomical visualisations. Music from Mozart's *The Magic Flute*, Verdi's *La traviata*, Bizet's *Carmen*, Wagner's *Tannhäuser*, Offenbach's *The Tales of Hoffmann*, Dvořák's *Rusalka* and Puccini's *Turandot* unfolds beneath the planetarium dome alongside cosmic images – from distant galaxies and planetary landscapes to solar and

stellar phenomena. Opera and astronomy thus merge into an intense, immersive experience.

Cosmic Opera is part of the collaboration within the *Cosmic* series between Stiftung Planetarium Berlin and the Hamburg Planetarium. The visual compositions and dome projections were developed by the Hamburg Planetarium's production team and specifically designed for presentation on the 360° dome. In return, the *Cosmic Jazz* program, conceived in Berlin, will be shown in Hamburg. The aim of this collaboration is to make high quality in-house and co-productions readily accessible and to strengthen the network between the two institutions over the long term. »With *Cosmic Opera*, we offer the world's most beautiful operas the greatest stage in the cosmos, namely the Universe itself«, says Tim F. Horn, president of Stiftung Planetarium Berlin.

BAVARIA

The Diedorf Observatory is operated by the Astronomical Association of Augsburg and features an LED planetarium whose design is virtually one-of-a-kind. It was built in the early 1980s and has lost none of its fascination to this day. Inside the Styrofoam dome, approximately 2,500 LEDs are precisely positioned to correspond to the locations of the stars. This creates an extremely lifelike starry sky (even more beautiful than with modern projection technology), though it is static – movements in the sky cannot be depicted with this system.

Since fall 2025, the planetarium has been enhanced with full-dome projection capabilities. This now allows constellations to rise and set, and any celestial movements to be realistically simulated. You can experience: real-time sky views, planetary movements, zooming in on celestial objects, eclipses, nebulae and galaxies, space travel: Virtual flights through the solar system, our Milky Way, or the universe.

Visitors can choose to view either the LED sky with its lifelike charm or the modern version with full-dome projection. The staff all work as volunteers in their free time and put their hearts and souls into designing the tours. Admission is free; donations are welcome.

SCHWITZERLAND

In Lucerne *Pixel Zoo Ocean* expands the planetarium experience. When audiences enter a planetarium, they usually expect a journey into the cosmos—through galaxies, star clusters, and distant planets. But what happens when the immersive dome instead becomes a portal to the depths of Earth's oceans? That is precisely the premise of *Pixel Zoo Ocean*, a new fulldome production presented at the planetarium of the Verkehrshaus in Lucerne. Premiering during a light festival for illuminative art at the museum's planetarium, the show quickly proved that immersive domes are not only windows to the Universe but also powerful tools for exploring our own planet. Despite being screened in a planetarium, *Pixel Zoo Ocean* focuses not on astronomy but on Earth's largest ecosystem: the global ocean. With its mix of artistic storytelling, scientific insights,

Continued on pg. 36

GDP. Promotion of Cosmic Opera as part of the Cosmic series. Courtesy of Stiftung Planetarium Berlin.





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**GOTO would like to congratulate
Keith Turner, Planetarium Director
at Carmel High School in Carmel,
Indiana, on the occasion of his
receiving the 2025
Thomas J. Brennan Award from
the Astronomical Society of the
Pacific, for excellence in Astronomy
and Planetarium education.**



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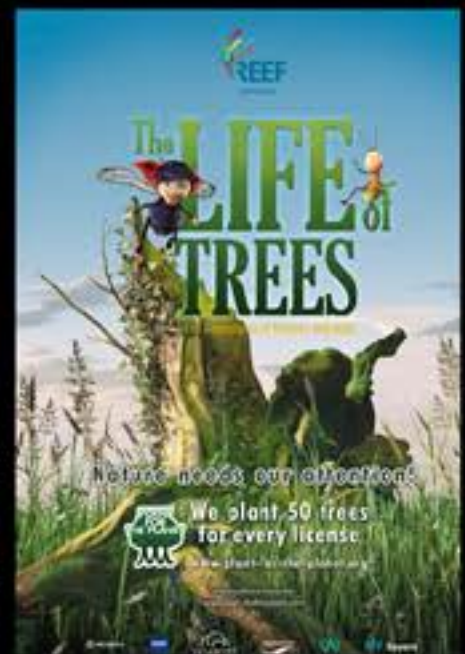
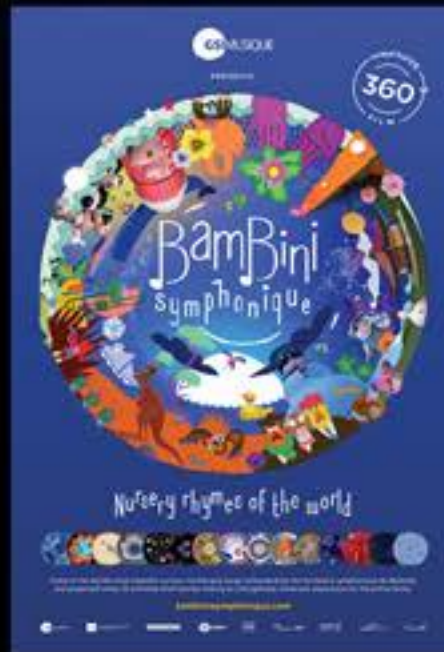
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and striking visuals, the production demonstrates how fulldome environments can expand beyond traditional space themes and become platforms for exploring the interconnected systems of our planet.

Pixel Zoo Ocean invites audiences to embark on an underwater expedition through the diverse habitats of the world's oceans. The show takes viewers from vibrant coral reefs and towering kelp forests to the vast open ocean and the mysterious darkness of the deep sea. Along the way, audiences encounter sea turtles gliding gracefully through the water, playful dolphins moving through shimmering schools of fish, and enigmatic creatures inhabiting the deep. The narrative framework centers on a fictional "space-time glider", which serves as the audience's vehicle for traveling across ocean habitats. This device—conceptually reminiscent of a scientific exploration vessel—allows the production to transition smoothly between environments and scales, from sunlit surface waters to the pressure-filled depths of the abyss. Although the show is designed for a family audience, it incorporates a strong educational component. The story introduces visitors to ecological relationships in marine environments and emphasizes the fragility of ocean ecosystems. By combining science-based content with immersive imagery and music, the production seeks to create an emotional connection between viewers and the marine world.

At first glance, an ocean-themed production might seem unusual for a planetarium program. Yet the dome environment is particularly well suited for representing large-scale natural systems. Much like space, the ocean is a vast and dynamic environment where orientation and spatial perception are essential to understanding complex phenomena. For the audience, the immersive projection of marine landscapes creates the sensation of actually moving through the underwater environment. Fish schools surround the viewers, rays glide overhead, and the dim blue light of the deep sea fills the entire dome. These experiences can be difficult to replicate in traditional flat-screen formats. This shift toward Earth-focused storytelling reflects a broader trend in the planetarium community. Over the past decade, many institutions have increasingly used fulldome theaters to explore topics such as climate change, biodiversity, and Earth system science. *Pixel Zoo Ocean* fits squarely within this movement, demonstrating how the same technologies that visualize galaxies can also reveal the wonders—and vulnerabilities—of life on our own planet.

A key aspect of the production is its collaboration with the Zoo Zurich, one of the World's leading zoological institutions. Marine biologists and educators from the zoo contributed scientific input to ensure that the depicted habitats and species accurately represent real ocean ecosystems. The result is a family-friendly show that balances artistic interpretation with educational credibility. Viewers learn about ecological concepts such as food chains, marine habitats, and biodiversity while remaining fully immersed in the visual spectacle of the dome. Educational materials were also developed alongside the production, allowing



GDP. *Pixel Zoo Ocean* at Verkehrshaus in Lucerne. Courtesy of Jonathan Imhof, Projektil, Verkehrshaus der Schweiz.

schools to integrate the show into classroom teaching. These materials explain topics such as the structure of the oceanic environment—from sunlit surface waters rich in plankton to the cold and dark deep sea where specialized organisms thrive. By connecting the immersive experience with specifically created and structured learning resources, the show extends its impact beyond the planetarium auditorium and also targets school audiences.

The production was created by PROJEKTIL, an internationally renowned artist collective based in Zurich. At the intersection of art and technology, they develop immersive experiences that have been inspiring audiences since 2008. Examples are immersive exhibitions about the art of Frida Kahlo, Claude Monet among others. Founded by a group of visual artists, musicians, designers, and

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TALES FROM DOME UNDER THE CURIOUS CASE OF RAY BRADBURY AND THE LOST SCRIPT

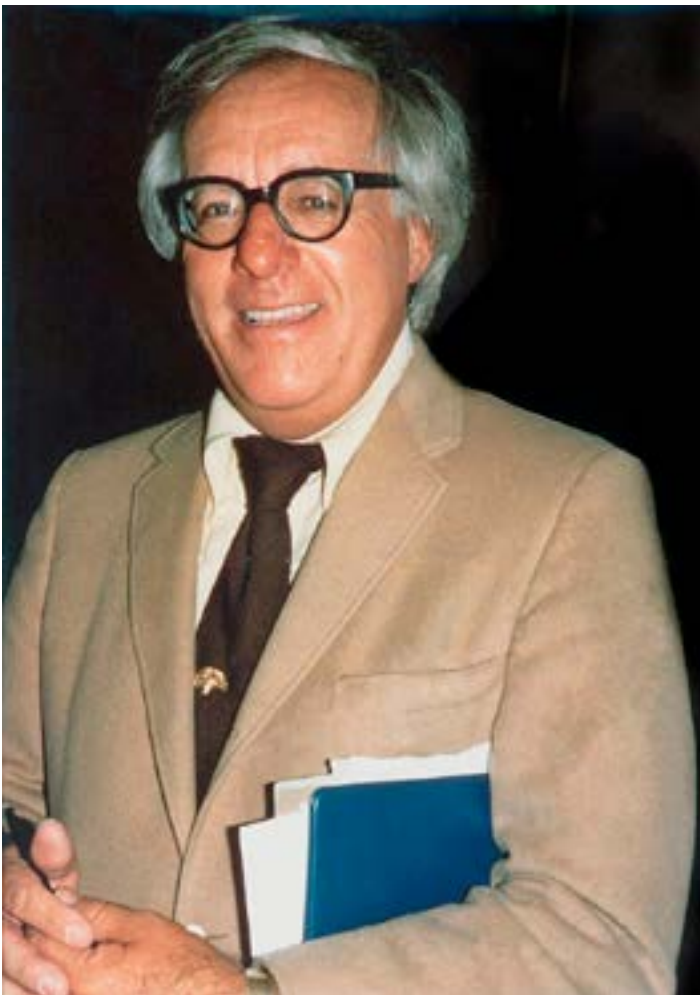
You'd have been either living in a cave, completely off the grid, or vacationing on another planet not to have seen how facts and truth have taken serious hits all around the world during the last decade. Both have been challenged like never before and it doesn't seem to be getting any better in 2026 either. If anything, it's gotten worse. That genie has both escaped its bottle, and then shattered it. I'm afraid that it's going to be some time before we get back to anything remotely close to levels of facts, and truth as they were prior to 2015.

Every so often something appears on Facebook about how the Smithsonian Institution's Albert Einstein Spacearium (eventually renamed the Albert Einstein Planetarium) of the National Air and Space Museum lost, or somehow botched, having a show script written by legendary science fiction

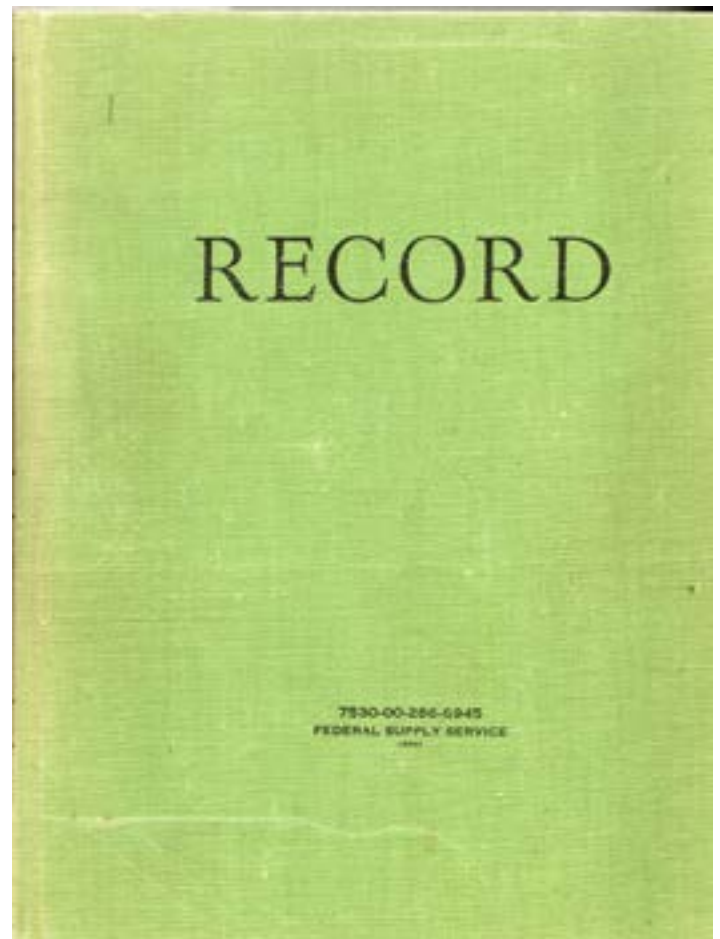
author Ray Bradbury (1920 - 2012). This also once appeared as a blog on the NASM website and in other online journalism, citing this same blog as a source. If memory serves, it's even popped up on Dome-L too from time-to-time.

What strikes me every time this happens is how these opinions are coming from people who had no knowledge of the situation, or why the decision to not accept the script or to not make a completed production.

As Production Specialist of the Albert Einstein Spacearium at the time (my first position of three while at the National Air and Space Museum planetarium), I would like to try and set the record straight for what I hope is the last time. Or, at the very least, place a first-person account of what happened on



Picture 1: American author and screenwriter Ray Bradbury (1920 - 2012), seen here at an unknown appearance in 1975. (Source: Alan Light, CC BY 2.0)



Picture 2: Federal Supply Service-supplied, US Government RECORD book, the likes of which are still in use today. It was the kind of book the author used during his tenure at the Albert Einstein Planetarium from 1978 through 1991 to, among other things, record notes from meetings. This is Volume II in a series, and was used during the months of the Bradbury script project. (Source: Tom Callen)

record. After that, those who still want to hope or speculate, you're on your own.

How is it that I can offer up such an account? Because I have retained all of my green, cloth-covered, Government-issued RECORD books in which I kept notes from meetings, etc., during my 13 years at NASM. The bound volume from November 1979 through May 1982 covers this period in question. Much to my surprise, these same Federal Supply Service-provided RECORD books are still in use today. I had business in Stockholm's U.S. Embassy in recent years, and saw them sitting in work areas.

Our show production cycle was on the order of about two years: come up with a hopefully popular topic, produce it, install everything in our theater, and open a new planetarium show. It's not that we were slow, but due to the fact that we needed to contract many of its elements out to third parties, like the soundtrack (original music, English and foreign language narration recording, studio work such as mixing, etc.), and artwork. The building of special effects projectors was performed in-house as was all photographic work. Installation of the completed show and all of the automation programming involved for what was essentially a one-off system (Gyrosystems at the time, though there were two built, the other being at the Hong Kong Space Museum) were our responsibility.

Besides coordinating and overseeing all of these disparate pieces coming together, I was also responsible for the writing of the contracts—all within Federal government and Smithsonian guidelines—for whatever went out of house. This included composers, narrators, sound studios, and artists; anyone external parties who were involved. Prior to doing so, I had attended a seminar on "Contractor Relations" (I still have my notes, which I'm referring to now) where we Smithsonian people involved with writing contracts and seeking those who could adequately fulfill them learned the ropes between supply, being the contracting officer, and the contractor.

Since we were contracting on behalf of the Federal government, NASM had the right to a good product result for what we were paying for based on the specific and accurately written specifications part of the contract. We were responsible for getting the best return for the taxpayer's money. Most problems with contracting were the result of those supplying a service making a misstep and taking some level of authority they didn't have. It was also important to not have any liability with a supplier, which could later be used against you. And as the contractor, we were not expecting to receive anything from the supplier that was more than what had been requested. Ten "whatsits" were in the contract and we weren't expecting twenty.

Once our contracts were written, they had to go for review and approval by the Smithsonian Institution's Office of General Counsel (OGC), i.e., the lawyers. For we contract authors, there was a wait to get what you'd prepared to come back with any comments on what the OGC thought might be needed to protect Smithsonian interests. I can say with some

pride that I was once told by one of the main lawyers that I came to write some of the best airtight contracts they'd seen.

Everything during the show production process was based on a schedule of inspections and approvals by our planetarium staff before moving on to the next stage. At some points in the process this also included "dog and pony" presentations to NASM's administration to get their sign-off before continuing. One of these administrative approval milestones, for example, was the show's storyboard. This was something we did for every presentation, based on the script I had written as well as a treatment which I also wrote, describing the presentation's visuals seen up on the dome intertwined with the spoken narration. If there was a part of the show the administration didn't like, it had to be changed and reapproved before moving forward. Fortunately, I never had this happen. This Bradbury script, however, was a different story.

Late-1980, early-1981 the Spacearium staff began casting about for a new show topic, leading to a number of different ideas. Our staff artist/photographer at the time had the idea that we could try and get a "big-name" science-fiction writer to do a script, which we could produce into a planetarium show. At this time we had a brand new head of the Exhibits Department, which we were a unit of then. Of course he was all in, all fired up, probably anxious to show the NASM administration he was capable of bringing something really new to the place.

I'm not completely sure how Ray Bradbury was settled upon. Perhaps he was the only sci-fi writer the staff artist knew about. Personally, I would have preferred Isaac Asimov, whose "The Last Question" had already been turned into a popular planetarium show at both Strasenburgh Planetarium (Rochester, New York) and Abrams Planetarium (Michigan State University, East Lansing, Michigan). Having met him while working at the former, he seemed to be a celebrity who might work with us.

Regardless, Bradbury was contracted to produce a script for us, a fee for his services was agreed to, and it was off-to-the-races. The only thing I found questionable was that the script would be an adaptation of something he had written before, rather than being something completely new and original. Which, to me, seemed like something one would expect from someone as productive as the great author was supposed to be. Using older material felt more like a way to pass off something with as little effort as possible. Everyone else on the Spacearium staff except for one other person, however, was fine with this.

We eventually got the script draft from Bradbury in two parts. It was accompanied by the following text quoted below, which seemed to take a peculiar attitude for someone who was writing for what has sometimes been referred to as the "National Planetarium." This was also for a medium which

has been shown through academic research to actually provide measurable educational results:

"I have been not informational but inspirational . . . I don't think a planetarium is a place to teach, per se. It is, after all, theatre. And just as I was inspired by museums when I was a child . . . so I feel that you and I and everyone connected with your planetarium, are in the business of shaking people up and rousing their blood so they go out of the show half-mad with love and stunned with the beauties of space. If we do that, the rest will follow . . ."

Three reviewers were tasked with going through the draft for science content: myself (Production Specialist with a Masters' degree in Planetarium Education), the head of the Presentations and Education Division at NASM (who happened to be a degreed astronomer), and a PhD astronomer from our department of Space History. Others on the Spacearium staff could also read the script, and comment what they thought. For we three, though, the science and astronomical content was what counted. Bradbury, in turn and as part of his contract, was required to make the changes or the corrections we—the contract's issuers—asked for.

If you're not already familiar with it, the Smithsonian Institution's driving policy is to be factual, accurate, and correct in the subjects it covers in what is considered one of the world's most well-known and widely respected constellations of national museums, educational facilities, and research centers. Its motto, "for the increase and diffusion of knowledge among men," dates back to the organization's original benefactor, British scientist James Smithson (circa 1765 – 1829).

Often called "the Nation's Attic," the Smithsonian has collections containing over 157 million objects, a total of 21 different museums with more than 200 other affiliated institutions and museums in 47 US states, Puerto Rico, and Panama. While most of the museums are located in Washington, D.C., there are additional facilities in Maryland, New York, and Virginia. Not only that, there are 21 libraries, plus 14 education and research centers, such as the Fred Lawrence Whipple Observatory in Arizona. And a zoo!

Throughout it all, we who worked for the Institution were to maintain the highest standards to present the best and most current information, including that involving science, to the tax-paying American public. At the planetarium we strove to be as educating and entertaining at the same time as we could. Granted, under 2026's current Republican-led administration there have been some trying moments for some of the Smithsonian bureaus, with changes being made by outsiders in an effort to alter and rewrite history as it relates to the United States.

What we got back from Bradbury had problems with science throughout the script. When we asked, by way of an example, for a correction on how he treated the Big Bang creating the universe, he was rather blasé about it, telling we reviewers it was only a theory, would probably change anyway, so it didn't need fixing. And this wasn't even counting the flowery, artsy,

and very unclear language the whole text was written in. Our point was to educate, not confuse.

Planetarium visitors only have the half-hour under the dome to take in the show's information, not spend their time trying to put meaning to a subject most of them aren't familiar with when they walked in. As professionals, we also know that with even the best presentation they're not going to assimilate 100% of what's being shown, so they need as much help from the start as possible.

Some of the comments from the internal NASM reviewers included, "Many of the phrases are crude and devoid of meaning. Some of it flows nicely, then suddenly it changes and becomes awkward." "'Suns that must birth themselves' reeks with misunderstanding." "Present concepts do not suggest 'worlds spun out of flame.'" "Life cooking itself is a poor way of describing/summarizing evolution." Without a single view in opposition from any of we reviewers, this was a no-go in its current state. And it was at this point where things started to go "off the rails."

One could make the argument that it was this style of writing one could expect from Ray Bradbury. He was certainly not Isaac Asimov when it came to writing more traditional science fiction prose, nor was he Carl Sagan when it came to making things understandable to those without any background knowledge in astronomy.

The case could also be made that Bradbury could have tempered or toned down his style for the text to be more approachable. In this case, and with the goals of making a show that would be comprehensible to our planetarium visitors, the general public from across the United States and around the world, this poetic, dreamy, visionary-flavored language did not fit even if the science was correct.

Now the struggle began to try and get the improvements made that we felt were necessary in order to get it to what we considered to be our standards, both scientific and educational. A series of phone calls between the Deputy Director of NASM, who had now gotten interested in participating in the project too, were made to Bradbury. At one point it seemed to be implied that the two of them had worked out an agreement where we—myself and the Deputy Director (who had no planetarium experience)—could do some editing on our own with Bradbury's blessing. Yet we were paying him to do the same while under contract.

By mid-June 1981 things were starting to get tense from our perspective. There was very little progress being made in any requested changes from the famous author, and another phone call between he and I was arranged to talk through some of them. Quoting directly from my internal memorandum of June 15th to the Deputy Director, I had the following to report to him (with the actual phone numbers redacted):

"I tried calling Bradbury at the appointed time, but the number he gave us, (XXX) XXX-XXXX, is no longer in service. Upon reaching him at another Palm Springs number I got

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IMMERSIVE MATTERS

UNDER THE DOME IN A CROWDED SKY

WHY PLANETARIUMS MUST SEIZE THE IMMERSIVE MOMENT — OR RISK BECOMING RELICS OF IT

A FEATURE ANALYSIS FOR THE PLANETARIAN

BY MICHAEL DAUT, RYAN MOORE, AND THE IMERSA TEAM

Something remarkable happened in September 2023. In the Nevada desert, a \$2.3 billion spherical arena opened its doors and sold out show after show by doing something planetariums have done for nearly a century: surrounding audiences with an enormous dome, filling it with stunning imagery, and making people feel transported to another world. The MSG Sphere's first custom production drew visitors into space photography, ocean depths, and ancient forests — all on the world's largest LED display, with haptic vibrations in every seat and 167,000 speakers overhead. The immersive experience industry looked at it and said, "this is the future". The planetarium community should say something different: this is our origin story, told with a bigger budget.

We invented the dome. We mastered full-hemisphere storytelling. And while the commercial immersive sector has exploded around us — pulling audiences into Van Gogh projections, Meow Wolf labyrinths, and TeamLab light sculptures — the core proposition of what we do has only grown more culturally relevant. The question is not whether planetariums belong in the conversation about immersive experiences. The question is whether we are ready to own our place in it.

THE IMMERSIVE BOOM: CONTEXT WE CANNOT IGNORE

The numbers are extraordinary. The Sphere attracted over two million visitors in its opening months. ABBA Voyage drew more than one million visitors in its first year and contributed an estimated £322 million to the London economy. Grande Experiences' Van Gogh Alive has mounted over 100 installations worldwide. TeamLab Borderless was drawing 2.3 million annual visitors before closing deliberately for expansion. Meanwhile, the Copernicus Science Centre in Warsaw — a model of what an ambitious science institution can achieve — posted its highest-ever attendance in 2023, topping 1.37 million visitors, driven by continuous programming innovation.

Research by the global design firm Gensler identifies five attributes shared by the most successful immersive venues: multi-sensory emotional engagement; active audience participation; distinctive environments that create presence; narrative storytelling that gives meaning to stimulation; and moments of transformation that make the experience memorable. Planetariums fulfill every one of these criteria. We always have. The difference is that the wider industry has

caught up, industrialized our format, and invested in it at a scale now reshaping audience expectations everywhere.

The commercial immersive sector has not made the planetarium obsolete. It has validated everything we were built to do — and raised the stakes for doing it well.

The TEA/AECOM Global Attractions Attendance Report states plainly that museums and science centers "must continue to innovate to remain relevant," given intense competition from immersive art collectives and location-based entertainment. The same data shows that institutions investing in immersive upgrades see corresponding attendance growth. This is not a warning to retreat. It is an invitation to advance.

WHAT WE HAVE THAT THEY DO NOT

The dome is our home turf. Planetariums pioneered full-hemisphere immersion. When Sphere developers described their venue's innovation as making audiences feel "not isolated like with VR" in a shared communal experience, they were describing what every planetarium director already knows. Modern digital systems render scientific data in real time — flying audiences through the Orion Nebula at 8K resolution, landing them on Mars with rover-accurate topography, showing the night sky from the surface of an exoplanet 400 light-years away. Optical star projectors remain, as one specialist publication notes, "a unique and revered instrument" — unparalleled in simulating a crisp, authentic night sky. This is a medium refined across generations of practitioners. No newcomer to dome format brings that depth of craft, and the medium itself — hemispherical, enveloping, shared — remains uniquely powerful.

Scientific authenticity is our competitive moat. Most commercial immersive experiences make no truth claims whatsoever. Visitors inside a Van Gogh projection experience a beautiful interpretation of art; they leave knowing nothing verifiable about Van Gogh's technique, chronology, or influence. Critics have noted that the emphasis on digital spectacle can actively "devalue" the substance of the original work. Meow Wolf's narratives are deliberately fantastical. Immersive theater is fiction. Planetariums deal in the actual universe. When a James Webb Space Telescope deep field image fills the dome, we are showing 13 billion years of light — cosmic history rendered from genuine observational data. This combination of authenticity and awe, immersion with intellectual integrity, is something no commercial venue can simply manufacture. Parents, educators, and curious adults increasingly value the distinction between entertainment and enrichment. We offer both, simultaneously, and that is a proposition with enduring market value.

The universe provides living content. Unlike fixed installations running unchanged for a year or more, planetariums respond to the cosmos in near real-time. When

NASA's Perseverance rover landed on Mars, planetariums held live dome events with expert commentary. James Webb images are woven into shows within weeks. When a comet appears or a new exoplanet discovery makes headlines, the planetarium is the natural venue for experiencing that discovery in full immersive context. No commercial venue, locked into fixed IP or seasonal installations, can match this agility. The universe is, in effect, our content department — and it never stops generating material.

Community trust is irreplaceable. Planetariums sit inside institutions — science museums, universities, public trusts — that have accumulated decades of community credibility. The Adler Planetarium opened in 1930. Visitors bring their children to the place their own parents brought them. That intergenerational loyalty, and the civic advocacy it generates — the communities that rally when a beloved planetarium faces budget cuts or closure — cannot be manufactured by any pop-up experience company, regardless of marketing budget. It is an asset built across lifetimes, and it gives planetariums a foundation from which to innovate that purely commercial venues simply do not have.

THE CHALLENGES WE MUST NAME HONESTLY

Acknowledging our strengths does not mean minimizing real pressures. Audiences who have experienced the Sphere's 16K wraparound display and haptic seating have recalibrated their baseline for impressive. As industry observers note, venues like the Sphere are “raising the bar for immersive entertainment” across the sector — shifting expectations that visitors carry into every subsequent immersive experience, including ours. A traditional star show on an aging dome system risks feeling underwhelming to a visitor who spent last weekend at a high-budget commercial venue, however rich its scientific content. This is not a reason to despair. It is a reason to invest.

The competitive field has also widened dramatically. Families now choose between planetarium visits, Meow Wolf outings, VR arcade afternoons, and immersive art exhibitions. Commercial operators bring substantial marketing infrastructure: Netflix is actively launching US location-based entertainment venues tied to its IP, promoting them to hundreds of millions of subscribers. A municipal planetarium's outreach budget cannot compete on that playing field without strategic creativity. Meanwhile, “VR planetarium” applications for devices like the Apple Vision Pro offer accessible star-gazing simulations from the living room. The case for visiting a physical dome must rest compellingly on what no headset can replicate: communal experience, expert live facilitation, and the social resonance of shared wonder.

Financially, most planetariums operate as non-profit or publicly funded institutions reliant on grants, museum budgets, and donations. Upgrading to the newest laser projection systems, installing interactive seat technology, and renovating aging domes — these are capital expenditures that require multi-year fundraising campaigns. Commercial

venues justify equivalent investments with projected ticket revenues. The gap is structural. COVID-19 severely compounded it, with many planetariums losing staff and momentum during closures, and recovery has been uneven. We are consistently asked to do more — update technology, develop new immersive content, compete for leisure audiences — with fewer resources than the moment demands. It's also critical to note that improved technology does not guarantee audience impact. We must look carefully at the experiences we are creating to decide honestly whether they will attract and entertain audiences.

Finally, the perception problem persists. Much of the public still pictures the planetarium of decades past: a curved ceiling, a projector shaped like an insect, a slightly soporific recorded narrator. This image endures regardless of how dramatically individual institutions have modernized, and overcoming it requires deliberate rebranding — not just better programming.

A STRATEGIC ROADMAP: SEVEN PRIORITIES

The following recommendations draw on documented innovations at leading planetariums globally and broader trends in the immersive experience sector. They address the full community — directors making capital and programming decisions, educators developing content, and technical staff maintaining the dome — because sustainable transformation requires alignment across all three.

1. INVEST IN TECHNOLOGY AS A MISSION IMPERATIVE

Framing technology upgrades as luxuries should be retired. In 2025, the quality of the immersive experience IS the educational experience. The Īmiloa Astronomy Center in Hawaii recently installed a 10K-resolution laser projection system with NASA support, producing visuals that rival commercial venues. Austria's “Your Dome” adopted real-time Unreal Engine rendering, enabling on-the-fly visuals and dramatically accelerating content production. Even incremental additions — audience-response consoles, spatial audio improvements, modest haptic elements — meaningfully lift visitor experience. Capital campaigns for these upgrades should be framed as competitive necessities: the TEA/AECOM data linking immersive investment to attendance growth belongs on every grant application and board presentation.

2. TRANSFORM THE DOME INTO A FLEXIBLE IMMERSIVE CANVAS

The dome is not just an astronomy venue. It is the world's most versatile immersive medium, capable of hosting natural history documentaries, climate visualizations, live concerts, digital art installations, and cultural heritage experiences. The Cité des Sciences planetarium in Paris has hosted artist residencies and digital art festivals since 2021, and its director, Cyril Birnbaum, notes that integrating art “attracts a broader audience” — with increased attendance and a younger demographic mix following. Austria's Your Dome now programs everything from rock concerts to children's

screenings to TED-style talks; visitors return two or three times because there is always something new.

Perhaps the most compelling proof of concept for after-hours dome programming is *Mesmerica*, the full-dome audio-visual experience created by Grammy-nominated composer and percussionist James Hood. Blending Hood's meditative music — centered on the rare PanArt Hangpan — with hypnotic 3D animations from artists around the world, the show is designed as an antidote to overstimulation: a one-hour sensory journey built to calm, uplift, and astonish. It has sold over 1,100,000 tickets, setting records as the fastest-selling full-dome music experience in history, and has played in more than 100 venues across the US, Canada, and internationally — from the Arizona Science Center and OMSI to the National Space Centre in the UK.

What makes *Mesmerica* particularly instructive for our community is not just its popularity, but who it brings in. Keith Laba of the Arizona Science Center reported that 99% of *Mesmerica* audiences were first-time visitors — a completely different demographic from those who typically attend science programming. Kathleen Meyer of OMSI described it as bringing “a steady stream of new visitors” and showcasing the dome to audiences who had never previously set foot inside. One venue director in the western US stated simply: “We paid off our debts thanks to *Mesmerica*.” The Louisiana Art & Science Museum in Baton Rouge called it “an amazing way to fill in holes where you might be falling short on revenue.” The Arizona Science Center reported that its August revenue was up 185% year-on-year during a *Mesmerica* run, with the fastest social media growth the institution had ever seen.

Mesmerica's model is a template worth studying closely. It runs primarily in evening slots that do not displace existing daytime educational programming, generating new revenue from a new audience while also measurably increasing awareness of the venue's daytime science offering. The evening entertainment audience becomes a feeder for the education mission — not a distraction from it. This symbiotic dynamic is the ideal that all after-hours programming should aim for. Planetariums should identify evening and off-peak slots for non-astronomy content and actively seek out touring productions and cultural partnerships with a similar profile: shows that attract first-time visitors, generate press and social media momentum, and leave audiences inclined to return.

3. BUILD CREATIVE AND COMMERCIAL PARTNERSHIPS

Arts residency programs — inviting filmmakers, sound designers, or visual artists to create original fulldome works — have produced acclaimed shows at several European planetariums that attracted arts press coverage alongside science media. Carefully chosen commercial partnerships, structured to protect editorial independence, can provide both funding and new audiences: BBC Earth or National Geographic dome adaptations reach their existing audiences while contributing production resources. Collaborative

content production — fulldome shows co-produced by multiple institutions and distributed through IPS networks — reduces costs for all participants while raising the quality of the global catalog. As one immersive industry whitepaper notes, such partnerships help institutions “enhance visitor experiences, attract new audiences, and ensure financial sustainability” simultaneously.

4. DEEPEN INTERACTIVITY AND AUDIENCE AGENCY

Research on memorable immersive experiences consistently points to agency — the feeling that one's presence matters. Interactive show formats, where live presenters poll audiences and dynamically adapt the program, transform the dome from cinema into a conversation. Modern planetarium software increasingly supports real-time branching; the question is whether programming teams use it. The Springfield Science Museum's Taylor Swift-themed planetarium show in 2024–2025 sold out repeatedly and attracted audiences who had never considered visiting — demonstrating that when programming meets audiences where they are, not only where educators think they should be, results can far exceed expectations. Above all, invest in science communicators: a skilled live presenter who can pivot to that evening's actual night sky, or incorporate a breaking space news story, delivers something no recorded experience can touch.

5. MAKE THE DOME A LIVE EVENTS HUB

No immersive art installation can offer what a planetarium can when a total solar eclipse approaches, a Mars mission lands, or a meteor shower peaks. Planetariums that built live-event programming around the 2017 and 2024 North American eclipses recorded some of their highest single-day attendance figures ever. These moments should not be treated as exceptional — they should anchor a live programming calendar that positions the planetarium as the region's essential destination whenever something significant happens in the sky. The combination of an authentic event, a communal setting, and expert interpretation is a proposition that no streaming platform or commercial venue can match.

6. REIMAGINE MARKETING FOR THE EXPERIENCE ECONOMY

The language of planetarium marketing has traditionally been educational: informative, earnest, content-first. In the immersive experience economy, leading with experience rather than content is more effective. “Travel the cosmos in the city's only full-dome theater” is more evocative than “Learn about stellar evolution.” The dome is extraordinarily photogenic, encouraging visitors to photograph and share dome moments, creating dedicated photo opportunities in pre-show programming, and cultivating relationships with science-interested content creators are low-cost strategies that commercial venues use systematically. Tie promotional cadence to cultural moments already tracking in your audiences' attention — eclipse seasons, mission milestones,

meteor showers — to compete for visibility without matching larger marketing budgets.

7. DIVERSIFY FUNDING WITH THE SAME CREATIVITY AS PROGRAMMING

Private event hire — renting the dome for corporate presentations, product launches, and private celebrations during off-hours — generates revenue at essentially no incremental programming cost. Few spaces in any city are as inherently dramatic, and this opportunity is significantly underutilized. After-hours adult programming, structured like the Adler Planetarium's long-running "Adler After Dark" series, attracts demographics that daytime educational programming does not reach, generating both revenue and new audiences who return with families during regular hours. Tourism partnerships, city experience passes, EU cultural heritage funds, STEM education grants, and corporate science communication sponsorships are all channels worth pursuing systematically — framed in the language each funding body responds to.

INSTITUTIONS ALREADY LEADING THE WAY

Across the global community, planetariums are demonstrating that adaptation produces results. Your Dome in Austria represents the most thoroughgoing reinvention:

a full rebrand, technology overhaul, and program diversification that turned a traditional planetarium into a multi-purpose immersive venue where visitors return multiple times because there is always something new. The Cité des Sciences in Paris shows the cultural dividend of arts partnership — inviting artists and performers into the dome has attracted media coverage and younger audiences without compromising scientific credibility. The Adler Planetarium demonstrates what community-first programming achieves at an institution with a century of heritage. And the Shanghai Astronomy Museum — drawing over one million visitors in its first full year despite capacity restrictions — shows what ambition at scale looks like when major public investment is paired with world-class design and programming intent. Taken together, these institutions prove that the strategic roadmap above is not theoretical — it is already being executed, with measurable results, by our peers.

THE STARS ARE STILL OURS TO GIVE

The immersive experience boom has not made planetariums obsolete. It has demonstrated, at an extraordinary scale, that there is an enormous and growing audience for exactly what we were built to deliver: immersive, emotionally resonant, multi-sensory experiences that

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MOBILE NEWS NETWORK OUTREACH WITH A MOBILE DOME



Marco Ávalos Dittel

Chair

Portable Planetariums Committee

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NEW MOBILE PLANETARIUM IN RÍO, BRAZIL

The Rio Planetarium is hitting the road! Planetarians everywhere might know that the Rio Planetarium has the largest dome in Brazil (23m), and three-story high interactive museum and has just recently reopened its original dome (12.5m) with the Zeiss Spacemaster projecting the stars like it was 1970.

But they also have mobile news! They just acquired a digital, portable dome, because if they want to bring Astronomy to the largest public school network in Latin America, they cannot wait for them to come to them; they must go to them! Their 7 m inflatable dome has a single projector made by Brazilian manufacturer Fulldome and its quality is remarkable. Congratulations!



The new 7 m mobile Rio Planetarium has started operating, bringing Astronomy to the largest public school network in Latin America.



Planetario Canopus is very active all across Paraguay, and offers 100% live presentations to their audiences.

BRINGING THE UNIVERSE TO PARAGUAY

Since 2022 a mobile Planetarium Canopus initiative combines live astronomy presentations, modern visualization software, and Guaraní sky culture.

This planetarium has been operating all around Paraguay, traveling across the country to bring astronomy and science education to schools, cultural institutions, and community events.

The integration of Guaraní sky culture is presented as a distinctive feature of the program, which highlights the traditional interpretations of the night sky by the Guaraní people.

Another feature is that all shows are presented 100% live, allowing direct interaction with audiences. Each presentation is built with original educational content supported by astronomical visualization software such as Stellarium

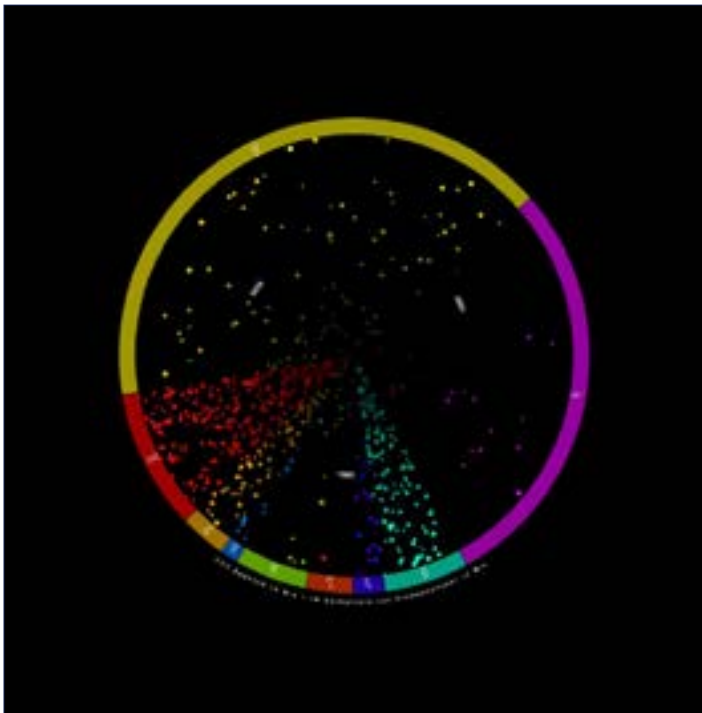
and OpenSpace, enabling dynamic and real-time journeys through the cosmos.

Planetarium Canopus has been a member of the International Planetarium Society (IPS) and APALCA (Association of Planetariums of Latin America and the Caribbean) since 2019. Its team also collaborates with the IAU Office for Astronomy Outreach through NOC Paraguay, contributing to science communication and public engagement initiatives.

NEWS FROM MOBILE PLANETARIUMS IN GERMANY

The German-Speaking Planetarium Association (GDP) had their in-person meeting last April 2026, and mobile dome owners and operators also participate in these events.

Among their last reports, they have discussed about how the general financial crisis has arrived in Germany and the rest of Europe, which they can evidence in the booking



Full-dome visualization of CO2 equivalents rise from horizon to the zenith through decades of data, as produced by Schulplanetarium app.

figures, particularly for mobile planetarium shows. They state that until recently, about 8 out of 10 booking inquiries resulted in concrete planetarium events, but currently that has reduced to about 5 out of 10 inquiries.

On the other hand, planetarium technology and edition software capabilities have increased, and that has allowed even mobile planetarium producers to start participating in international events, such as full-dome festivals.

Other areas in which mobile planetarium institutions and companies participate is scientific software. For example, an app to display the CO2 equivalents rise from the horizon to the zenith, which they achieve by allowing users to jump through the decades from 1950 to 2020, observing and discussing the increase in CO2 emissions. This can be visualized in the full-dome format. In order to exchange ESD concepts and content for the real-time application, please contact Schulplanetarium, at their e-mail info@schulplanetarium.de

MOBILE PLANETARIUMS' WORLDWIDE ONLINE MEETING UPDATE

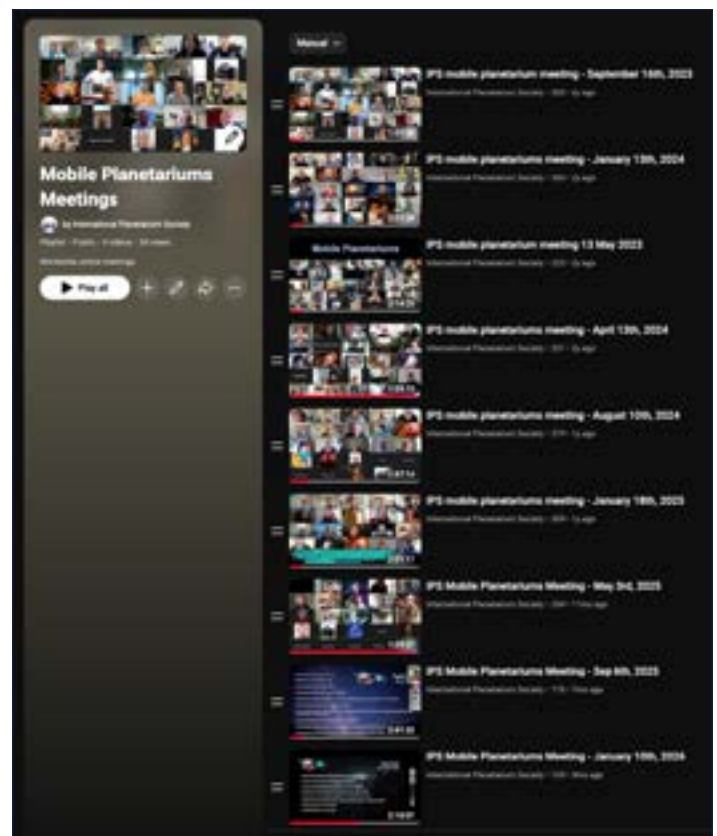
We invite you to participate in the live discussion about the results from IPS 2026 Conference in Japan during our next mobile planetariums online meeting, set to Saturday, September 19th, 2026, at 14:00 UTC.

Also, if you want to schedule your presentation at this meeting, please contact:

Marco Ávalos – info@planetarioaventura.com

Susan Button – sbuttonq2c@gmail.com

You can find all previous recordings of these meetings at IPS's YouTube channel: <https://www.youtube.com/@ipsdomes>



All previous mobile planetariums online meetings are available at IPS' YouTube channel.

LIP SERVICE



Customized logo created by Sara Schultz after and in honor of the LIPS 2025 Conference, hosted by the Fiske Planetarium at the University of Colorado in Boulder, Colorado. As for the significance of the tiger with the fish in its mouth, IYKYK. Or ask someone who attended.

As with the June 2025 issue of *Planetarian* (Vol. 54, No. 2), *Live Interactive Planetarium Symposium* (LIPS) is taking time out to recognize and learn from a talented colleague based on a recent interview. Karrie Berglund takes a break from her regular LIP Service column so we can highlight, at her suggestion, Sara Schultz. I would have preferred an in-person interview, but due to geography, this one took place over Zoom. And although connecting through screens can seem like a second-rate alternative to face-to-face interaction, Sara's combination of enthusiasm, insight, and empathy came through absolutely undiminished. She showed up decked out in a LIPS t-shirt featuring the logo she spontaneously created after the 2025 conference. In true LIPS fashion, she captured the unique creative spirit of the gathering based on a seminal

moment of audience interaction that took place. During our conversation, Sara exhibited a focused, thoughtful presence, but in a relaxed manner, peppered with her easy laugh and casual humor.

As you will learn, Sara Schultz is a teacher due to both nature and nurture. Since 2014, she has been the Planetarium Director at Minnesota State University Moorhead (MSUM), where she completed her undergraduate degree (Physics with an Astronomy minor) in 2003. Sara went on to get her masters in 2006 (University of South Carolina) and became Dr. Sara Schultz when she earned her PhD in 2020 (University of Wyoming). The focus of her dissertation dealt with—no surprise here—evaluating interactive learning in the planetarium. She lives and breathes the LIPS philosophy, and we are fortunate to have her creative spark within the LIPS and planetarium communities.

To date, Sara has secured grant awards totaling over \$200K, and she's been recognized by organizations in both academia and informal education. She has a favorite African proverb that states: "If you want to go fast, go alone. If you want to go far, go together." This is reflected in the fact that Sara is a prolific collaborator, with a long list of co-authored publications as proof. She is also a sensitive and accomplished mentor. You'll find that out from her, but also from the quotes by colleagues and former students sprinkled below. Appropriately, Sara received the Mentor Award from the Great Lakes Planetarium Association (GLPA) in 2025. Just as she has guided presenters at her home facility, LIPS plans to put those skills to good use by offering future training sessions under her guidance.

It seems a shame to share only part of Sara's wisdom here, but there's only so much room. We hope to add more insights from her interview on the LIPS website (<https://lipsymposium.org/>). So now again, a year later, I step aside, this time to let Sara's warmth and vision come through. The following remarks have been edited for clarity and brevity.

—Andy Kreyche



Andy Kreyche

LIPS Board Member

Kvamme Planetarium
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akreyche@gmail.com

SARA SCHULTZ IN HER OWN WORDS: ASKING, RESPONDING, GUIDING, GIVING

THE PATH TO TEACHING

I never wanted to be a teacher, honestly. I was in speech all throughout high school, but was terrified of public speaking: I was sick every time before I had to go up and talk in front of somebody. So teaching certainly wasn't in my mind for a career path. My mom kept telling me, "You'd be a great teacher." I said, "No, I'm not going to be a teacher—never!"

When I attended college as an undergrad here at MSUM, my research advisor, Dr. Matthew Craig was integral in supporting active learning. He got me involved with informal science education during a summer I worked with him on a grant. That's when I realized that I really like teaching people. I discovered I was good at taking complex ideas and breaking them down. Even if people gain a piece of the picture, that empowers them to learn more. I really enjoyed helping people learn—especially things people come in thinking they won't understand.

But my first mentor—especially in my teaching approach and how I relate with my students—was my mom. I came from a very small school out in the middle of nowhere in North Dakota and she was the high school English teacher. So when I had her for my four years of English, I got to experience her from a different perspective: as an educator instead of as a parent.

As I got into teaching, I realized I approach my students a lot like my mom: with honesty and humility. And I meet them where they are. When I work with student presenters, I don't try to fit them into any sort of mold. I try to figure out what space they fit into in the planetarium. Then I allow them to guide their own experience based on their interests. And when I see a spark of something, I push them a little bit, kind of like the bird that gets pushed out of the nest. "Let's make you fly." My mom was the start.

"Sara lives for the wellbeing and future success of her students."

—Katy Accetta Downing, Planetarium and Programming Coordinator, Lake Erie Nature and Science Center

THE LIPS APPROACH: FIRST CONTACT

My first exposure to LIPS was at a one day session led by Karrie Berglund before a GLPA conference. We acted out stories and did improv workshops. I really enjoyed it and it resonated with me. It was new, so a little awkward at first, because it took me out of my comfort zone. But the nice thing about LIPS is that it's such a welcoming and supportive community. I felt very safe to be able to express myself in these kooky ways I'd never done before. I'd just started as the



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Encounters in the Milky Way was developed with the major support and partnership of the National Aeronautics and Space Administration (NASA).
With deep gratitude to Van Cleef & Arpels. Generously supported by Robert and Kristen Peck.



Sara Schultz' mom, Bonnie Jarolimek in her classroom at Midway Public School, Inkster, North Dakota, circa 1998. Photo provided by Sara Schultz.



Sara Schultz, interacting with audience members in her home dome at the Minnesota State University Moorhead (MSUM). Photo provided by Sara Schultz



Her students pulled an epic April Fools joke on Sara in 2025. Sara Schultz (middle), surrounded by her "minions," with mentor Dr. Matthew Craig (second from left) inside the MSUM Planetarium. Photo provided by Sara Schultz

planetarium director here at MSUM and had come from a more formal science education background. I was already teaching, but I didn't want to just lecture. That's what I'd experienced as a student, and our department stressed active learning and participation. Finding LIPS right away was an integral part of my development. It was the perfect opportunity to be able to experience the approach, make it my own, hold on to that feeling, and then do it in the planetarium.

Coming into the LIPS community, Karrie Berglund was a big influence. She's amazing and I connected with her right away. With LIPS, you are able to meet colleagues who want to make the planetarium as impactful an experience as possible. More than just provide a fun field trip and then it's over. We want to spark that desire to learn more. Audience participation and interaction in the planetarium brings so much more to the table. That's what makes us different. We make it personal.

That fuels me, because I love to help people get that spark, that light bulb moment. I can do that in the classroom on a deeper level, and in an informal science education environment I can do it more broadly, reaching more people. It's like two sides of a coin for me.

I really enjoy relationship building. Even if it's just for 45 minutes or an hour in the planetarium. Each time it's a process of getting familiar with people and getting them familiar with me. Then it's about getting them to open up a little bit to experience something new and different, hopefully learning something along the way. It turns out I love it. It's great!

DEVELOPING EXPRESSION, IN SELF AND OTHERS

The biggest thing for me was finding my own voice and approach. It's important that you learn from others. That's the best way for us to improve and to help each other grow. But early on, I realized that I cannot be someone else. I can emulate what they do. But I have different skills.

And I bring that to my work with student presenters. I don't expect them to fit a picture I have in my mind. I want them to make their own picture. When they're developing their skills,

it's important for them to realize that they're bringing their own unique talents and personality to their presentations.

Whenever I meet a new student, I say, "Okay what are you interested in? What things do you like? What kind of things do you know?" If they respond, "Oh I like to write poetry," I say, "Well, let's do a poetry show in the planetarium and showcase some of your work."

Combining music with the planetarium experience is also an amazing opportunity because music is so moving. Abby was a student musician who played the violin in the orchestra, so we brought a chamber ensemble into the planetarium to perform Christmas music. And then we did Holst's *The Planets*, and then *Carnival of the Animals*. I love music and it's an integral part of my life. So being able to combine those two things was magical.

So when I find a student who has some sort of passion, I try to bring that in. It makes them more invested in both the planetarium and their experience, and it gives them a sense of ownership. If we focus on our strengths and embrace who we are, and then enhance that by learning from others, we create the best presentation and programming in the planetarium.

Sara always finds time to help others ... (she) is the epitome of a mentor"

—Melinda O'Malley, Planetarium Director, PHM Arthur M. Klinger Planetarium, Air & Space Museum

STRATEGIES FOR INTERACTION

Coming into the planetarium, an audience member may ask, "Are we going to watch a movie?" Or some of them will say, "I'm going to take a nap." And I say, "You better not or else I'll throw something at you!" [laughs] They may expect to just passively sit there, but they find out once I get started that we're going to be talking with each other. I like to establish those expectations, because I don't want to just talk at them for an hour. I don't want to answer my own questions.



Sara Schultz (second from left) shares in a fun moment during a session at the LIPS 2025 Conference, hosted by the Fiske Planetarium at the University of Colorado in Boulder, Colorado. Photo by Andy Kreyche

Because this isn't for me. I enjoy and love it, but it's for them, and I want them to get the most they can out of it.

The idea of the strategic questioning that I do came from my PhD work.

It stemmed from, again, wanting to figure out who I was and my approach. At the time, I was seeing a lot of interactive strategies that required technology. I couldn't go out and buy things, so I thought about the essence of interaction. It comes down to having a real back and forth with the audience and, in that process,

figuring out what they understand. What are their preconceived notions? What information and ideas are they coming in with? That way you can help guide them by correcting a misunderstanding they might have. Instead of assuming they're at a certain level—you ask. That way you can build them up from there.

There can be the appearance of interaction and audience engagement with asking questions, but a lot of times it's just classroom management. I'm talking about things like refocusing, or getting people to look at the thing that you want them to look at, or call and response interactions. My intention with questions is to really get at the heart of what they know, what they think they know, what they don't know, and, honestly, why do they think that?

There are so many misconceptions among audiences in astronomy. We talk about that a lot in LIPS. Even if you know they have a certain misconception, you may not know why. If you can't get to the heart of what that misconception is, then you can talk to them till you're blue in the face, but they're never going to understand why what you're saying is different from what they believe to be true. When you ask—and then

Continued on pg. 62

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PLANETARIAN

VOL. 55, NO. 2



SEEKING WHAT WORKS ORIGIN OF PARTICIPATORY ORIENTED PLANETARIUM SHOWS

...and thanks to the authors of Planetarium Educator's Workshop Guide: Alan Friedman, Lawrence T. Lowery, Dennis Schatz, Cary I. Sneider, and Steven Pulos



The Lawrence Hall of Science Holt Planetarium in 1973.

I was introduced to audience participation planetarium shows when I was hired at the Lawrence Hall of Science's Holt Planetarium, in 1974. Alan Friedman was the Director and Dennis Schatz the Associate Director. Alan had learned about "participatory oriented planetarium shows" (POPS for short) visiting planetariums in the Middle Atlantic Planetarium Society (MAPS) region. He saw Charles Foell in Warminster, Pennsylvania having kids study the effects of color (light) mixing by mixing their shadows on the dome. Children would also guess what colors a child was wearing while bathed in entirely red light. Years later Holt Planetarium staff used these very ideas in a planetarium show titled "Colors from Space." MAPS members were in the vanguard of the development of the POPS technique and published the book *Under Roof, Dome and Sky* about participatory programs.

The idea of the audience doing something, of stopping a show and waiting for them to do it, was radically different from recorded shows or live lecturers. At the Lawrence Hall of Science in 1973 the Holt Planetarium was built with the express purpose of doing audience participation shows.

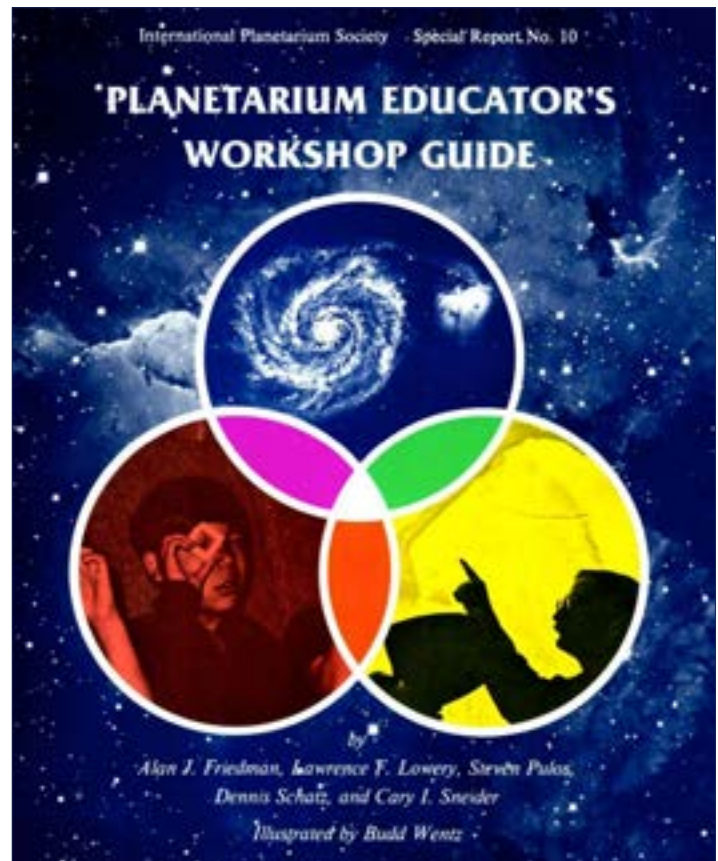
PLANETARIUM EDUCATORS WORKSHOP GUIDE

After five years of developing planetarium shows in audience participation style, LHS received National Science Foundation (NSF) funding to hold five workshops in the summer of 1978 to promote audience-participatory programs. The project, with 100 planetarium educators from around the nation, was called POP (Participatory Oriented Planetariums). That project resulted in a publication, "Planetarium Educator's Workshop Guide" distributed to all



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Cover of the Planetarium Educator's Workshop Guide.

the members of the International Planetarium Society as [IPS Special Report #10](https://www.ips-planetarium.org/pass) and now is available on the IPS website [<https://www.ips-planetarium.org/pass>].

In the years 1989-93, the LHS Planetarium received another National Science Foundation grant to conduct six Summer Institutes in Astronomy and Space Science Education for Elementary and Middle Schools. With the acronym POPS—Participatory Oriented Planetariums for Schools, each institute had 25 participants, for a total of **150 participants** [https://cdn.ymaws.com/www.ips-planetarium.org/resource/resmgr/education_materials/pass/vlpewg.pdf#b-participants].

The appendices of the Planetarium Educators Workshop Guide were separated out and supplemented with additional planetarium shows to become volumes, a series of booklets with the acronym PASS standing for Planetarium Activities for Student Success. Later, because the audience participation techniques work in both public shows and school shows, the PASS acronym came to stand for Planetarium Activities for Successful Shows. Titles and descriptions of all the PASS shows may be found on the [IPS PASS web page \(https://www.ips-planetarium.org/pass\)](https://www.ips-planetarium.org/pass).

Let's focus now on questioning strategies, which is the topic of Module 5 of the Planetarium Educator's Workshop Guide.

CATEGORIZING QUESTIONS

Asking questions is a simple and effective way to elicit audience participation both in school shows and public programs. When well phrased, questions can stimulate interest and fresh ideas. They can help develop cognitive processes such as recall, reasoning and hypothesizing. And they can be just plain fun. Module 5 of the Planetarium Educators Workshop Guide, Questioning Strategies, has six sections: (a) Categorizing Questions, (b) Practice in Classifying Questions, (c) Sequencing Questions, (d) Recording and Improving Your Questioning Strategies, (e) Responding Strategies, and (f) Using Responding Strategies.

In workshops, participants start out by thinking of their own ways of classifying questions using these example questions:

- What does a light-year measure?
- What topics would you like me to cover in our next planetarium show?
- Did you hear my last question?
- Based on your observations of the setting sun during the last two weeks, where do you predict it will set one week from now?
- What do you think your life would be like if you were an astronomer?
- Planets certainly aren't as hot as stars, are they?

Different types of questions stimulate different kinds of thinking. One question may flex one's memory, another may encourage deeper thought, while a third may evoke value judgments. Most planetarium instructors' do not stray much past the memory/recall types of questions. John T. Curtin, in a 1967 research study of 38 planetariums, "An Analysis of Planetarium Program Content and the Classification of Demonstrator's Questions", found that 98 percent of the questions instructors asked of students required only information recall. But with suitable practice and intent, you can increase the range of questions you ask, making your planetarium programs that much richer and satisfying.

A particular classification scheme developed by University of California Berkeley education professor Lawrence Lowery is shown in Table 1. No scheme is entirely satisfactory to

Table 1

Types of Questions						
	Narrow		Broad		Other	
	Direct Info.	Synthesizing	Open-ended	Feeling	Rhetorical	Managerial
1	✓					
2						✓
3						
4						
5						
6						

everyone, but the categories below are the result of much testing and revision.

NARROW QUESTIONS

A narrow question (Direct Info or Synthesizing) has a certain "correct" answer or a limited number of acceptable responses related to it. When you ask such a question, you are hoping for a response that matches something you know.

Direct-Information Questions require recall of information or recognition of information that is readily at hand. Responses are often one word or short answers. Examples:

- Which planet is farthest from the sun?
- What does a light-year measure?
- What did Viking discover about life on Mars?

Such questions are useful in finding out what the audience knows. They can be effective at the beginning of a program to "set the stage."

Synthesizing Questions require people to relate information in a specific way. Examples:

- "Based on your observations of the setting sun during the last two weeks, where do you predict it will set one week from now?"
- "Using shadows on the moon's surface as a guide, which lunar features do you find to be the tallest?"
- "If the astronaut is ten light-minutes away from earth, how long will it take to receive a reply to our message?"

To answer such questions people must know certain facts and compare, contrast, associate, or state relationships.

BROAD QUESTIONS

A broad question (open-ended or feeling) has a wide range of acceptable answers. Such a question should

Continued on pg. 60

A DIFFERENT POINT OF VIEW

A LITTLE BIT OF EVERYTHING

This is a most unique quarterly magazine, and this issue is most unique. First it marks the end of Keith's Captured Quips. Yes, I have run out of Quips and would like to thank Keith Johnson again for supplying me these treasures from the vault of time. Hopefully they brought a smile to your face as they did mine.

Also, I am told, it marks the end of the printed editions of this magazine. Digital continues to take over everything and I for one will miss holding a physical copy of the *Planetarian* in my hands. One wonders how many read and keep their back issues of this or any magazine. Perhaps the digital world is embraced by more than not. It allows for a cleaner desk without all that extra paper taking up space, but then I seem to get more when I read from a paper printout than a computer screen. Yes, I can download and print a copy (that's one way to keep the printing head clear) but I would certainly need to find a nice paper stock to capture the quality of the current physical copies. It kind of reminds me of the IRS in a way. Not only do they want money but now I must use my paper and ink to print out the forms to send them money. Kind of like adding insult to injury. The digital revolution is a two edged sword however. Even I must admit it's kind of handy being able to ask my phone anything and getting an answer in seconds in any voice I like. Good by Encyclopedia Britannica.

And yet, there is still hope as vinyl records, magnetic tape, and celluloid film are all making a comeback. Hopefully books will remain as well. Nothing is more maddening than having a battery die when you in the final chapter of a kindle book.

In the "the more things change, the more they stay the same" department, I must comment on a picture in the March 2026 issue. As I was perusing the magazine I came to a sudden stop on page forty-four. On this huge curved dome screen is a view of mountains with (I imagine) the camera soaring through the clouds above. An image I saw some sixty-four years ago in 1962 as the giant curved Cinerama screen began the film, "How The West Was Won". Perhaps planetariums are turning into movie theaters after all.

Now, if you follow the exploits of those that do this stuff under a dome as a hobby, I will direct you to Scott Tucker's building of his "Zeit" planetarium projector. Those of us that pursue this strange hobby tend to visit every antique, junk, tourist trap store that we can find and search for anything that can make a better planetarium. His story of finding a Zeiss ZKP1 starball and a Spitz 512 planet cage might be interesting to some of you out there. Scott is thinking of calling it a Speiss rather than a Zitz, but whatever he calls it, it should be a very capable projector when finished. If you want to follow along with his exploits you will find them here: <https://planetariumsasahobby.freeforums.net/thread/218/speiss-zkp-512-frankenprojector>.



Ron Walker

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KEITH'S CAPTURED QUIPS ~ CHAPTER THIRTY-FIVE

"Why are you so nice?"

"Thank you for using your knowledge to strengthen mines."

"The way you made the performance made me love science more than I do now."

"I'd rather go back to the planetarium then go to the movies." (YES!)

"I learned that...the ocean can not come to a end when you fall into a bunch of monsters."

"Also you used science words."

"I know that the show took about a week to set up..."

10 YEARS AGO (JUNE 2016):

Sharon Shanks introduces us to Allie's planetarium. A high school student who took it upon herself to bring her school planetarium back from the mothballs. In this day and age when shuttered planetariums remain so unless funds in the millions can be obtained it does my heart good to see what fifteen thousand and a lot of hard work can accomplish. A quick check shows the planetarium is still open and working at the school.

Dr. Jack Schreder pens an article entitled "In Others' Words: Keep the Redding planetarium open". I've seen this same story appear time after time as the years go by. During the 80's, many a planetarium was funded during the race to the moon. All that was asked was money for upkeep and staff. Over the years staff dwindled down until everything fell on the shoulders of one poor sole. This can be a lot of work (believe me I know) and it can be especially disheartening when envious eyes look at the space and think that with just a little cleaning up it would be a great place for the wrestling team to practice. Perhaps with this new trip to the moon decade, astronomy and the lowly planetarium will get another lease on life and given the budget they deserve. Dr. Schreder said it best, "...but I do know that a simple light switch in a planetarium can ignite and illuminate limitless creative thought."

I read with interest Cecilia Ohrner article, "Planetarium content hits the flat screen at Kennedy Space Center". Now I have seen this same type of presentation at ASU here in Phoenix and while the content is much the same as one would find in a Planetarium, the presentation...how shall I put it...is just not the same. A planetarium (that's what they call it) is not a planetarium without a dome screen to present it on. Now perhaps this is just an old fogie talking but give me a break, a flat screen is a movie theater. What appears to be happening is that we are relying on spectacle and special effects rather than the spectral of a clear night sky void of

pollution. As we rely more and more on computers it is no wonder we have trouble funding our planetariums. I am commenting here on technology that is but ten years old. In computer lingo all of this new, spectacular imaging is from the age of the dinosaur. New computers will not even play a lot of it, everything needs to be replaced every three years or so. And yet, the old hundred optical planetarium projectors still present the sky as good as they ever did. Boy O Boy, I sound like a broken record.

25 YEARS AGO (JUNE 2000):

Vadim V. Belov provides us with a “Report On The Public Planetariums In Russia” and things appear to be going well there.

In Steve Tidey’s “Forum” column he asked planetariums what they do to discharge their batteries. It brings up the question as to how many of you out there are the entire planetarium department. I kind of thought that I was in the minority in doing everything but it appears I am not alone. And this was twenty-five years ago. How many “one man/women bands” are now being phased out completely.

In Richard McColman’s Planettechnica, he writes about building a Moon Phase Exhibit. It is from the days of mechanical/optical, what I call brute force exhibits, that ran and ran unattended day after day. I remember growing up with such an exhibit at the Adler in Chicago. I remember a huge moon, perhaps six feet in diameter, with a light source

the moved along a track above the viewers head. I remember it taking at least a minute or so to go through the various phases before the light turned off and the light reset itself.. One wonders if the exhibit still exists in some far corner of the basement. Certainly the large moon should have been kept as it was an impressive globe.

Finally I direct you to Jane’s Corner. After all, I’ve run out of “Keith’s Captured Quips” and you need something funny to read here. Now Jane’s stories are a bit longer than Keith’s one liners. They are more like stories that need time to play out. It crossed my mind that I could just present these in their entirety and get my 1500 words down very quickly...but that would be cheating. No, if you want to enjoy these gems you will need to go to the *Planetarium Archives*, June 2000, page 50.

45 YEARS AGO (JUNE 1980):

Two interesting articles on “The Star Of Bethlehem”, one called, “THE STAR OF BETHLEHEM RECONSIDERED: A THEOLOGICAL APPROACH” by Carl J. Wenning which describes the triple conjunction of Saturn and Jupiter in six/seven BC and a second article entitled, “THE STAR OF BETHLEHEM RECONSIDERED: A HISTORICAL APPROACH” by John Mosley and Ernest L. Martin who consider the astronomical phenomena of one/two BC as a much more accurate series of events. I’m not at all sure how many planetariums still give a show on what was the star of

Continued on pg. 63



VEDARTH ANIMATION
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ANNOUNCEMENTS

NEHRU PLANETARIUM, MUMBAI

3 MARCH 1977 ONWARDS

On 3rd March 2026, Nehru Planetarium, Mumbai, completed forty-nine years of dedicated service and proudly entered its Golden Jubilee year, marking a historic milestone in the scientific and cultural landscape of Mumbai. Established in 1977 within the premises of the Nehru Centre at Worli, and inaugurated by the then Prime Minister of India, Indira Gandhi, the Planetarium was conceived as a tribute to the visionary ideals of Jawaharlal Nehru. His firm belief that the cultivation of scientific temper was essential for national development continues to guide the institution's mission.

From its inception, the Planetarium has evolved into a vibrant centre for astronomical education, research orientation, and public outreach. For nearly five decades, it has nurtured curiosity, inspired generations of students, and made complex scientific ideas accessible and engaging for citizens of all ages. What began as an ambitious initiative to popularize astronomy has grown into one of India's most respected institutions for science communication.

In its formative years, Nehru Planetarium distinguished itself through the creation of high-quality astronomical presentations. Thirty-five original planetarium programmes were produced, twenty-eight of them using the iconic Carl Zeiss Mark IV Universal Projector. These meticulously crafted sky shows blended scientific precision with artistic creativity, offering audiences immersive journeys through constellations, galaxies, and cosmic phenomena. Over 18 million visitors have experienced these programmes, a testament to the Planetarium's enduring educational impact.

Embracing technological advancement has been central to its growth. In 2003, the installation of the Digistar-3 digital projection system marked a significant transformation. Supported by a network of eight computers and six high-resolution video projectors, the system enabled seamless full-dome visualization and real-time simulations of celestial events. The shift from optical-mechanical projection to advanced digital imagery enhanced the immersive experience, allowing audiences to explore the universe with unprecedented clarity and dynamism.

The making of a planetarium programme remains both a scientific and creative endeavour. It involves collaboration among scientists, researchers, artists, scriptwriters, musicians, and technical experts. Each presentation begins with careful research and verification, followed by script development and artistic integration to ensure both accuracy and engagement. This harmonious blend of science and art has defined the Planetarium's distinctive identity.

Beyond its dome, Nehru Planetarium has consistently extended its outreach through lectures by eminent scientists, astronomy courses, science film screenings, exhibitions, and

competitions such as quizzes, essay writing, astro-painting, and astro-poetry. Special shows aligned with celestial events—solar and lunar eclipses, planetary oppositions, comet appearances, and rare alignments—have drawn enthusiastic participation while dispelling myths and promoting rational understanding.

The Mini Planetarium initiative, operational until 2010, was among its most impactful outreach programmes. This portable dome system, capable of projecting 960 stars, brought astronomy directly to classrooms and rural communities. Designed to accommodate around 40 students, it democratized access to astronomical knowledge across district towns and villages. Complementing this effort, telescopes are regularly deployed for public sky observation sessions, fostering direct engagement with the night sky.

Inclusivity has remained central to the Planetarium's ethos. Students from municipal schools, economically weaker sections, and physically challenged groups have been offered concessional or complimentary access, reinforcing the commitment that science education must remain accessible to all.

As Nehru Planetarium steps into its Golden Jubilee year, it celebrates not merely the passage of time, but five decades of sustained vision, innovation, and public trust. It has illuminated minds, expanded intellectual horizons, and strengthened scientific temper in society. With renewed purpose, it looks ahead to commemorative programmes, special sky shows, memorial lectures, and exhibitions that will honour its legacy while inspiring future generations.

The Golden Jubilee marks both reflection and renewal. As humanity enters an era of unprecedented space exploration and discovery, Nehru Planetarium reaffirms its enduring mission—to inspire every citizen to look up with wonder, to question with courage, and to embrace the transformative power of science.

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EVERY YEAR, EVERYONE, EVERYWHERE — INCLUDING ON YOUR DOME

Every year on a single night, people on all seven continents step outside and look up at the Moon. Some gather at observatories and dark sky parks. Some set up telescopes in backyards and parking lots. Some simply stand on a sidewalk and look. A simple and profound event, all over the world, people look up together.

That's International Observe the Moon Night — and if your planetarium isn't already part of it, this is your invitation.

The event started on September 18, 2010, when lunar enthusiasts around the world gathered for the first event. The spark happened earlier, though—the way the best ideas often do: a group of LRO scientists, some drinks, and a conversation that turned into a plan. What began as a spontaneous idea has grown into one of the largest coordinated public astronomy events on the planet, a NASA-led celebration of our Moon.

JOIN US ON SEPTEMBER 19, 2026

This year's International Observe the Moon Night is centered on September 19, 2026 — but participation extends through the week before and after, giving you flexibility to find the right moment for your community. Events can be in-person or virtual, large or intimate. For planetariums, this is one of the best public engagement opportunities of the year.

Planetariums are a natural fit — arguably the best fit. You already have the equipment, the expertise, the community relationships, and the public trust. The Moon is endlessly

accessible to newcomers, but still meaningful for experienced observers. And InOMN gives you a globally recognized framework to build programming around, with built-in promotional hooks: NASA partnership and worldwide participation.

MAKING THE MOST OF YOUR EVENT

Hosting doesn't have to be complicated. Full dome shows followed by outdoor viewing, cultural connections to the Moon, lunar science Q&As, family activities — the programming is yours to shape. If you're planning public viewing, have a cloudy night backup ready: a lunar slideshow, a NASA video, or an indoor presentation can turn a weathered-out crowd into an engaged audience. A printed Moon map and a friendly explainer about the lunar surface can turn a curious passerby into a lifelong stargazer — and a future planetarium member.

Each year, ASP hosts a free virtual webinar in July for event organizers, sharing practical tips, resources, and lessons learned from hosts around the world. Keep an eye on the ASP website for this year's date and registration link.

Registration for International Observe the Moon Night 2026 opens this summer. In the meantime, visit go.nasa.gov/ObserveTheMoon to explore resources and sign up for NASA's newsletter for updates, observing tips, and lunar science highlights.

One Moon. Everyone, Everywhere, Every Year. This year, we hope that means you and your community.



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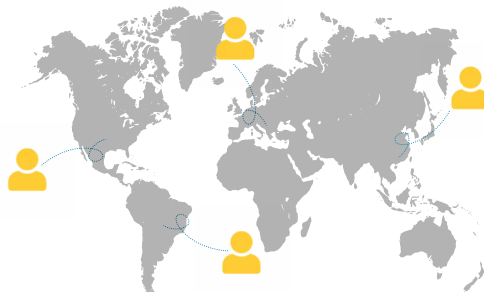
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Seeking What Works (con't.)

be posed in a trusting context where responses will be accepted and not criticized.

Open-Ended Questions allow people to explore freely in their own terms, without restrictions and with only minimal guidance. Examples:

- “Why do you think ancient civilizations created their own systems of constellations?”
- “What topics would you like me to cover in our next planetarium show?”
- “What is your conclusion about UFO’s after hearing these reports?”

Feeling Questions ask people to express an emotion, attitude, or opinion. Examples:

- “How did you feel when you first looked at the rings of Saturn through a telescope?”
- “How do you feel about the amount of money being spent on space exploration?”
- “What do you think your life would be like if you were an astronomer?”

OTHER TYPES OF QUESTIONS

Rhetorical Questions

- “Earlier, I told you that a light-year is a measure of distance and not time, right?”
- “That is true for most of us, isn’t it?”
- “Planets certainly aren’t as hot as stars, are they?”

Responses are not really expected although responses are sometimes given.

Managerial Questions are used to keep things moving smoothly. Examples:

“Can everyone hear?”

“Who has the pointer?”

“Who needs more time to find their constellation?”

SERIES OF QUESTIONS

One way to practice classifying questions is to generate a list of questions that have been posed in a planetarium program and identify which type of question each one is. If you make a table like Table 2, you can try it out on

Types of Questions					
Narrow		Broad		Other	
Direct Info.	Synthesizing	Open-ended	Feeling	Rhetorical	Managerial

Table 2. Record of Types of Questions

the following transcript of a planetarium program (with questions numbered):

- “Good evening. As our planetarium sky darkens, can anyone recognize the Big Dipper?” (1)
- “Oh, I see it.” “Yeah, I see it too.”
- “Okay, will you please take this light pointer and show the rest of us where the Big Dipper is?” (2)
- “Thank you. Well, that’s the Big Dipper. Just about all of the stars that we can see in the sky belong to groups like the Big Dipper and people have been naming the constellations for just about as long as there have been people.
- Why do you think people do that?” (3)
- “Worship.
- “Okay, worship—that’s a good possibility. What’s another?” (4)
- “To go places.”
- “How would knowing the constellations help you to go places?” (5)
- “You’d like to know which way to go from the stars. Directions.”
- “Yes, knowing the constellations does help you find your way.
- Does anyone know how to use the Big Dipper to find which way is north?” (6)

You can analyze a sequence of questions and the questioning strategy by considering:

- Are the types of questions and the kinds of thinking they stimulated satisfactory?
- How could you improve this series of questions?
- What other general improvements could this instructor make?

If you make an audio recording of your planetarium program and apply the latest modern voice recognition, you can generate a transcript, number the questions, and classify them as in the example above. Examining the patterns of question in light of your objectives in each section of the program may help you decide if you need to change your questioning strategies.

RESPONDING TO QUESTIONS

WAIT-TIME

Mary Budd Rowe described wait-time in her article “Science, Silence, and Sanctions” (Science and Children,



March 1969, pp. 11-13). Her research at that time found that most instructors waited only one or two seconds after asking a question before they either asked another question, rephrased the question, called on another student, or gave the answer to the question themselves. She also found that if teachers waited a bit longer after a question was asked (e.g. four to six seconds), students tended to respond in whole sentences and complete thoughts rather than one-word responses. They also justified answers more fully. Yes, a four to six second waiting period can seem awkward or feel like an eternity, but it's apparently well worth the wait in quality of educational experience.

ACCEPTANCE AND ENCOURAGEMENT

No matter how good an instructor's question is, if the students are worried about feeling "wrong" or "stupid" in front of others, thinking is stifled. How you react to the audience's ideas early in a planetarium show is crucial to what participation you get in the remainder of the show.

Your response should be appropriate to the type of question. If you ask a narrow question, a positive or negative comment on the student's answer is expected and appropriate (as long as it's not harsh in the case of an incorrect answer). For a broad question neither praise nor criticism is appropriate lest you inhibit further participation. The best response for an answer to an open-ended or feeling question would be an accepting response. Here are three kinds of accepting responses:

1. Passive acceptance lets the person know that they have been heard without giving any value judgment about their contribution. Examples of passive acceptance are:

- "Mm-hmmm."
- "Okay."
- "That's a possibility."

2. Active acceptance involves rephrasing, translating, or summarizing what the person has said or done. This ensures that you have not only heard the message, but also understood it. Being non-judgmental encourages further participation. Examples of active acceptance are:

- "What I hear you saying is that water on Mars could have soaked into the ground, so there may be Martian life underground."
- "These four people seem to feel that the reddish star moved, but at least one person disagrees. Perhaps everyone should watch this one star next time to try and decide whether or not it moved."

3. Empathic acceptance involves indicating that you appreciate the person's feelings, emotions, or behaviors. Examples are :

- "I understand why you are upset with money wasted on poorly-planned government programs, including space research."
- "Don't feel embarrassed about having difficulty understanding Einstein's theory of relativity. In many ways it is contrary to common sense."

FIELDING STUDENTS' QUESTIONS

One of the best indicators of success of a planetarium show is evoking questions from the audience. Whether or not the questions are pertinent to your next point, they are likely somehow related to the topic, at least in the person's mind. It can be a challenge to satisfy the questioner's need for information, while maintaining the general flow of the planetarium program. Here are some strategies:

Sometimes a short, factual answer is all that the asker really wants. For example, in response to the question "How far away is the Moon?", resist the temptation to define mean distance and instead reply: "about a quarter of a million miles away." You may also offer to give a more detailed answer after the show is over.

You can sometimes invite audience participation by admitting you can't answer a question. For example: "I don't know what Native Americans call the Big Dipper. Does anyone else know?" If the person really has the means of answering their own question, you might use the opportunity to elicit that. For example: "You can answer that yourself by looking at your star map. Which part of the horizon is Leo closest to? Okay, then that's the direction you must look tonight to find Leo, the Lion."

It may be appropriate to ask a student to hold a question until later if the topic is dealt with later in the program. For example, in response to the question, "Why are stars different colors?" you could say, "We will be exploring that very question in a little while," if that is indeed the case.

Asking the audience questions is not commonly done in most planetarium programs. It may not be practical with very large audiences. But wait...perhaps it really is doable in a big planetarium. There are digital response systems that work well if you can enter in advance the question(s) you plan to ask. You can also have large groups respond by means such as clapping, standing, stomping feet, or other individual actions that make for an obvious auditory indication of approval or disapproval of proposed answers to questions.

In conclusion I'd like to again thank to the authors of Planetarium Educator's Workshop Guide, Alan Friedman, Lawrence T. Lowery, Dennis Schatz, Cary I. Sneider, and Steven Pulos, from whom I've learned and borrowed freely.

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Lip Service (con't.)

specifically address—what someone's understanding, ideas, or even what their opinions are, it becomes more personal. The goal is to make the whole presentation more personal for all of the people who are experiencing it.

OUTCOMES

It's been beneficial on both sides of the console. This is anecdotal of course, but public show audiences seem to have a more impactful experience because they feel more connected. You can amaze them with cool visuals, but then they walk away and don't really remember anything. But when I get them to interact, ask a question, or even stop to think about someone else's question, it sticks with them longer.

A large majority of my shows during the year are school groups, with standards the teachers are trying to meet. I've developed programming based on those standards and try to make the planetarium an extension of their classroom. During those shows the students are talking as much as I am. That's because I have them tell me what they understand, what they don't, where they're coming from, and what they're learning. That way I can gauge whether or not they're with me.

I know where I want us to go, but sometimes in a show the students don't get past a certain level. I may not finish the whole show because we've got to figure out other foundational things before we can move on. So I try to look at my programming as scaffolding through concepts. We'll start with daily motion, say, and once we have a good idea about that, we can move on to annual motion and talk about that.

In LIPS we talk a lot about letting the audience guide the show, but there are times when I have a specific path we need to take. That doesn't mean that the audience doesn't have opportunities to guide the program. I have them tell me how they understand a concept—or what part of that concept they understand—and we'll work through that until we all get to the same place. So I strategically use that interaction, not to let the show be a free-for-all, but to allow everyone to have their voice. And if there's somebody there who's still not understanding, a lot of times I'll get their classmates to help them.

Apart from learning goals, interaction can be more impactful on the affective side of things: feeling more of a connection and wanting to come back. Because if an audience has a unique experience, they know the next time it won't be the same thing. They'll want to come back.

Interaction has absolutely made me a better teacher because I can understand where people are coming from. It helps me take what seems like a completely wrong answer, and drive it back to a place where we can work with it. And it helps me to react in a positive way. It's made me more adaptable, and it just makes it so much more fun!

If I'm just spouting off things and my audience is not interacting with me—which happens occasionally—I don't enjoy it as much. But when I have a group that keeps asking me all these wild questions, and we get into exploring great

topics, you can just see their minds blowing. Those are my favorite experiences. And I think it's theirs too. The process helps me relate to people better. It's improved my interactions with students and colleagues. It makes me a better instructor, and it's much more satisfying, honestly.

"I do not know if I have ever known anyone more willing to help, train, show, and teach than Sara."

—Cassie Ishaug, former student presenter

CURIOSITY AND THE COSMIC PERSPECTIVE

I grew up on a farm in the middle of nowhere which is why I got into astronomy in the first place. I just had to turn the yard light off and it was dark, so I saw a sky that a lot of people never get to see. It's near and dear to my heart to give people the opportunity to experience that and help them understand how it's connected to everything else.

My hope is to bring more of that into the planetarium and get people thinking beyond their day-to-day experience: to realize that there's more to it. A lot of people are missing a sense of awe. Maybe there's a little bit too much self-importance. Growing up on a farm, nature was all around me. For humans to be whole it's necessary to understand their perspective and their place. When we connect to nature we realize how much bigger everything is than us.

That provides a really good perspective when you're going through something that feels so big. When I connect to the stars or nature, I realize that, okay, something might feel really big to me. But in the grand scheme, it's not the only thing. When you look up at the sky or connect with nature it can help put those things—specifically negative things—in perspective.

It gives me a sense of peace and belonging. It's like, "Well, okay, this is a big thing for me, but I am a tiny little person on a tiny little speck in the middle of a tiny little nothing-nothing." You know everything is just so much bigger, and so, we will continue—we'll keep going. We've got another day. We can try again.

Curiosity: that's what fuels me. I want to know how things work. I want to know what's there. I want to know. And so knowing that I can't know—I won't know—none of us will ever know all of the things. It's just really exciting and humbling.

"I cannot help but hear Sara's guidance in my head as I look forward to my future. I will always carry what I have learned ... in how I conduct my professional and personal life. And if all else fails, I know I can look to the stars fondly, knowing she taught me them."

—Emily Watson, former student presenter

Tales from Dome Under (con't.)

from his housekeeper, (YYY) YYY-YYYY, Bradbury denied that he ever had a phone number like the one that he gave us Friday afternoon.

“He has been looking over parts of the script, and feels that he can make all our scientific changes in about two days. Of course, he has no inkling (as yet) over our stylistic changes.

“We are to call him sometime Wednesday, June 17 at his home phone, (ZZZ) ZZZ-ZZZZ. Somehow, in spite of our asking to look over the script, he has managed to finish his eighth song. As far as any actual physical writing on our script, he still states that he will not do anything until he has received his check.”

Not exactly the kind of thing that inspires any sort of trust, especially within the Federal government. For one thing, he was working on something else, his musical efforts—it turns out Bradbury had written almost 30 songs in his career—instead of our project. Not only that, his refusing to perform any changes on the material until after he had received his check from NASM was in clear violation of how our contracts worked. While up to 75% of a contracted fee could be paid at the start of a project to be used, for example, in the supplier's start-up expenses, there was no way they could get 100% at one time without delivery of the stated objectives spelled out within.

We weren't getting anywhere fast, the clock on producing our next production was ticking away, and an administrative decision above my pay grade was made to stop the project right where it stood. The general consensus among those involved on our part was that the “vibes” between NASM and Bradbury were bad, and that the Smithsonian Institution shouldn't be supporting this kind of behavior.

The head of the Exhibits Department called Bradbury with the bad news. Apparently, the author took it well, even offering that he was still interested in any possible future collaborations between the National Air and Space Museum or the Smithsonian at large. Considering our experiences with him to date, I'm not sure if that was good hustling on his part, or just plain hubris. Perhaps a little of both.

Unfortunately, this doesn't end quite yet. Bradbury had received a letter from the staff member of another planetarium in the Midwest asking about the possibility of getting a script out of him that they could turn into a show for their own dome. In his reply, Bradbury mentions that he was currently working on something for the Spacearium/Planetarium at the Smithsonian's Air and Space Museum. The author then goes on to say once it's finished, and “after a decent interval” if the Smithsonian doesn't mind it being used elsewhere, then perhaps the Midwest planetarium would like to “toss it on your ceiling.”

Perhaps Bradbury was used to working this way on other writing projects with other organizations, but there was no chance of this ever happening here. His contract (had he read it himself?) stated that it can only be used by the NASM

planetarium since it was to be made for use by the Federal government using taxpayer's money. It was wishful thinking on his part, but I guess that's what one could expect from such a visionary dreamer?

As for the aftermath, we ended up with a nice storyboard for a show we didn't produce, nor could we develop anything similar to it on our own for fear of being accused of plagiarism. We were also back to square one again on coming up with a new show topic.

Sure, perhaps we could have, along with Bradbury, massaged his inaccurate, oddly worded and unfocused script into something usable, but what then would have been the point of paying such a famous science-fiction author to write something for us, which was itself just a rehash of something he had already written before?

There's absolutely nothing wrong with trying to get such a person to work on a similar project as long as it's working for everyone involved. The several planetarium show versions of Asimov's “The Last Question” bear this out, and that particular author, having talked to him, was very pleased with the results.

Hopefully this will conclusively put this “curious” case of the missing Bradbury planetarium script to rest. You could even liken it to solving a “cold case”—minus the forensic DNA—coming 45 years after the fact.

Postscript: Upon completing this article, it was sent to five other people for comment: two from the planetarium profession, and three of them not. All were in agreement that: 1) I hadn't treated the great author unduly, and 2) Isaac Asimov would have made a better choice for a new planetarium show's script. One of these five readers was also a member of the Albert Einstein Spacearium staff at the same time this production development was taking place, and agrees that my memories of what happened are the same as his.

Point of View (con't.)

Bethlehem, it, for me, is still one of my most popular shows. From my independent research in developing my show I can say without any doubt that the second approach is the most accurate.

Since I have run out of “Keith's Quips”, I would suggest you review “Jane's Corner” as it is full of amusing anecdotes.

Back in the day before computers could generate anything your mind could imagine, practical effects ruled the day. Brian Sullivan in his “Creative Corner” shows how to build a space station out of an ice cream lid. Before you laugh at such simple construction, consider the movie of the moment, “Hail Mary” is receiving many accolades, some of which are for its use of practical effects rather than computer generated ones. Yes, vinyl records, magnetic tape, celluloid film are all making a comeback...will the mechanical/optical planetarium projector be next?

International News (con't.)

technologists, PROJEKTIL specializes in transforming architectural spaces into immersive environments through high-resolution projections, sound design, and storytelling. Their works often combine digital animation, generative art, and narrative elements to create experiences that blur the boundaries between art installation, educational exhibition, and live performance. In recent years, the collective has gained international recognition for their global EONARIUM tour, transforming churches, heritage sites and unexpected locations into emotional, immersive spaces – bridging culture, history, and modern technology. They have established themselves as a market leader for immersive light shows in historical buildings. The *Pixel Zoo* series—of which *Pixel Zoo Ocean* is a part—has become one of their most popular projects. These productions transform entire architectural spaces into animated ecosystems. Walls, ceilings, and floors become canvases for animated wildlife, allowing audiences to step inside environments rather than simply observe them.

Marc Horat, the director of the Lucerne Planetarium, approached the creative minds behind *Pixel Zoo Ocean* and suggested to bring this show into his planetarium dome. Adapting the concept in this way offered new creative possibilities. The dome's curved projection surface enables a continuous environment without edges or corners, allowing marine scenes to unfold seamlessly around the audience. Additionally, it provides a standardized projection area and the time-consuming step of projection mapping can be skipped entirely for these venues which makes the project scalable in ways not possible before.

The planetarium at the Verkehrshaus in Lucerne provided the ideal venue for the production's debut. The museum's planetarium is one of the most modern, productive and innovative immersive theaters in the World and regularly presents both astronomical programs and experimental fulldome experiences. *Pixel Zoo Ocean* premiered during LiLu, a winter light festival in Lucerne, where it quickly became a highlight of the festival's program.

The show runs approximately 45 minutes and includes a short live segment presented by a planetarium educator, connecting the immersive visuals with additional scientific context for audiences. From the beginning, visitor reception was extremely positive. Families in particular responded enthusiastically to the colorful visuals and accessible storytelling. For many younger visitors, the show represents a first encounter with both the ocean's biodiversity and the immersive possibilities of the planetarium dome. The success of the premiere has also highlighted the potential for distributing the production internationally through planetarium networks. Because the show combines universal themes—nature, exploration, and environmental awareness—it has strong potential to resonate with audiences across different cultural contexts.

Planetariums have always been places of exploration. Traditionally, that exploration focused on the night sky and

the vastness of space. Yet the oceans of Earth remain one of the least understood environments on our planet. Much like space, they are immense, mysterious, and filled with extraordinary forms of life. By bringing ocean ecosystems into the dome, *Pixel Zoo Ocean* reminds audiences that exploration does not only mean looking outward into the universe—it also means looking back at our own planet and realize the fragility of our existence on this tiny speck of dust in the cosmos. In doing so, the production reflects a broader evolution in the role of planetariums. Increasingly, these institutions are becoming immersive science theaters capable of telling stories about Earth, nature, and humanity's place within the planetary system.

For visitors in Lucerne, the experience of diving beneath the waves without leaving their seats has already proven unforgettable. For the planetarium community, *Pixel Zoo Ocean* offers a compelling example of how immersive storytelling can bridge the gap between art, science, and environmental awareness. And sometimes, the most fascinating frontier under a planetarium dome is not the stars above—but the oceans below.

NORDIC PLANETARIUM ASSOCIATION

As a resource to planetaria in its region the Nordic Planetarium Association now maintains a list on its website where planetaria can see which shows have been translated to the Nordic & Baltic languages. The NPA invites vendors to add their shows to this list - but only those shows that are available in either Danish, Estonian, Finnish, Icelandic, Latvian, Lithuanian, Norwegian or Swedish. The list can be found at: <https://www.npa-planetarium.org/resources/local-language-shows>.

PAGES OF STARS 2025 FIRST PLACE WINNER



Del, Xavier, Adonis, and Yerikza at the Cosmosphere in Hutchinson, KS. Credit: Delmo Torre Franca Jr.

IPS is delighted to announce this year's first place winner of *Pages of Stars* is Delmo Y. Torre Franca Jr. from Oceanside, CA. He is a student in the American Public University System and is pursuing a Space Studies Bachelor's Degree with an Astronomy concentration. In his entry, *Mining the Night Sky*, he imagines that future space explorers may mine the asteroids, a rich resource for metals and water. Here is his story:

MINING THE NIGHT SKY

When I look up at Orion's belt, with three stars aligned, I imagine not just the hunter of myth, but the tool belt of tomorrow's explorers. Every point of light whispers a promise, with some hidden in the quiet asteroids wandering between Mars and Jupiter.

The asteroid belt is not just rubble from the dawn of the solar system. It is a warehouse of metals such as nickel, cobalt, iron, and even platinum. Some asteroids contain something even more precious: water (Sommariva, 2015). Water to drink, water to shield us from cosmic radiation, water that can be split into hydrogen and oxygen to fuel ships pushing deeper into space. These resources are waiting, silent and abundant, on worlds with almost no gravity, where reaching in and taking hold requires far less energy than hauling cargo up from Earth (Sukumaran, 2016).

We have already touched them. Japan's Hayabusa spacecraft carried back a sample from asteroid Itokawa (NASA Jet Propulsion Lab, n.d.). NASA's OSIRIS-REx embraced the surface of Bennu, bringing back dust billions of years old (Lauretta et al., 2017). Soon, the Psyche mission will journey

to a metallic world that may reveal secrets of planetary cores and hint at the riches we could one day mine (NASA, 2023).

Asteroids come in many forms: C-types rich in carbon, M-types forged of metal, and S-types made of stone (Sukumaran, 2016). Each one is a potential stepping stone, each one a different answer to the question: how will we sustain ourselves when Earth is too far behind us? Well... We may use electromagnetic launchers to send ore to lunar depots (Engel & Prelas, 2017), or melt metals into feedstock for 3D printers aboard spacecraft. Already, on the International Space Station, tools have been printed in orbit like wrenches built not on Earth, but in the sky itself. Someday, entire ships may be printed among the stars, shaped without the burden of gravity (European Space Agency, 2022).

This is no longer fantasy. The Artemis program will return us to the Moon to build a camp, a gateway to Mars and beyond (NASA, n.d.). And when our species sets sail for those distant horizons, it will not carry everything from Earth. It will gather from the heavens themselves, transforming asteroids from wandering relics into waystations of survival (Sanchez et al., 2021).

So, the next time you stand beneath Orion, or watch Sirius blaze against the dark, remember: the night sky is more than a map of myths. It is a blueprint. Each constellation may one day be the backdrop for miners, builders, and dreamers shaping their lives among the asteroids.

The night sky has always been our storybook. And soon, it will become our workshop.

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INTERNATIONAL PLANETARIUM'S CALENDAR

COMPILED BY: LORIS RAMPONI

2026

- **2-4 June.** European Network Science Centres & Museums (ECSITE), Annual Conference, Universeum, Gothenburg, Sweden. <https://www.ecsite.eu/conference>

28TH INTERNATIONAL PLANETARIUM SOCIETY CONFERENCE, FUKUOKA CITY SCIENCE MUSEUM, FUKUOKA, JAPAN.

- **18-19 June.** Fulldome Festival. @ Fukuoka City Science Museum.
- **20-21 June.** IPS Board Meeting.
- **21 June.** Welcome (Social Event).
- **22-23 June.** Open Ceremony, Sponsor Promotion, Sessions and workshops.
- **24-26 June.** Sponsor Exhibition, Concurrent Sessions, General Meeting, Keynote
- **27 June.** Post Conference Tour.
Contact: ips-fukuoka@fukuokacity-kagakukan.jp
<https://www.ips2026fukuoka.com/>
- **30 June.** Asteroid Day. <https://asteroidday.org/>
- **15-17 July.** Fulldome Festival Jena, Jena, Germany.
<https://fulldome-festival.de/info>
- **31 July.** Deadline for the applicants of "A Week in Italy for an American Planetarium Operator", in collaboration with IPS Portable Planetarium Committee. ips-planetarium.site-ym.com/?page=Italy
- **4-6 August.** LIPS Conference (Live Interactive Planetarium Symposium), Seminole State College/ Emil Buehler Perpetual Trust Planetarium in Sanford, Florida, USA. Contact: Karrie Berglund, karrie@digitaliseducation.com;
<https://www.lipsymposium.org/registration>
- **12 August.** Total solar eclipse (Arctic, Greenland, Iceland, Atlantic Ocean, northern Spain and very extreme north eastern Portugal). <https://nso.edu/for-public/eclipse-map-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/>

- **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/>
- **12-16 October.** Digistar Users Group, Strasenburgh Planetarium, Rochester, New York, USA. <https://digistarusersgroup.wildapricot.org/conference>
- **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>
- **12-16 November.** Viva Inmersiva Film Festival, Planetario Medellín, Medellín, Colombia. <https://www.vivainmersiva.com/>
- **18-20 December.** Workshop of Planétariums Interactif Associés francophones (PIAf), Marseille, France. Inscriptions: lionel.ruiz@live.fr Each month, all the year, PIAf Meeting online. Free inscription: <https://groups.io/g/lss-plane>; <https://planetariums-interactifs.org/>
- **31 December.** Deadline for the contest "A week in United States". For information and application requirements go to: www.ips-planetarium.org/?page=WeekinUS
- **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

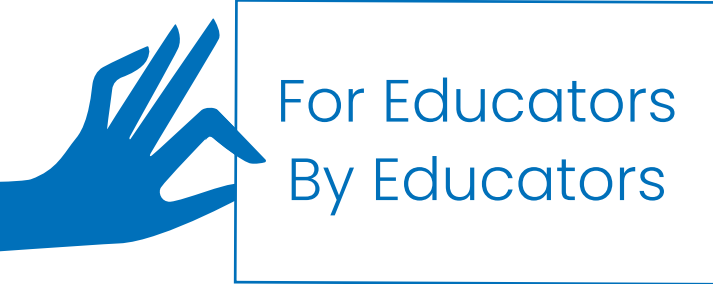
- **20 March.** The Best of Earth Fulldome Awards 2027. The Best of Earth Awards Show is a coalition of fulldome film festivals around the world (Jena, Los Angeles, Plymouth, Melbourne, Canada, Brno) to celebrate the innovation and magnificence that fulldome provides. The event will be streamed. <http://bestof.earth/>
- **31 March.** Deadline of 15th PLANit Prize for an original video production, organized each year by Italian Association of Planetaria (PLANit), Italy. The prize

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

— Peter Drucker

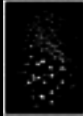
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- **April.** Italian Association of Planetaria (PLANit), 42nd National Conference of Associazione dei Planetari Italiani. Contact: segreteria@planetari.org; Dario Tiveron, dario@fddb.org; www.planetari.org
- **April.** Gesellschaft Deutschsprachiger Planetarien e.V., (GDP), Annual Conference of the Society of German-Speaking Planetaria. Contact: Voss, Björn Dr., 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/>
- **2 August.** Total solar eclipse (Europe, Africa and the Middle East). 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

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

- <https://www.ips-planetarium.org/news/705534/>

be-pages/under-roof-dome-and-sky/

Immersive Matters (con't.)

transport people beyond everyday reality, anchored in something true.

The challenge before us is strategic, not existential. Invest in technology that lets our medium compete visually. Programs with the creative ambition that the dome format merits, reaching audiences who have never thought of themselves as planetarium visitors. Build partnerships that amplify reach and diversify funding. Market the experience in the language of adventure and wonder. Make the dome a hub for live, communal encounters with the universe that no home device or commercial installation can replicate.

None of this requires abandoning our core. It requires recognizing that our core — immersive, scientific, communal, authentic — is precisely what the experience economy is most hungry for. Only in a planetarium can audiences look up at a cosmos rendered from genuine data and feel the specific vertigo of understanding where they are in the universe. That is an experience no commercial investment can manufacture. The moment to advance has never been clearer.

The universe always has something new to show us, and the dome can always be reprogrammed to show it. That is not a modest advantage. That is an inexhaustible one.

Thanks to Ryan Moore for his ideas that inspired this article. This article draws on research compiled in “Planetariums in the 2025 Immersive Experience Landscape,” informed by the TEA/AECOM Global Attractions Attendance Report 2023, Blooloop analyses of immersive experience trends, Gensler’s research on immersive experience attributes, the Softmachine immersive events whitepaper, and case studies from the Adler Planetarium, Cité des Sciences, Your Dome (Tyrol), Shanghai Astronomy Museum, ‘Imilao Astronomy Center, and the Copernicus Science Centre Warsaw.

EDITORS NOTE:

The *Planetarian* staff would like disclose that the main author of this article is a part of the Worlds distribution team for *Mesmerica*.



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