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Comet Tsuchinshan-Atlas in the sky of Saint-Chaptes (Gard / France ; October, 18th). Photo : Jean-Michel Faidit - Sony A7iii - 35 mm - 3,2 s - F4.5 and 12800 iso - Digital processing : Christine Cougoulaine (Etoile Cévenole / Alès Planetarium) with Lightroom and Photoshop.

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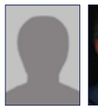
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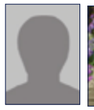
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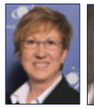
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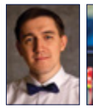
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IPS President Dave Weinrich
Welcome to the 2012
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DEAR SHANNON...
A MESSAGE FROM THE PRESIDENT

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Dear Shannon,

I'm so proud of you. I'm so excited for the future of IPS, for your plans and your vision. I feel deeply fortunate to pass the reins of this organization to someone with such talent and intelligence. I am thankful for the wisdom and perspective you've given to me the past two years, and with that counsel, I've been able to serve IPS better than I could have on my own. But most of all, it is an honor to call you friend.

I've learned so much more than I could have imagined during my time as president. It has been both a time of growth and an instrument of humility, a reminder that while what we do is important and consequential, we are not terribly important ourselves. We're conduits and connectors, bridging the old and the new and helping to make the future better with whatever tools and opportunities that arise. I hope that my legacy is simply that I turned over IPS to you better than when I started.

The Centennial has been the defining characteristic of my time in office, and there's so much that's been done to celebrate our successes and our stories. We've almost made it cliche to talk about remembering the past, but focusing on the future, but I can't think of a better guiding principle for the work we've done, and especially for the ideas and initiatives that you'll bring to IPS. The past century isn't a peak, but a baseline to exceed - and I hope the years to come see us waving from such great heights.

I look a whole lot more like that typical IPS president of the past than you do. I can try – really hard! – to understand what's best for the future of planetariums, and specifically for future planetarians, but I believe without reservation that you will do better. You are, and will be, an inspiration and role model to new planetarians in a way I could never be. But don't forget... you're an inspiration and role model for me, too.

One of my hopes for the future of IPS is that we inspire great things. I believe in a planetarium future that is wonderous and awe-inspiring and provocative and relevant to so many people and experiences. The prospect of a more professionalized planetarium community, where we feel the confidence to stand shoulder-to-shoulder with any industry or discipline, fills me with elation. We must continue to hold space for great minds to do great things. I promise that's not just your responsibility, but I do know that you are already a catalyst, a spark that will set off a hundred more. We will be faced with challenges - that much is sure. We represent planetariums that stand up for science, that combat the scourge of misinformation and indifference that's become so insidious in parts of the world. We get to support the people that work tirelessly to make the Universe a bit more accessible, across countries and continents, and bring their voices and perspectives to the forefront.

We've done a lot these past two years. We saw a wildly successful conference in Jena and Berlin, even if the world's computers conspired to keep you out of Germany for as long as possible. We've forged new collaborations that reflect the reality of modern domes. We've funded and platformed new planetarium research, and set foundations to build the future of planetarium scholarship from. We've seen IPS membership to grow to its highest levels in more than a decade. We literally got to work with Pink Floyd. You've represented IPS on the international stage numerous times, and oh yeah, you've probably added a ton of birds to your life list.

But I'm certain that your list (both of birds and IPS accomplishments) over the next two years will put mine to shame, and nothing would make me happier. Stand on my shoulders, and let me help you see further. Be an inspiration to the next generation of brilliant planetarium folk. Continue to be a remarkable friend, colleague, provider of Girl Scout cookies, and planetarium director. Just be you - because we're lucky to have that.

With hope and appreciation,

Michael

A CALL TO ACTION
IN FRONT OF THE CONSOLE

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EOS PLANETARIUM THEATER UPDATES

It's been a busy fall in our planetarium dome as we've been hard at work training a new group of undergraduates to share their passion for science and astronomy through planetarium presentations. What makes this group truly special is the diversity of their backgrounds. Each of them brings unique perspectives and experiences, enriching the stories we tell under the dome.

Training sessions are never without their challenges, but that's part of what makes this journey so rewarding. We see each trainee grow in confidence and skill, transforming into voices for science that inspire curiosity and wonder in their audiences. Their enthusiasm and dedication remind us of the vital role we play in fostering a love for learning and discovery.

At the same time, this season brings a bittersweet transition. A few of our seasoned team members, who have been with us for years, are preparing to graduate. These individuals truly embody the mission of our planetarium—to craft shows that not only educate but also captivate, tailoring each performance to engage our diverse audiences. From public visitors to school groups, their ability to connect and inspire will leave a lasting legacy.

While it's always hard to say goodbye, we're proud of what they've accomplished and excited for what lies ahead—for them and for the new generation stepping up to continue the tradition. The cycle of learning, growing, and inspiring is at the heart of what we do, and I couldn't be more grateful to be part of this journey.

Alongside these personal milestones, we're thrilled to be working with G-Systems again to maintain and enhance the technology that makes our dome experiences possible. One exciting development is our upcoming server upgrades, which promise to make our software run smoother and more efficiently. These improvements won't just enhance day-to-day operations—they'll also open new doors for what we can showcase on the dome, from cutting-edge visualizations to more immersive storytelling experiences.

BUSY, BUSY, BUSY

Before I go any further, I want to take a moment to personally apologize for the consistent lateness of recent issues of the *Planetarian*. I understand how frustrating it can be to wait longer than expected for something you value, and I deeply regret any inconvenience this may have caused.

As someone who is juggling a busy schedule, I know firsthand how challenging it can be to meet every deadline, and I often ask for your patience as I navigate these demands. In the same spirit, I strive to extend that same patience and understanding to our columnists, article writers, and advertisers. The planetarium industry has grown busier and more complex over the last few years, and many of us are balancing multiple responsibilities while striving to contribute to the journal.

That said, I recognize that timeliness is important to the quality and credibility of the *Planetarian*. Going forward, I will make a concerted effort to be firmer with deadlines while still fostering the supportive, collaborative environment that makes our journal so special. This balance won't always be easy, but I believe it's necessary to ensure that the *Planetarian* continues to meet the needs of our incredible community.

SHAPING THE FUTURE

At our planetarium theaters, our goal is to spark wonder and curiosity while delivering top-notch educational experiences. But how do we know we're hitting the mark? That's where you come in! Feedback from our audiences is an essential tool—it's how we learn what's working, what could be better, and what new ideas we might explore next. Whether it's a comment about a show, a suggestion for new topics, or a creative idea we hadn't thought of yet, your input helps us evolve and create even more meaningful experiences.

The same goes for the *Planetarian*, our journal dedicated to supporting the planetarium community worldwide. We want it to be your go-to resource, filled with articles and features that meet your needs. Are there topics you'd love to read about? Educational techniques you want to learn? Technology you're curious to explore? Your feedback ensures we're delivering exactly what our community is looking for.

And speaking of contributions—we're looking for new voices to help expand what the *Planetarian* offers! Do you have innovative teaching methods or fresh ideas to share? Are you passionate about reviewing books that could benefit the community? We'd love to hear from you. Writing a column is a great way to connect with fellow professionals, share your expertise, and spark conversations.

Your feedback and ideas—whether as a reader, audience member, or contributor—are what keep us moving forward. Let's keep the dialogue going and make our theaters and the *Planetarian* even better together. After all, it's your insights that help us reach for the stars!

GEOSCIENCE VISUALIZATIONS IN FULLDOME PLANETARIUMS

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1. INTRODUCTION

When fulldome projection technology started to take hold at the turn of the millennium, many in the planetarium community recognized that the new digital theaters could result in new ways of educating the public, visualizing scientific data, transporting audiences, and creating artistic expression. The ability to introduce non-astronomy topics like geology was also highlighted as an important feature (Matthews 2005). In fact, Earth science programs started to appear within a few years of the opening of the first fulldome theaters, via movies (Sumners & Reiff 2004, 2005) and live shows with real-time visualizations (Yu, Raynolds, & Dechesne 2008; Yu 2009), while scientists also began to use domed displays to show their geoscience research (Kwasnitschka 2008).

It seems logical to present geoscience topics in the dome since Earth is just another planet like any other to be visualized and explored. But the enormous promise of planetariums for Earth science education has never been realized. Although roughly 160 fulldome films with some connection to planet Earth appear in the FDDB.org database as of August 2024, there are few domes that regularly present geoscience lectures. This is not surprising since most planetarium staff have astronomy as opposed to Earth sciences backgrounds, and their branding often still is astronomy-centered. We also have not witnessed a mass movement of Earth scientists demanding equal time with the astronomers to give presentations in domes (cf. Kwasnitschka 2017).

Yet, there are many reasons why we advocate digital planetariums for geoscience education. The importance of visuals in teaching geoscience makes fulldome theaters ideal venues for disseminating such content. Many real-time interactive fulldome software already have features that allow them to be used for geoscience presentations. Furthermore, there is a deep connection between today's fulldome visualization software and early attempts at creating a "digital Earth." In this paper, we will look at these historical roots, examine what is involved in geoscience education, how fulldome theaters currently support these topics, and advocate for new features in vendor software to make fulldome theaters even more capable of Earth science education. Finally, with people worldwide experiencing record-breaking temperatures and extreme weather events, we will show that fulldome theaters have the capacity to engage the public in the climate crisis.

2. VIRTUAL GLOBES AND DIGITAL PLANETARIUMS

If the public is asked to think of a computer-generated Earth, Google Earth will likely come to mind. Surprisingly, this familiar "virtual globe" has deep ties to the visualization technologies used in digital planetariums. To see how this is so, we need to go back to visionary thinker Buckminster Fuller's concept of a "Geoscope," a large spherical replica of the Earth 200 feet (61 meters) in diameter, floating over the East River outside of the United Nations building in New York, presenting geospatial data to help world leaders make better decisions (Fuller 1962). Although a full-sized Geoscope was never built, the idea inspired US Vice President Al Gore's vision of a "Digital Earth" computer program, first expressed in his book Earth in the Balance (1992) and later in a speech at the California Science Center in Los Angeles (1998). Based on this conception of an interactive software tool that would combine all types of geospatialized scientific, economic, and social information, a working group—that included US federal agencies, international standards organizations like the Open Geospatial Consortium (OGC), and led by NASA—determined how to integrate and work with data from different federal sources, and fund research and technological development. One result of this working group was defining the Web Mapping Service (WMS) protocol for sharing mapping data online (Grossner, Goodchild, & Clarke 2008).

During this time, Silicon Graphics Inc. (SGI) developed "clipmapping," which allows an arbitrarily large image, such as one representing the entire surface of the Earth at high resolution, to be managed within the limited texture memory of a computer (Tanner, Migdal, & Jones 1998). Inspired by Ray and Charles Eames' Powers of Ten film (Aubin 2006; Fig. 1a), SGI released a demonstration of clipmapping at work in their "From Space To Your Face" interactive in 1996, which showed in real-time, a smooth transition from Earth orbit down to the Swiss Alps (Fig. 1b). Some of the earliest fulldome visualization software used clipmapping running on SGI hardware (see §4.1 below), while the Eames' short film further inspired the default manner by which real-time navigation is done in digital planetarium software, where the virtual camera pivots around and zooms in and out from a central point (Emmart 2005).

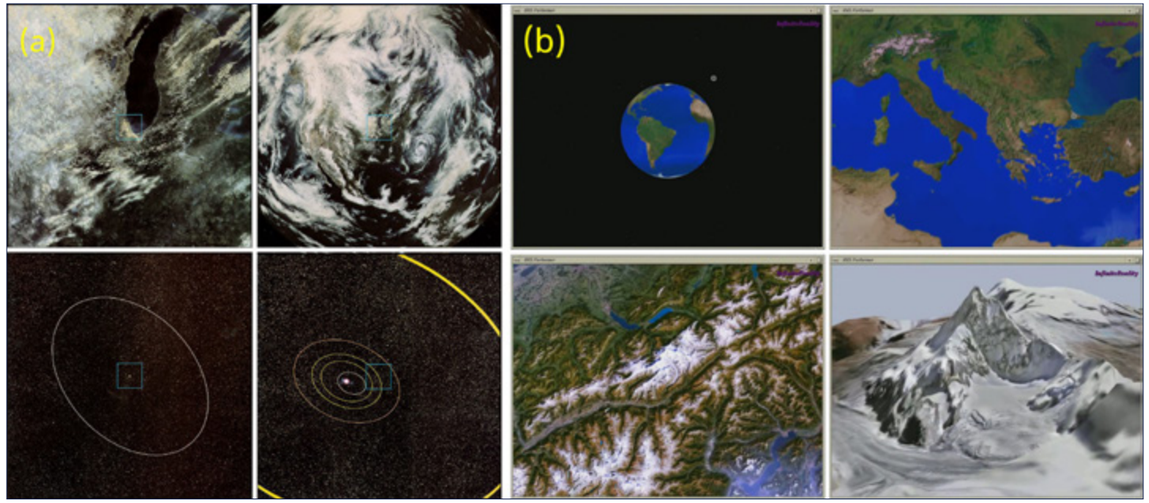


Fig. 1. (a) Four frames from Ray and Charles Eames' *Powers of Ten* film. (b) Four screenshots from SGI's "From Space To Your Fvace" demo.

Early digital Earth browsers appeared at the turn of the millennium, including Earthviewer, released in 2001 by Keyhole, a company that was a legacy of three of the engineers that worked on SGI's "From Space To Your Face." Earthviewer was a commercial product requiring an expensive license, but that changed when Google acquired Keyhole in October 2004 (Ratliff 2007), and Earthviewer was repurposed as Google Earth the following June. Scientists quickly adopted Google Earth and other virtual globes to display and analyze their data. Superimposing geospatial data layers proved to be a very intuitive way to understand geographic relationships between different datasets (Butler 2006). Let us explore further how and why a virtual globe in a fulldome theater should be used for geoscience education.

3. FULLDOME THEATERS FOR GEOSCIENCES EDUCATION

In the United States, the most recent set of national science standards for elementary and secondary schools are the Next Generation Science Standards (NGSS), which define a set of grade-specific disciplinary core ideas about Earth sciences, including the history of the planet; the role of plate tectonics; how Earth's surface is shaped by geophysical, biological, and human forces; and how weather and climate work (NGSS Lead States 2013). In addition to these core ideas, NGSS also proposes frameworks about common science and engineering practices, and crosscutting ideas that apply across multiple disciplines of science, such as the notions of scale and the use of models to describe natural phenomena.

At the university level, introductory science courses give students a deeper and more sophisticated understanding of a discipline, but they also give learners a sense of what working and thinking like a scientist is like. Orion & Ault (2007) further identify a number of distinctive features of university Earth sciences education, including: the need for visual representations and spatial reasoning; understanding phenomena that occur over large-scales and through deep-time; and the use of multiple size scales to explain phenomena. Since planetarium visualization software are designed to visualize astronomical phenomena at a range of size scales and in their correct three-dimensional relationships with each other, such software should also be suitable for visualizing geoscience phenomena.

In addition, second- and third-year Earth sciences students take field classes, where they go to geologically interesting locations, and learn from expert practitioners on how to make observations out in the field. Undergraduates in a field geology course apply the principles outlined by Orion & Ault (2007) in fieldwork when they study the landscape, synthesize their observations into a hypothesis explaining what they see, and then use the working hypothesis to interpret new (or re-interpret) old information (Hawley 2012). Virtual field trips (VFTs) have been created in recent decades to mimic real field trips (e.g., Dolphin et al. 2019) by incorporating a wide variety of media assets, including explanatory text, photos, 2D image mosaics, 3D computer models, videos, 360° spherical panoramic images, and drone footage. VFTs allow students to revisit and review field environments, and a well-designed VFT can even result in better learning gains than in-person

field trips (Ruberto et al. 2023). Given that most fulldome visualization software can present a wide variety of media content means that digital planetariums are also well suited for creating a VFT experience.

Visuospatial learning is just as if not more important in the geosciences (Kastens & Ishikawa 2006) than it is in astronomy (Plummer 2014). Being immersed in a virtual environment and having the freedom to view objects in the simulation from multiple perspectives is commonly done in fulldome theaters and has been shown to be important for understanding phenomena like seasons (Yu et al. 2015) and phases of the Moon (Chastenay 2015). Similarly, seeing virtual 3D models of geological features like outcrops in a larger simulated landscape from multiple vantage points allows students to get a better understanding of such structures, along with the regional context of the small-scale feature embedded in its landscape. In fact, freed from physical restrictions (e.g., having to climb a slope) in virtual space, students can gain more perspectives in some VFTs than would be possible visiting the site in real life (Klippel et al. 2020). The visual immersion of a fulldome theater offers increased presence, the sense of "being there" in that environment, while the wide field-of-view makes it easier to understand spatial relationships (Yu et al. 2015).

Lastly, geological fieldwork is most efficient when practiced as a group effort. A typical field party consists of about a handful people, perceiving an environment together at the same time, discussing their impressions all at the same time and on site, with the goal of agreeing on an interpretation of the geological setting. Much more so than isolating head mounted displays or even CAVE spatially-immersive environments, domes of almost any size foster a group experience by housing several people, and by offering a comparably small deviation of individual vantage points within the dome due to the curved screen. In other words, everyone sees more or less the same thing, and at the same time. By facilitating such a face-to-face dialectic discussion literally in light of the visualized content, domes may even be seen as mixed-reality environments.

Let us examine next the types of media assets and visualizations for real-time fulldome software needed for geoscience education.

4. GEOSCIENCE VISUALIZATIONS FOR PLANETARIUMS

Geoscience data visualizations for virtual globes can be roughly categorized into those that are 2D or 3D in nature (Zhu et al. 2014). The first type of 2D visuals is the 2D raster, which consists of an image file, like a JPEG or PNG, representing a filled array of values spread continuously across all of its pixels, and laid on the surface of the virtual globe. The next type of 2D visualization is vector-based, consisting of points, lines, and polygons draped onto the surface. This category represents cartographic-style features like markers showing locations of cities, lines representing country borders, or colored polygons showing different types

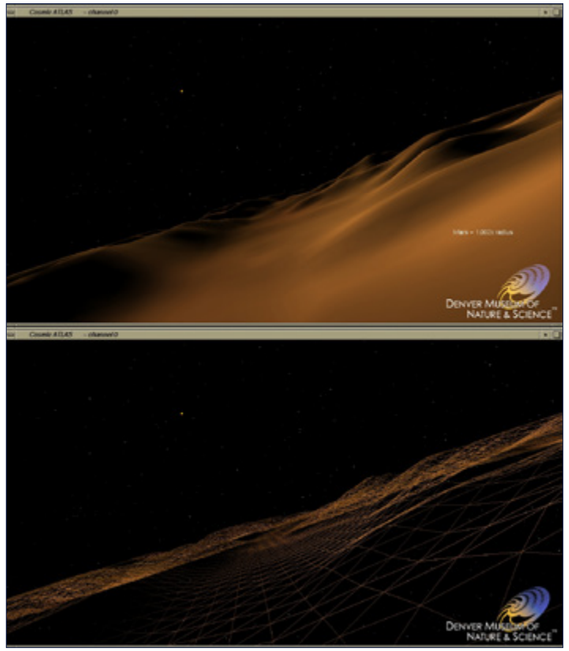
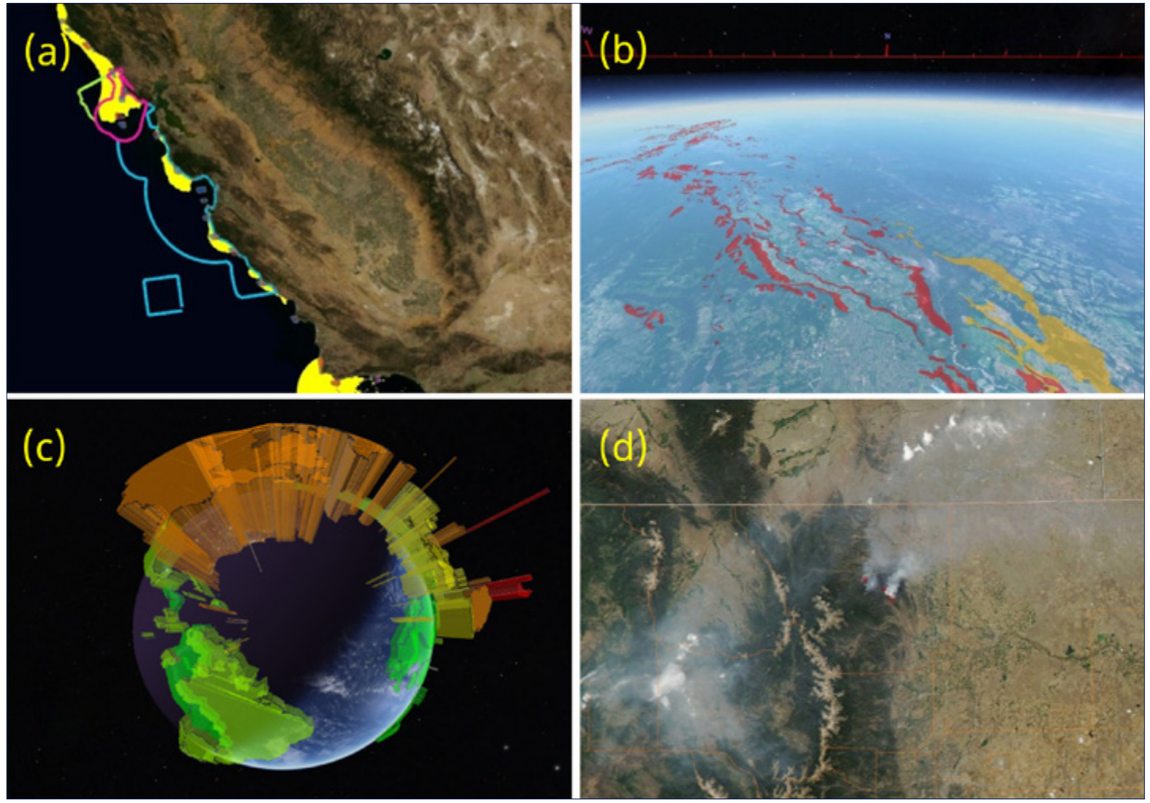


Fig. 2. Cosmic Atlas flight over Mars showing clipmapping in action.

of rock in a geologic map. Digital Elevation Models (DEMs) representing the surface topography (minus vegetation and buildings) can be thought of as 2.5D (Zhu et al. 2014), where each datapoint is represented by the two dimensions of latitude and longitude, plus an extra dimension representing the elevation. The most common type of 3D model is the boundary representation, where the boundary between the interior and exterior of an object is defined by a polygonal mesh. Examples of this would be a 3D model of a house or a mountain where you see and interact with only the external surfaces of these objects and have no knowledge of what their interiors are like. The second style of 3D model is the volumetric model, where voxels (the three-dimensional equivalent of pixels) are distributed in a 3D grid, with each voxel representing a data variable at its position in space.

4.1 SURFACE BASE MAPS AND DIGITAL ELEVATION MODELS

As noted in §2, displaying imagery with a high level of surface detail requires a large, high-resolution image that is not loaded all at once, but is broken up into smaller tiles at different resolutions. In 2001, the Denver Museum of Nature & Science's Cosmic Atlas was the first fulldome planetarium visualization software to use SGI's clipmapping feature to present surface imagery mapped onto a Mars DEM (Yu & Jenkins 2004; Fig. 2). A few years later, SCISS AB's Uniview 1.3 was the first commercial planetarium software that allowed global planet layers to be rendered from geospatially registered tiles served over the Internet via the WMS protocol. With their aptly named "Geoscope" feature, a user can load



multiple WMS layers into Uniview, re-order them to be drawn one atop another, and individually adjust the opacities of each layer (SCISS 2008). Current virtual globe implementations like that in OpenSpace use more sophisticated techniques to render views of planetary surfaces while managing the retrieval of multiple types of tiled maps from different remote servers (Bladin et al. 2018).

4.2 2D RASTER MAPS AND VECTOR OBJECTS

Surface 2D raster imagery is not restricted to photorealistic satellite imagery. They can be any sort of map representation that is geospatially registered so that the map features line up correctly with the corresponding features on the virtual globe. Many fulldome visualization software, such as OpenSpace, SkySkan's Dark Matter, or Cosm's Digistar, can access the global layers from the Science On a Sphere (SOS) archive. SOS is a technology invented at the US National Oceanic and Atmospheric Administration (NOAA), consisting of a digital globe projection onto a 1.7-meter diameter sphere. NOAA has curated a vast catalog of global visualizations from multiple content creators about Earth's many geophysical, biological, and human-social systems. Because the SOS archive contains both animated image layers in addition to static ones, time-variable phenomena can be shown as an SOS dataset. For example, one can present not just the current

Fig. 3. (a) Polygonal and line vector KMLs showing marine protected areas off the California coast. (b) Polygonal vector KML showing flooding near Santa Cruz, Bolivia. (c) An extruded polygonal KML where the height of each country represents their annual consumption of fossil gas. (d) A 2D raster that was manually positioned with Google Earth showing satellite imagery of wildfire smoke plumes. All KML visualizations rendered on SCISS' Uniview.

configuration of Earth's tectonic plates, but also run an animation of the last 500 million years of continental drift.

In addition to global layers, many fulldome software packages can also render Keyhole Markup Language (KML) files atop their virtual globes. Surely one of the reasons why Google Earth became as successful as it did was the release of the KML standard to the public, which is written in a human-readable code that is relatively easy to learn, use, and share. Users could use Google Earth to create and edit KML files of their own data, without the extensive training that was needed for traditional mapping software. Planetarium software does not necessarily support all KML features available in Google Earth, but they can generally show vector-based geometries like location placemarks, lines, and polygons that represent basic cartographic features (Figs. 3a, 3b). When rendered above the surface of the Earth, points, lines, and polygons can appear to "extrude" from the ground, with the height representing additional information (Fig. 3c).

KMLs can also be used to present geo-registered 2D raster imagery like satellite image overlays (Fig. 3d).

Instead of KMLs, OpenSpace currently supports only GeoJSONs, which encodes points, lines, and polygons in a format intrinsically more compact than KMLs. However, there is not a tool as user-friendly as Google Earth for creating or editing GeoJSON files, and if a user has a choice, they may opt to work with the bulkier KML file just because it is far easier to read and modify than the equivalent GeoJSON.

4.3 3D MODELS

Starting in 2006, Google Earth added support for 3D models (Google Earth Blog 2006). This was important for academic geoscientists since they could now build models of rocks, subsurface layers, and other geological units for their undergraduate courses (Whitmeyer, Nicoletti, & de Paor 2010; de Paor 2016). Because of the need to show spacecraft and space telescopes, most digital planetarium software can also import many different types of 3D models, also making them capable of loading geological models. Digistar 8 is further expected to have integration with the Unity and Unreal Engine video game engines, allowing models and environments created for those platforms to be imported into the software.

Instead of being built from scratch with modeling software, 3D models can also be created from physical scans, such as with LIDAR. Another popular method is photogrammetry where a real-life object or environment is photographed from multiple directions, and photogrammetry software derives a 3D model from the overlapping images. Recently, multiple locations from Carlsbad Cavern were photogrammetrically captured, which allowed for photorealistic recreations of these subterranean settings to be explored in the dome (Yu 2023; Fig. 4a). Another example is the photogrammetric reconstruction and implementation in OpenSpace of selected Apollo 17 landing site features using half century-old photographs taken by astronauts.

Other 3D models can be generated from observations or computer models. Global seismic survey data of Earth's mantle were imported into OpenSpace as simplified contour surfaces. This allowed planetarium audiences to have the experience of journeying through Earth's interior to view enormous convective mantle plumes around them (Hoyle et al. 2024; Fig. 4b).

4.4 SPHERICAL 360° PANORAMIC PHOTOGRAPHY

One final type of visualization common to fulldome theaters are the 360° panoramic image spheres. Before the digital era, planetariums would create their own limited panoramic images, which might wrap 360° around the dome, but consisted only a few degrees of content above and below the horizon. The sky was masked off, and the images were shown via slide projectors to create a realistic-looking horizon below the star field. Theaters would commercially sell their panoramas to other planetariums (Brown 1979), while techniques for creating photographic and later computer-generated panoramas were widely shared (e.g., McGee 1977; Bruno & Burnston 1986; McColman 2000). Modern high-resolution panoramic photography that requires stitching together individual overlapping digital images are a more recent development (Gledhill et al. 2003), with Apple's QuickTime VR (Chen 1995) an important early display tool that introduced full spherical 360° panoramic imagery to the public. For fulldome planetariums, shooting spherical panoramas offers an inexpensive way to capture and display a real-world environment in the dome.

Anecdotal evidence from our own geoscientific research in domes shows that high textural resolution is more important for the interpretation of a human scale outcrop than high geometrical resolution (or even, any geometrical resolution). In a geoscience fulldome presentation, scientifically relevant details can be pointed out in the panoramic image by a skilled presenter, who can explain to the audience what they

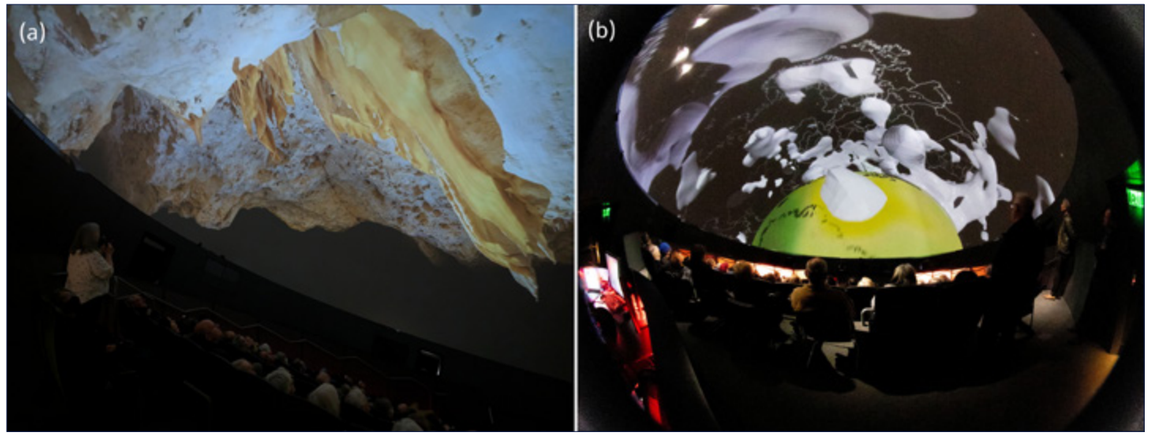


Fig. 4. (a) A photogrammetric model of bacon drapery from Carlsbad Cavern being explored in real-time loaded with OpenSpace in the Gates Planetarium, DMNS. (b) Convective mantle plumes surrounding Earth's core-mantle boundary (in yellow-green) visualized in OpenSpace at the Gates Planetarium.

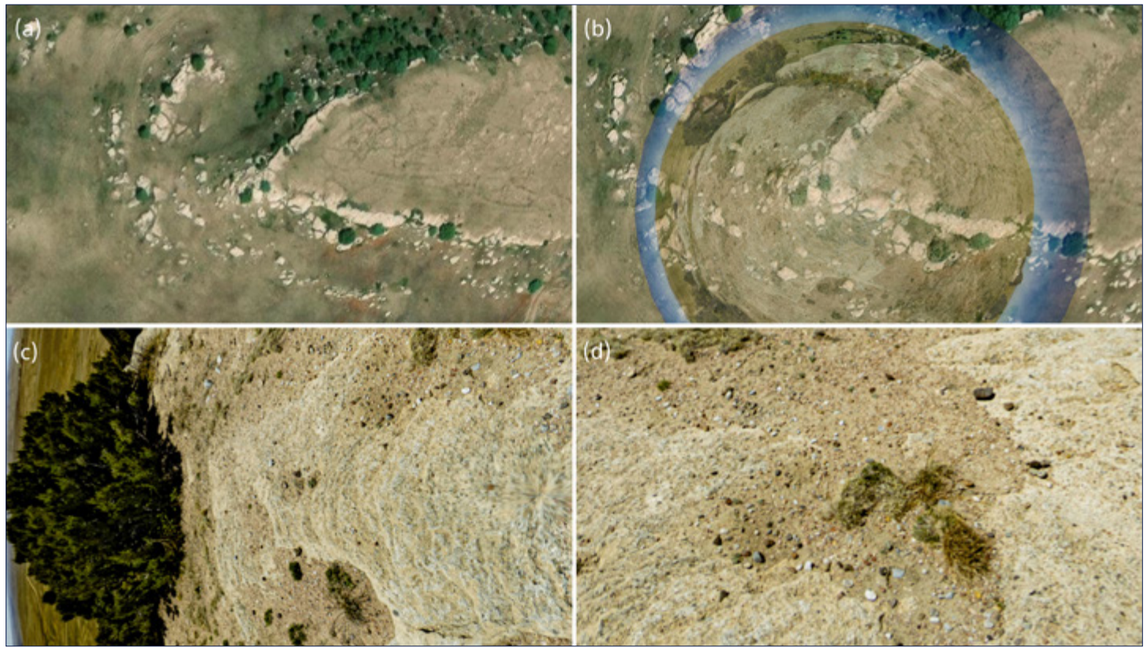


Fig. 5. An example virtual field trip to Cedar Point, Colorado showing (a) satellite imagery; (b) flying into the spherical panorama recorded at the site; (c) features that show the direction of water flow; (d) cobbles and pebbles eroded from distant mountains that were then transported by the ancient river to the current location.

are seeing, as they would if they were out in the field. As an example, Fig. 5 shows frames from OpenSpace of a flight into a spherical panoramic image located at Cedar Point in Elbert County, eastern Colorado. This location is one of the western tips of the High Plains Aquifer in Colorado, and the location shows evidence of an ancient riverbed, whose sandstone layers trap the groundwater that make up the aquifer. On the surface, trough-like patterns left in the fossil riverbed show the flow direction of the water. The rounded cobbles and pebbles visible on the ground represent material eroded from the distant Rocky Mountains and subsequently transported by the river to its current location. A geologist can examine and interpret the numerous visual clues at this location to present a story of how this landscape evolved over time into the current state that we see it, and how this story fits into the larger context of the geology of the region. In the equivalent virtual field trip in the dome, the same geologist can make the same arguments based on what is visible in the panorama image, but without the need to physically transport the audience to this remote location.

5. RECOMMENDATIONS FOR IMPROVING DOME GEOSCIENCE VISUALIZATIONS

Ideally, the visualization features we reviewed in §4 would have universal support in all vendor software, although they currently are not. There are also features missing that need to be added for maximum educational flexibility. Here are four recommendations for improving geoscience visualization support in planetariums.

- By tradition, virtual globes like Google Earth have prioritized visualizing Earth's surface, with little thought given to the interior. Fulldome planetarium software have similarly followed this lead for what can be visualized. Because subsurface models are an afterthought, they also are not usually easy to place even if the software supports 3D models. And even after placing the geological model, we may not want a Powers of Ten-style of pan and zoom for navigation. In the case of exploring a virtual cave, we want to be able to venture through the model like an actual human would in the real-world location. Many immersive video games and head mounted displays offer the mature and widely used feature of "teleportation" which might also be considered.
- While high-resolution satellite imagery is now common in virtual globes, this imagery is usually only of the land. The oceans, which make up 70% of Earth's surface, are neglected and left blank. In some cases, a bathymetry layer showing the ocean floor can be displayed, but this is usually just a flat 2D raster without any 3D topography, unlike the continents above the shoreline. As a result, although Kwasnitschka et al. (2023) describes visualizing ocean floor research with various models and media assets, these are not fully integrated and placed into a precise geospatial context of the virtual globe in fulldome software. Developers should therefore integrate more realistic depictions of the oceans in their fulldome software.

- Most planetarium software can show aurorae and 3D volumetric models of Earth's magnetosphere. Yet the volume of space below space weather phenomena and above Earth's surface is neglected, which is where one could place structural models of the atmosphere, the oceans, or the outputs from oceanographic, meteorologic or generally climatologic simulations. Fulldome visualization software should allow users to easily insert and correctly position these types of data products into the virtual globe.
- The way that users add, delete, or modify 2D and 3D datasets and models on the virtual globe may be very unintuitive and technical, and involve manual editing of configuration files. Making this process as friction-free as possible, at run time, would make it easier for a user of any ability to add content for an Earth-centric show. Many software systems like Digistar or OpenSpace already have interfaces for SOS, making it easy to drag-and-drop and delete SOS layers from the virtual globe. More user-friendly and responsive interfaces for other 2D datasets and 3D models would help users immensely.
- However, we also advocate for advanced users to be able to "hack" the code to add new types of data and model assets that have never been used on a visualization platform before. Power users can help expand the types of data and media that can be visualized in fulldome software and open up new geoscience content to planetarium audiences.

6. FULLDOMES FOR CLIMATE EDUCATION AND CLIMATE SOLUTIONS

As the public becomes more aware of impacts from climate change, there is a recognition that both formal education (Niepold et al. 2018) and informal education institutions (Yu 2024) have roles to play. Since fulldome planetariums can be either formal or informal institutions (or sometimes both!), they can become a trusted source of climate science information for students and the public alike. Many planetariums have developed their own fulldome films (e.g., The Cosmic Climate Cookbook from the Science Museum of Virginia, and Climate Change In Our Backyard from the Fiske Planetarium, University of Colorado Boulder). Given the data visualization features showcased in §4, many fulldome software platforms can already present slides, images, and SOS layers to depict and explain a wide range of climate phenomena.

Yet, delivering more information to an audience is not always the right solution, especially when the topic itself has become highly politicized in countries like the US. One fifth of the American public is skeptical or outright hostile to the idea of human-caused climate change (Leiserowitz et al. 2021), and presenting more information will not change their minds. For hot-button issues, the identity of an individual becomes wrapped up in the debate, so that criticizing one's viewpoint is interpreted as a personal attack. In fact, people who reject the notion that global warming is a problem may actually be quite knowledgeable about the facts of climate change (Kahan et al. 2012), and it is their personal identity—and not more climate facts—that determines what they believe (Kahan 2012).

An alternative to simply delivering more information is to highlight climate impacts at the local level, which is the scale that people typically care about. Many countries have created reports on impacts at national, state/provincial, and local levels. (In the US, this is found in the National Climate Assessment.) These highlight how drought, wildfires, heat waves, flooding, and other extreme weather events can personally affect the audience. But telling only stories of climate doom can make people feel hopeless that they can do anything about a global problem (O'Neill & Nicholson-Cole 2009). Instead, the public wants to know what actions they can take to address climate change (Koepfler, Heimlich, & Yocco 2010). Therefore, having worrying but hopeful messages can make people think about their choices and motivate them to action (Ojala 2012; Smith & Leiserowitz 2013). One way of conveying hope is to show how action is being taken where groups and individuals are doing their part to reverse environmental damage, or to counter and reverse the effects of global warming (Hawken 2017). These examples show that the problems are not insurmountable, that many individuals and groups are working on remedies, and everyone can be part of the solution as well.

Such a hopeful, solutions-oriented, local approach was undertaken by the Worldviews Network, a collaborative group of scientists, educators, and artists, that used planetariums as convening spaces to discuss ecological, biodiversity, climate and other global environmental change issues (Yu et al. 2012, 2013). The Network created more than a dozen "bioregional community dialogues," that involved a live Uniview-driven presentation, followed by an audience discussion led by topic experts, with the goal of getting the community to remain engaged with the challenging issue (Fig. 6). A mix of WMS datasets, 2D raster and vector KML layers, 360° spherical and fisheye imagery, and image slide decks were used to support carefully constructed stories that emphasized the complex Earth systems surrounding each problem. Using fulldome visualization software meant that the stories seamlessly transitioned through different scales, from the global down to the local level. Inspiring, hopeful examples of strategies being developed around the world to solve humanity's problems were used to highlight solutions. Professional development helped planetarium staff (who often had no background in these topics) learn to co-create stories about ecological and environmental issues involving complex Earth systems. These staff also learned to seek out external partners who were experts on the issue, who could engage with the audience in discussions, and in some cases, helped with script development, and even co-presented at the live events.

There are many other climate change education efforts that similarly engage with entire groups, as opposed to just the individual. These get community members to work together on projects, such as in a citizen science effort to measure the urban heat island effect across a city (Hoffman 2020) or engage students to design and build rainwater harvesting basins at their school (Wilkening & Murrieta 2020). What these and other projects show is that informal science institutions have as big of a role to play as schools, in educating and engaging the public about climate change and other problems at the intersection of science and society. There is substantial evidence to suggest that by the time people become adults, most science learning actually occurs outside of the classroom, happens throughout one's lifetime, and comes from a variety of different sources and contexts (Falk & Dierking 2010). Access to informal science learning—such as at science museums, zoos, aquariums, and planetariums—help maintain public interest in and knowledge of science (Falk et al. 2016). With geoscience visualizations and education efforts, planetariums have the opportunity to be relevant to their communities about issues that are close to home, while helping their audiences to learn about environmental issues important to them, remain engaged, and respond to the environmental crises occurring around them.

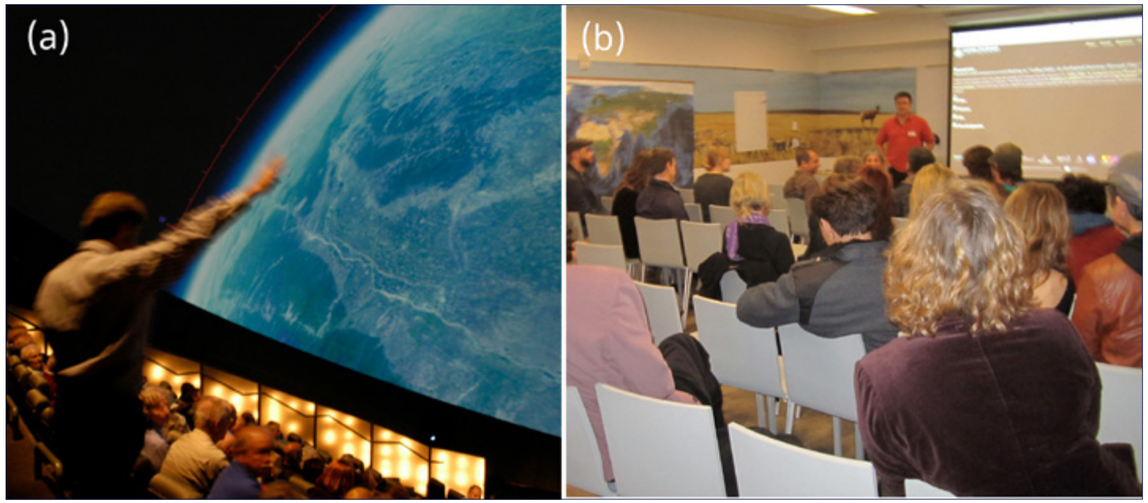


Fig. 6. (a) Worldviews Network dome presentation and (b) community dialogue.

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AUDIENCE REACH OF SCIENTIFIC DATA VISUALIZATIONS IN PLANETARIUM-SCREENED FILMS

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University of Utah (UU) & University of Illinois at Urbana-Champaign (UIUC), UIUC, UIUC, UIUC, UIUC, UIUC, UU

ABSTRACT

Quantifying the global reach of planetarium dome shows presents significant challenges due to the lack of standardized viewership tracking mechanisms across diverse planetarium venues. We present an analysis of the global impact of dome shows, presenting data regarding four documentary films from a single visualization lab. Specifically, we designed and administered a viewership survey of four long-running shows that contained cinematic scientific visualizations. Reported survey data shows that between 1.2 - 2.6 million people have viewed these four films across the 68 responding planetariums (mean: 1.9 million). When we include estimates and extrapolate for the 315 planetariums that licensed these shows, we arrive at an estimate of 16.5 - 24.1 million people having seen these films (mean: 20.3 million).

1. INTRODUCTION

Immersive experiences in planetariums, museums, science centers, and other educational environments with domed theaters (collectively referred to as “planetariums” hereafter) strive to engage diverse audiences through a mix of live presentations and pre-rendered dome show films. These films often incorporate cinematic scientific visualizations (Borkiewicz 2020), offering an impactful way to communicate complex scientific findings to the public. This study focuses on pre-rendered dome shows, particularly those that leverage the power of scientific visualization to enhance educational content. The growing importance of cinematic scientific visualization in planetarium settings was underscored in the 2023 IEEE VIS keynote, “Visualizing The Chemistry of Life on Giant 360-degree Screens” (Berry and Ynnerman 2023). Dome shows, and the scientific visualizations they contain, can have a profound global reach. As our data reveals, many dome shows remain in circulation for decades and continue to be screened long after their initial release. By analyzing the reach and viewership of four specific dome shows from a single visualization lab, this paper aims to shed light on their global impact.

Considering the substantial investments of time, effort, and funding required to create cinematic visualizations, it is imperative to quantify their impact. Understanding the reach of these visualizations is essential for assessing their potential value and determining whether the investment in their creation is justified. However, there are several challenges to determining the precise number of viewers for any given dome show. Unlike traditional film screenings where ticket sales provide concrete metrics, planetariums lack standardized mechanisms for tracking viewership. Moreover, planetariums range from small portable facilities to major institutions up to 30 meters in diameter (Yu et al 2016). While major planetariums may maintain detailed attendance records, many smaller venues lack such infrastructure, posing significant challenges in obtaining comprehensive viewership data. Small domes are much more prevalent than large domes globally (Petersen 2020) and thus contribute a sizable portion of all dome show audiences, making it imperative that these venues are included in analyzing viewership data.

To evaluate the global reach of planetarium dome shows containing visualizations, we surveyed the planetariums that licensed four such films. Based on the survey responses, we determine a minimum viewership of 1.2 million. We then extrapolate from the list of total licensees to provide a low-range estimate of 16.5 million viewers. Our survey and analysis processes, along with detailed results, is presented below.

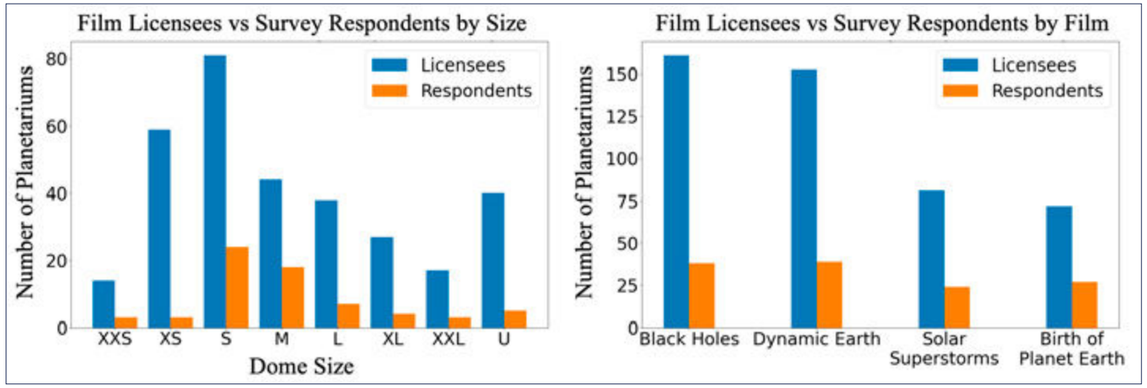


Figure 1. Distribution of planetariums that have licensed the four studied films, compared to those who answered our survey.

2. DATA COLLECTION AND ANALYSIS

Four dome documentary films were selected for this study: Birth of Planet Earth (2019), Solar Superstorms (2015), Dynamic Earth (2012), and Black Holes: The Other Side of Infinity (2007). These films feature visualizations from the Advanced Visualization Lab at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign. We chose these films because they contain cinematic scientific visualizations and licensing data was available to the authors. We sent a survey regarding viewership and received responses from 23% of the total licensees. We then deductively coded the data for viewership as described in Section 2.1. Finally, we combined the data with information about planetarium sizes to estimate viewership across all licensees.

2.1 DATA COMPILATION

Evans and Sutherland[1], the films’ distributor, provided the sales data for the four selected films. The data included the name of each planetarium, city, length of the purchased license, and purchase date. We coalesced data by planetarium, i.e. if a single planetarium re-purchased a show after the expiration of a license, we combined rows, using the combined length of the purchased licenses and first purchase date. The resulting data contains information for 315 planetariums.

We matched the sales data against two planetarium databases, the World Planetariums Database (Audeon and Ruiz n.d.) and the Loch Ness Productions Fulldome Theater Compendium (Petersen and Petersen n.d.), to obtain contact information for the planetariums as well as information about their sizes and capacities. The combined dataset includes the following data: (1) the seating capacity, (2) the size of each planetarium dome in meters, and (3) the annual attendance for each venue. In instances where this information was not available, we conducted a manual search to find the information on the planetariums’ websites, annual reports, and/or Wikipedia pages, as applicable. We acquired dome sizing information for 280 of the planetariums which had purchased the film.

Each planetarium was categorized into one of seven size buckets, as defined by Petersen (Petersen 2020), which we label as XXS, XS, S, M, L, XL, and XXL for readability, with “U” for planetariums of unknown size. We used the dome size in meters to make this classification when it was available, otherwise, we estimated the classification using the dome capacity. When the planetarium had multiple domes, we used the largest dome size for the classification.

2.2 SURVEY DATA COLLECTION

We sent our survey to the 268 planetariums for which we could find contact information and received 72 responses. Figure 1 shows the distribution of planetariums by dome size and by film. For each purchased film, the survey participants were asked to provide data or estimates regarding the number of people who attended film screenings and information about how the data was gathered or estimated. If the planetariums did not have the requested information on hand, additional questions about their planetarium and their events were asked to assist in making estimates.

Several planetariums answered survey questions about films which they should not have had according to the licensing data from the distributor. We cross-checked their access to these films by checking listings on the planetariums’ websites as well as sending follow-up emails, and we verified all but two survey answers. All of these responses were kept, and marked as licensed. Ten planetariums did not list their institution name in the survey. Where possible, we mapped these responses to planetariums by using identifying information from their responses. For example, a survey respondent that specified a seating capacity of 77, a specific and unique value, was easily matched to a corresponding planetarium among the list of purchasers. Likely matches were found for five of the ten unspecified planetariums, and the others were marked “U”. One planetarium had two different people respond with slightly different answers, so we averaged them. We removed four responses for having

1 https://shows.es.com/

no estimate (2) or no record (2) of screenings. After this initial data cleaning, 68 survey responses from planetariums remained. Several respondents provided information about multiple films, resulting in 105 data points for dome show viewership out of 459 license purchases across the four films.

All survey questions were optional and allowed numerical or free-text answers to encourage the submission of partial information if available. Many planetariums provided rough, text-based answers (e.g. "about 500 per year since the purchase date"), which were coded by two of the authors into a range of possible values. The coders followed a mutually agreed upon set of rules for coding, and met to discuss differences in interpretations. Where a consensus could not be reached among the coders, the lowest-low and highest-high were used for the range. We applied the following coding criteria with equations for hedge word estimation based on work from Ferson et al (Ferson et al 2015).

1. If an exact number is provided, use that value.
2. If an estimated number is provided, use the range x ± 2*10^-d where d is the decimal place of the last significant digit of x.
3. If a phrase like "about x" is used, use the range x ± 2*10^-d.
4. If a phrase like "above x" is used, use the range [x, x+ 2*10^-d].
5. If the above calculations result in numbers that are negative or zero, reduce d by one.
6. If viewership information is not provided, calculate low and high estimates using numShowsPerWeek * numWeeksPerYear * numYearsSinceLicense * seatingCapacity if these values are available.

   a. numShowsPerWeek uses the reported survey value for the "high" estimate calculation and 1 for the "low" estimate calculation. We chose this range because upon cross-checking against their websites, it appeared several planetariums misunderstood the survey question "What is the number of showings for this show per week?" to mean all shows rather than the particular title

   b. numWeeksPerYear uses 49 ("low") and 52 ("high") weeks per year to account for planetarium closings. If the planetarium is part of a school district, the number of weeks in the school year is used.
7. Use the planetarium attendance and capacity information provided in the survey over information pulled from external databases. Use the numbers provided by respondents where possible.
8. If it is not possible to determine a number based on the response, mark the data for non-inclusion in the analysis.

Each coder coded the data independently. There were 39 differences in interpretations prompting discussion. The most common issues (27 out of 39) were easy to resolve due to a simple misapplication of a rule or a coder not utilizing all relevant information, however several instances were difficult to resolve and required turning to outside sources of information.

One large planetarium claimed to have "63+" showings of Black Holes per week, adding that "Attendance is strong when BH is on the schedule". This was an instance where the "63+" survey answer actually refers to the total number of shows played per week, and not specifically Black Holes shows. Our attempts to contact the planetarium to acquire scheduling information were unsuccessful, so per coding rule 6a, we initially coded a viewership range assuming the film is shown between 1 and 63 + 2*10^0 times per week, which resulted in a viewership estimate of 51,000 - 3,529,000 for this planetarium---an extraordinarily unhelpful range. Coder #2 identified historical versions of the planetarium's website between 2012 - 2020 using The Internet Archive Wayback Machine[2], and from this was able to determine that the film was actually shown between 4 times a week 20% of the time, and 3 times a day 35% of the time.

A spreadsheet detailing the licensing information, dome size information, and coding results is available at doi.org/10.7278/S5d-1anf-0dcr

2.3 SURVEY RESULTS

The total reported number of viewers of these four films across 68 planetariums (out of 315 total) lies between 1.2 - 2.6 million (mean: 1.9 million) based on the coded survey responses: 742K - 1.81M (mean: 1.28M) for Black Holes: The Other Side of Infinity (2007), 184K - 406K (mean: 295K) for Dynamic Earth (2012), 43K - 80K (mean: 62K) for Solar Superstorms (2015), and 190K - 274K (mean: 232K) for Birth of Planet Earth (2019). The breakdown per film and per dome size classification is shown in Figure 2. This holistic analysis demonstrates that the four films together have reached millions of viewers.

We report a wide range for the viewership of Black Holes: The Other Side of Infinity due to significant uncertainty in a small number of the coded survey responses. A z-score analysis of the variation between the lower and upper bounds identified two outliers with value ranges that fall more than 3 standard deviations from the mean. Removing these two outlier survey responses narrows the range for Black Holes to 672K - 823K (mean: 748K). As a result, the total viewership estimate for the four films also decreases to 1.1 million - 1.4 million (mean: 1.2 million).

We next consider the annual viewership of each film, considering factors like years since release and planetarium size. We will use this metric to help estimate viewership across non-responding planetariums. Specifically, we consider two interpretations of the term 'annual': (A) the average number of viewers per year since the film's release, and (B) the average number of viewers per year under a planetarium's licensing agreement. For example, in the second interpretation, a film that is 10 years old might have only been licensed for 5 of those years, affecting its annual viewership average.

2 https://archive.org/

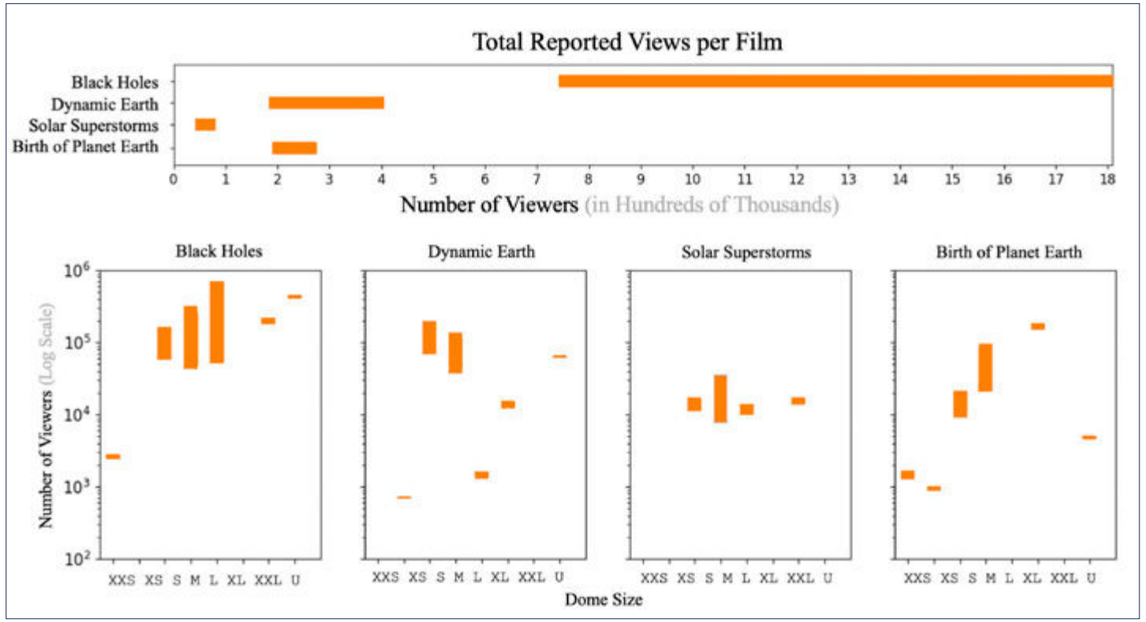


Figure 2. Results from the 68 planetariums that answered the survey. These charts show total reported views per film, presented in log scale on bottom.

To address interpretation A, each coded survey response is divided by the number of years since the films' release date. The release month and year were obtained from the Fulldome Database[3], using the 15th of the month as the release day. From this perspective, the total reported viewers annually of these four films across 68 planetariums lies between 138K - 264K (mean: 201K) since their release dates based on survey responses: 49K - 120K (mean: 84K) for Black Holes, 18K - 40K (mean: 29K) for Dynamic Earth, 6K - 12K (mean: 9K) for Solar Superstorms, and 64K - 93K (mean: 78K) for Birth of Planet Earth. The per-film and per-dome size breakdown of results is shown in Figure 3 in green. Removing the two Black Holes outliers reduces the film's range to 44K - 54K (mean: 49K) and the overall range to 129K - 176K (mean: 152K).

Interpretation B requires dividing each coded survey response by the number of years that the particular planetarium has had the film. We were unable to make this calculation for ten survey respondents due incomplete data regarding licensing years. A few of our respondents either (1) did not provide their name in the survey and could not be mapped to licensing information, or (2) responded regarding a license missing in the licensing database. Therefore, of the 68 survey responses and 105 data points from the survey, only 58 planetariums and 79 data points were usable for this calculation.

From a licensing perspective (interpretation B) for planetariums that have had a show for at least 6 months, the total annual reported viewers of these four films lies between 277K - 445K (mean: 361K) per license year across the 58 planetariums. This breaks down as 191K - 284K (mean: 238K) for Black Holes, 13K - 45K (mean: 29K)for Dynamic Earth, 8K - 17K (mean: 13K) for Solar Superstorms, and 64K - 99K (mean: 81K) for Birth of Planet Earth. The per-film and per-dome size results breakdown is shown in Figure 3 in blue. Removing the two Black Holes outliers reduces the film's range to 188K - 239K (mean: 214K) and the overall range to 273K - 401K (mean: 337K).

3 https://www.fddb.org/

3. ESTIMATING ACROSS ALL LICENSEES

Section 2 presented viewership from the planetariums that answered our survey. We now use the data to estimate viewership across all 315 planetariums that licensed the four dome shows.

3.1 DATA EXTRAPOLATION METHOD

For planetariums that did not respond to our survey, we estimated their viewership using the yearly ranges of responding planetariums in their size class for each film. Specifically, for each of the planetariums that licensed a show, and for each show they licensed, a low estimate and a high estimate was extrapolated based on the annual viewership per licensed year for their dome size. For survey responders, we used their estimates as per Section 2.

Thus, data from 58 planetariums about viewership at 79 instances of licensed dome shows was extrapolated to 315 planetariums with 459 instances of licensed dome shows.

When we did not have survey information for a particular combination of film and dome size, we used averages for neighboring size classes when possible. For example,

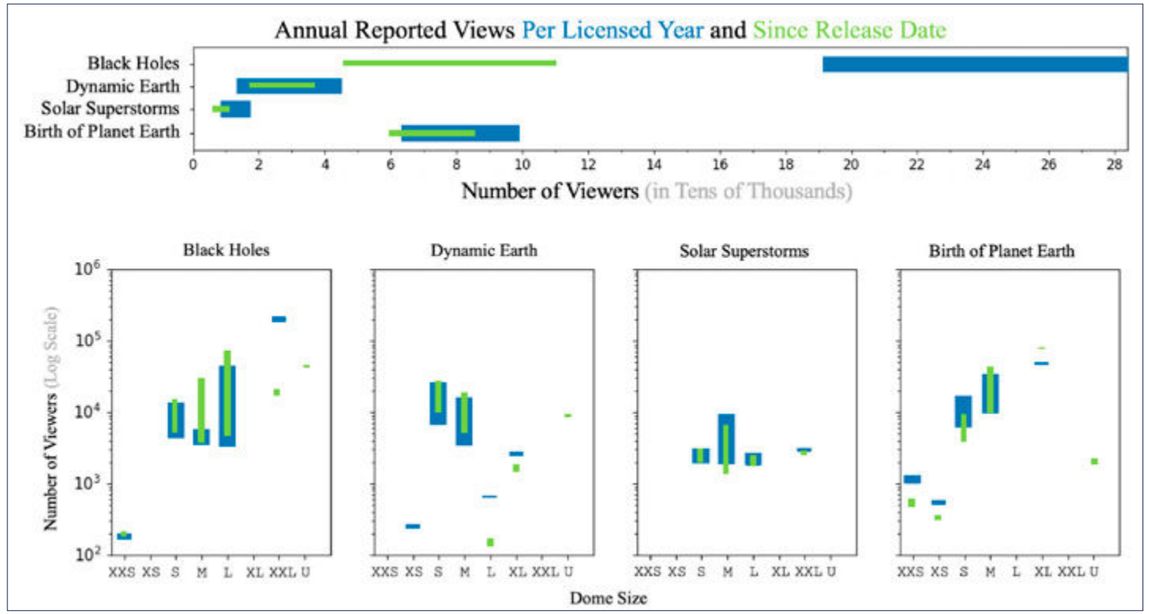


Figure 3. Results from the survey, showing the annual number of views. The blue bars represent views in the years that the films have been licensed, the green bars represent views since the films' release.

there was no survey data for Birth of Planet Earth from planetariums of size "L", so the data for Birth of Planet Earth from planetarium sizes of "M" and "XL" were averaged.

For missing XXS and XXL data, rather than averaging based on similar sizes for that film, we averaged the data from that exact size class, across all films. For instance, there was no survey data for XXS planetariums for the film Dynamic Earth, so the survey data for XXS planetariums which had the three other films was averaged, as differences between the films striated by dome size were much smaller than across all sizes. When the planetarium size was unknown (U), we used the median from all planetarium sizes which had that film. Similarly, if a film was licensed for an unknown number of years, we used the median overall license length for that film.

3.2 EXTRAPOLATION RESULTS

We estimate that the total reach of these four films is between 16.5 - 24.1 million (mean: 20.3 million) viewers: 12.8 - 19.4 million (mean: 16.1 million) for Black Holes (2007), 1.2 - 1.8 million (mean: 1.5 million) for Dynamic Earth (2012), 182K - 303K (mean: 243K) for Solar Superstorms (2015), and 2.4 - 2.6 million (mean: 2.5 million) for Birth of Planet Earth (2019), as shown in Figure 4. Removing the two Black Holes outliers reduces the film's range to 1.2 million - 1.5 million (mean: 1.4 million) and the overall range to 15.9 million - 20.0 million (mean: 18.0 million).

Taking into account the number of years that each film has been released, the annual viewership since release date of the four films is 1.8 - 2.4 million (mean: 2.8 million): 847K - 1.28M (mean: 1.1 million)for Black Holes, 116K - 182K (mean: 149K) for Dynamic Earth, 27K - 45K (mean: 36K) for Solar Superstorms, and 797K - 883K (mean: 840K) for Birth of Planet Earth, shown in Figure 5. Removing the two Black Holes outliers reduces the film's range to 1.2 million - 1.5 million (mean: 1.4 million) and the overall range to 15.9 million - 20.0 million (mean: 18.0 million).

If we consider the total number of years a film will be screened, we can estimate a lifetime audience for a film. We use the term "lifespan" for the number of years a film is licensed past its release year. Jensen et al. (Jensen et al 2022) suggested that the total lifespan of these dome show films was over ten years. We use the license data provided by Evans and Sutherland to refine this estimate.

Figure 5 shows the license horizon for the four films, with Black Holes and Dynamic Earth licensed for over 50 years past their respective releases. Considering that these four films are still being actively licensed, it is likely these values are underestimated. Purchases of 10-25 year licenses of Black Holes still occur even 15 years after the film's release.

As we cannot predict if planetariums will use their licenses 50 years in the future, we use the conservative estimate of 10 years from Jensen et al. and average across the four films with respect to the low and high estimates for annual viewers since released. This calculation results in an expected reach of 4.9 - 6.5 million viewers (mean: 5.7 million) of a planetarium dome show over a 10-year lifespan, and the cinematic scientific visualizations therein.

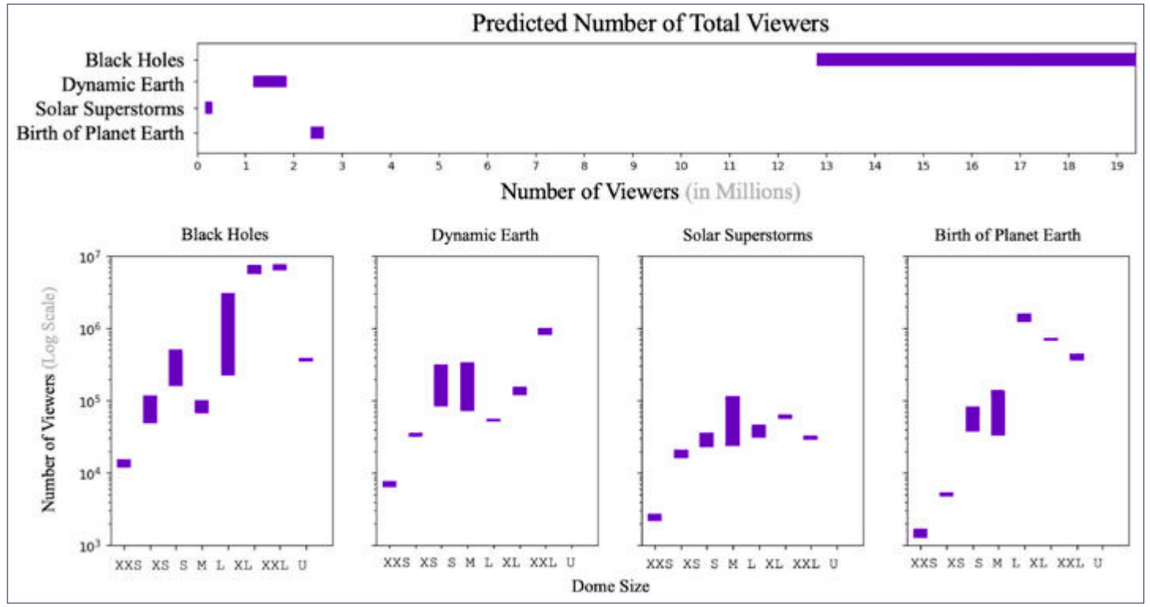
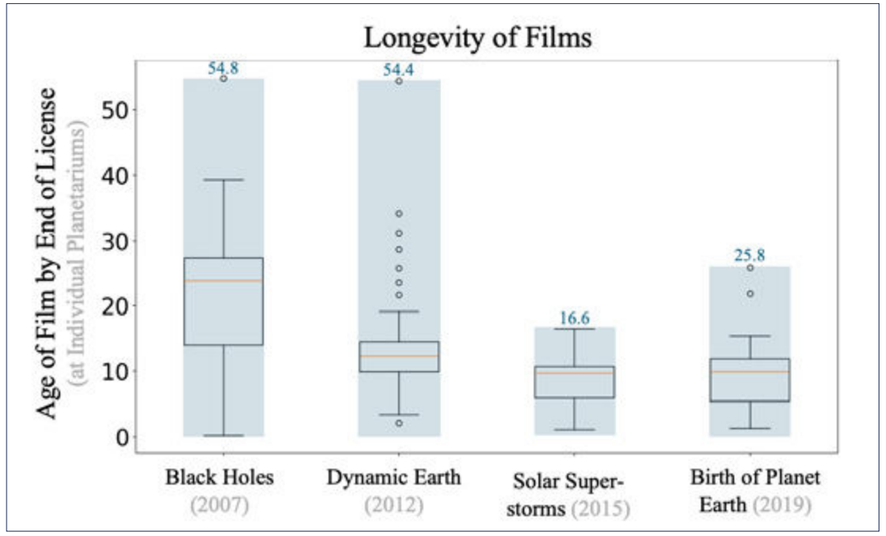


Figure 4 (Above). Predicted number of total viewers based on extrapolation.

Figure 5 (Right). Our data shows that the longevity of dome shows is much longer than the previously-claimed 10+ years (Jensen et al 2022). On the low end of these box plots, a planetarium might purchase a film on its release date and play it for one year. On the higher end, a planetarium may acquire a film 10 years after its release, and purchase a 25-year license. Two outliers show that by the time current licenses expire, some planetariums retain rights to screen 50+ year-old films.



4. LIMITATIONS

This work has several limitations. The survey was conducted in English and this is likely the reason for poor representation from countries where the primary language is not English. Of the 68 usable survey responses, 51 were from the USA, 6 from Europe, 2 from Canada, 2 from the Middle East, 1 from Australia, 1 from South America, and 5 from unknown locations. This under-representation of international planetariums likely biases the results.

Furthermore, a possible issue with Black Holes is that the topic of black holes is popular among dome shows, so there is a possibility that a planetarium might have confused this film with another of a similar title. To minimize this risk, when a planetarium claimed to have the film but was not represented in the licensing database, we followed up with respondents to confirm the data corresponded to "the 2007 dome film Black Holes: The Other Side of Infinity, narrated by Liam Neeson'. All confirmations were positive.

We also note that not all films are created equal and confounding factors such as popularity of the topic (Zajan and Stengler 2021) and quality of the film also affect viewership. For instance, black holes became a topic of wide interest when the first photograph of a black hole made international

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UNDER THE CLASSDOME

AN OPEN SOURCE INTERACTIVE PROGRAM — SPACE

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This edition of Under the ClassDome was contributed by a rising star in our community. Guilherme Frederico Marranghello is a Physics and Astronomy Professor at the Universidade Federal do Pampa where he also works in Planetário da Unipampa, in Brazil. After listening to his presentation for the October 2024 edition of the Pacific Planetarium Association's "Planetarian's Zoom Seminar", I was thrilled! It is an amazing and interactive show that really ties into what we are trying to accomplish with the Next Generation Science Standards. Students have to discuss, debate and actually think. It is highly interactive and there is no completely right or wrong answer at the end of the experience. I asked Guilherme to write up a summary so that we could share it with you. I hope you find it useful!

UNITED NATIONS COMMITTEE FOR THE PEACEFUL USES OF SPACE

Guilherme Frederico Marranghello, guilhermefrederico@unipampa.edu.br

In 1957, the Soviet Union launched the first artificial satellite around Earth. A short time later in 1959, the United Nations General Assembly set up the Committee on the Peaceful Uses of Outer Space (COPUOS) to "govern the exploration and use of space for the benefit of all humanity: for peace, security and development." Our new free show, available on IPS website, is meant to put the audience as COPUOS members. Based on a talk by Pedro Russo, we have long used this theme in teacher training courses. Now, we have moved it to the dome.

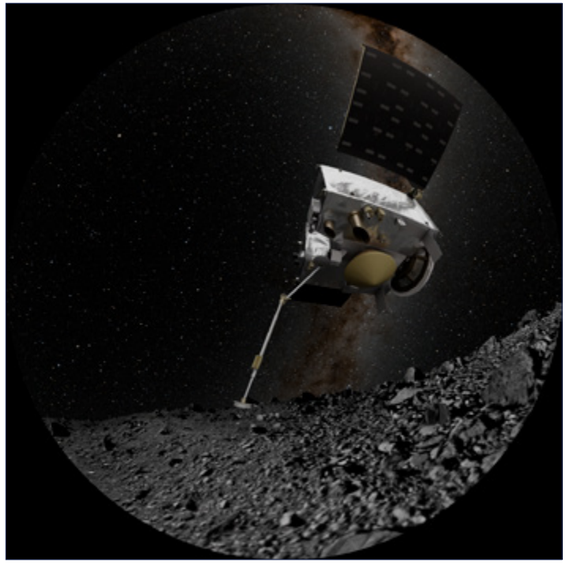
The show is built on a mixture of science and science fiction and it is split in three parts, each of them is around 7 min long. The first part introduces COPUOS, and introduces the first topic to be discussed: The fictitious Kingdom of Syldavia is asking permission to commercially mine an asteroid. After this introduction the show introduces what we already know about asteroids and the missions we have recently sent to bring samples back to Earth. We discuss their composition and why these elements are important for our technological development.

Next, the show asks the audience to decide if we allow this kingdom to explore an asteroid. The role of the planetarian is to promote the discussion between the audience, not only with their votes, but to share why they are choosing to support or not support the exploration. At the end of the discussion, the planetarian can ask students to vote and explain that this committee decides by consensus.

The second point of discussion says that SETI has finally found a signal from a distant source. The signal comes from the System Trappist-1 and it was directed to Earth. Before the decision, the show introduces two techniques for detection of exoplanets, the number of known exoplanets, and the signal. It then asks the visitors to decide if we shall or shall not answer and, if we decide to answer, what should our answer

(Continued on pg. 64)

Frame showing COPUOS built in Blender. Small objects like chairs were obtained from free 3D models websites.



Frame showing Osiris-Rex exploring Bennu. 3D models obtained from NASA.

IMMERSIVE MATTERS

A LOOK INSIDE THE INTUITIVE® PLANETARIUM'S APPROACH TO PROGRAMMING

IMERSA welcomes guest columnist Brittany Kundert to this issue of Immersive Matters. Her team at INTUITIVE® Planetarium prioritize personal connections in their programming. This is the magic of Planetariums, elevating the audience's experience to much more than a "movie".

A LOOK INSIDE THE INTUITIVE® PLANETARIUM'S APPROACH TO PROGRAMMING

As someone who has worked at the INTUITIVE® Planetarium at the U.S. Space & Rocket Center for several years, I've had the unique opportunity to witness the transformation and evolution of our programming firsthand. When you're involved in planetarium work, you quickly realize that it's not just about projecting stars on a dome or delivering informative presentations; it's about sparking curiosity and encouraging people to explore the cosmos beyond the confines of their planetarium experience. To quote my first mentor in the planetarium field, Paul Larson, "the goal is for guests to leave the dome with more questions than they came in with."

At the core of our work is a mission that guides everything we do: to inspire the spirit of discovery in all individuals through education and immersive engagement. We aim to create an experience that goes beyond facts and data, where the science of the stars becomes personal and meaningful for each audience member. By blending innovation, creative storytelling, and scientific information, we strive to connect visitors to the cosmos in ways that resonate deeply and last long after they've left the dome.

ORIGINS AND EVOLUTION OF OUR PROGRAMMING

In just five short years since our planetarium first opened in 2019, our programming has changed considerably, from straightforward planetarium presentations that primarily relayed scientific information to the dynamic, interactive experiences we offer today. Initially, many of our shows were more like lectures. While informative, these shows didn't always engage audiences on a deeper emotional or intellectual level.

We quickly recognized that audiences are not only interested in what lies beyond our world but also how it relates to their own lives. We began crafting narratives that emphasize this connection. This shift enables our audiences to connect with the material on a deeper level in ways that are personally meaningful to them. Our commitment to blending creative storytelling with scientific accuracy became central to our approach.

CREATIVE AND SCIENTIFIC STORYTELLING

At the heart of every planetarium show is a compelling story. Rather than presenting science as a list of facts and figures, our approach is rooted in the idea that storytelling is the most powerful way to communicate complex concepts. Yes, we want to get the science right—after all, we're dealing with facts that shape our understanding of the universe. However, if we fail to tell a compelling story, much of the magic is lost.

Each show we produce is a story designed to connect the audience to the universe in a meaningful way. We focus on answering questions like, "What does this mean for me? How does this affect my understanding of the world?" Whether it's discussing the latest discovery of a distant planet or explaining the life cycle of a star, we always try to frame the content in a way that intrigues the viewer.

Our live presenters play a huge role in making this happen. Rather than sticking rigidly to a script, they act as personal tour guides to the universe, tailoring each show to the audience's mood and energy. The ability to pivot in real-time, addressing questions and feeding off the crowd's reactions, is one of the most rewarding aspects of live presentations. This makes for a planetarium experience that is organic and fluid, with a nice dose of humor. A. David Weigel, our Planetarium Director, elaborates, "instead of a lecture or a pre-recorded movie, the audience participates in a conversational journey of collective exploration and discovery."

LIVE PRESENTATIONS: THE CORE OF OUR PROGRAMMING

Live presentations are, without a doubt, the cornerstone of our planetarium programming. Unlike pre-recorded shows, live presentations allow us to interact directly with our audience, adjusting the flow and tone of the show based on their reactions, energy levels, and engagement. As a presenter, you can feel the energy in the room. If a group is particularly interested in a certain topic, you can dive deeper. If there's a collective gasp at a stunning visual, you can pause and let that moment sink in.

What I've learned over the years is that no two audiences are alike, and neither are our live shows. That's what makes live shows so exciting! Some visitors come in with a deep interest in astronomy and ask highly technical questions, while others might be seeing the stars in such detail for the first time. Being able to adapt on the fly, answering questions in real time, and tailoring the content to the specific audience in front of you creates a truly unique experience.

Our live shows are designed modularly, where each visual is either being rendered in real time within planetarium software or as a short video. Rather than a pre-recorded show or movie, our programs are made up of a collection of visuals with flexibility to add, remove, or reorder segments so that we can easily tailor our shows to whatever audience we may have in our dome.

With this format, we always stay up to date with the latest astronomical discoveries. Astronomy is a fast-moving field and keeping our content current means that our guests are always learning something new. We incorporate new findings into our live shows almost immediately, and every member of our team contributes to keeping shows up to date. One way we facilitate this is through our internal weekly "Universe Update" newsletter highlighting recent space news and discoveries, which our presenters review and incorporate into their shows. This astronomical relevancy and immediacy are part of what makes the INTUITIVE® Planetarium stand out as a leader in immersive education.

IN-HOUSE ASTROVIZ AND SHOW PRODUCTION

One of the most distinguishing features of the INTUITIVE® Planetarium is our in-house production team, which creates visuals for all of our shows. We are particularly passionate about making immersive, contextual experiences for the data on display and really pushing boundaries of what we are able to create for our guests. As shows are developed, our team concurrently creates the outline and script in coordination with what can be shown visually and often the ability to create something beautiful for the dome both inspires and guides the direction we proceed in show production.

Erin Nagelkirk, the planetarium's Visualization Manager, emphasizes the importance of blending "cinematic flair with scientific accuracy." This approach allows the planetarium to create visually compelling, data-driven shows that are accurate depictions of scientific concepts. And because we produce everything in-house, we can quickly update our shows as new information is released, or even create visuals that automatically download data live from the internet during a show. Our various shows are created with an awareness that they will be updated often and are never considered "finished."

We fully embrace the idea of Data to Dome, championed by Mark SubbaRao (Past IPS President), as an IPS-led

initiative. Using the dome as a canvas for visualizing big data demonstrates the sheer quantity and quality of scientific research that exists; which is something that the audience might never experience otherwise.

Each member of the INTUITIVE® Planetarium team has their own unique interest for processing different types of data. For example, Alex Shepard, one of our Developers, prefers to visualize large 3D catalog datasets whereas I (Brittany Kundert) and my colleague, Carson Mason, like to process JWST imagery so that we can include relevant observations in our shows without waiting for color images to be released by NASA.

To those who have visited our dome, it should come as no surprise that our entire team is keen on incorporating terrain into our shows. Seeing Mars as a globe from orbit is one thing, but transporting our audience to the surface of the planet is another! By flying in real-time down to the surface to view imagery taken from orbit at 25 cm/pixel (thanks, MRO) and then crossfading into photogrammetry-derived 3D models of the surface, we can explore the surface of Mars in up to ~1 mm/pixel detail with our guests. Our visitors often comment on "how real it looks" after the shows.

DOME TO PHONE

Once guests leave the dome experience behind, what is next? Building off of Data to Dome, we introduce Dome to Phone. How often do our audiences rave about something they saw in the dome and want to explore further or share it with their family and friends? David Weigel explains, "with Data to Dome, we bring the latest and greatest in astronomical discoveries to an enormous screen and with Dome to Phone, we continue that process onto your personal device." Imagine exploring the Orion Nebula in multi-wavelength context of the sky, with the highest resolution images available from telescopes all over the world and in space! We use open-source software like WorldWide Telescope to create custom interactives to mimic what we create within Digistar so that our visitors can continue the excitement and exploration on their own time and own technology.

Recognizing that custom web interactives can be time-consuming to create, plenty of free web interactives exist from NASA and others that can be shared with guests, too. We also create infographics as an effective, less time-consuming way for the public to interact with the information conveyed through our programming.

THE ROLE OF PRESENTERS: BRINGING THE UNIVERSE TO LIFE

As much as we invest in visuals or show production, our presenters are the real stars of the show. They are the ones who bring our programs to life, using their personalities and expertise to engage the audience and make complex scientific concepts accessible and relatable. Each presenter has their unique style, which means that even if you attend the same show multiple times, it will feel different depending on who is guiding the experience.

As Phil Schrimsher, our Planetarium Operations Manager, once put it: "Our presenters act as a bridge for the audience, connecting them to an incredibly complex, sometimes overwhelming universe."

And it's true. The technology we use is incredible, the visuals are stunning, but at the end of the day, it's the connection between the presenter and the audience that makes the experience memorable. Presenters take the audience on a journey, making them feel like active participants in the exploration of space.

One of the things that makes the INTUITIVE® Planetarium special is how much emphasis we place on presenter training and development. We're not just trained to understand the science—we're trained to tell a story, to engage an audience, and to make every show feel

personal. Just like how our audiences come from different backgrounds and walks of life, so do our presenters. Having varying life experiences, in addition to a wealth of topical knowledge, allows our presenters to connect with the audience in differing ways and grow as a team.

During training, our presenters will typically spend about one month learning a new show. They are encouraged and given time to research all of the topics in the show so that they have a deep understanding of the concepts and can be conversational while presenting in the dome. It helps that our staff have diverse educational backgrounds, with knowledge in science, astronomy, education, business, etc. We often bounce concepts and explanations off each other to make sure things are clear, concise, and interesting for a variety of people. After much research, collaboration, practice, and lots of constructive feedback, our presenters are "cleared" to present their show to the public!

MAKING USE OF THE DOME

The INTUITIVE® Planetarium offers a variety of shows to cater to different crowds. Daily Shows are our most structured live programs and are slightly theatrical in nature. These shows are designed to be both educational and entertaining, providing a succinct yet comprehensive overview of key astronomical concepts.

For a deeper dive into more technical topics, Cocktails & Cosmos offers relaxed, customizable programs. With a new show created every week, this event series allows presenters to explore more specialized subjects, often based on the latest astronomical discoveries and research, in a casual, enjoyable setting. Guests are encouraged to ask questions, making for a more interactive and personalized experience.

In addition to regular programming, we host Alternative Programming, which includes special events, speakers, or even programs that blend science with forms of art. One particularly memorable event featured a live performance by internationally acclaimed violinist Itamar Zorman, with custom made visuals projected onto the dome timed precisely to the music,creating a dazzling fusion of music and astronomy. Events like these highlight the versatility of planetariums as spaces not just for science but also for creativity and collaboration.

A COLLABORATIVE APPROACH

As the official visitor center for NASA's Marshall Space Flight Center, the U.S. Space & Rocket Center provides the INTUITIVE® Planetarium with remarkable opportunities to collaborate with experts in space science. This allows us to feature renowned guest speakers who bring cutting- edge insights straight from NASA and other leading institutions, enriching our shows with real- world expertise and firsthand knowledge.

For example, during the Apollo 17 50th Anniversary event, we hosted Dr. Harrison "Jack" Schmitt, Apollo 17 Lunar Module Pilot, who had the special opportunity to retrace his steps across the lunar surface inside our dome, sharing personal reflections from his historic mission. Similarly, Dr. Jon Arenberg, Chief Engineer for the James Webb Space Telescope, captivated audiences by answering questions about the intricate engineering behind NASA's next- generation space observatory, offering insights that only someone with his level of expertise could provide.

More recently, we celebrated the 25th anniversary of the Chandra X-ray Observatory with a special event featuring a distinguished panel of mission members. Among the speakers were Eileen Collins, the pioneering astronaut who commanded the Shuttle mission that deployed Chandra; Dr. Jessica Gaskin, the X-ray Astrophysics Group Lead at Marshall Space Flight Center; and Dr. Steven Ehlert, Chandra's Deputy Project Scientist. The event was domecasted live to other planetariums, allowing interactive exchanges between audiences and mission experts across multiple venues. This direct communication between scientists and attendees added a dynamic element to the event, culminating in an engaging Q&A session where visitors could ask questions and deepen their understanding.

These partnerships allow us to tell the stories of space exploration in an immersive, visually stunning way, and more importantly, they offer scientists the ability to present their data through engaging, cinematic experiences—not just slideshows. Rather than a PowerPoint-style presentation, we can create high-quality, immersive visual assets that these experts can use even beyond our dome, promoting science education in classrooms, conferences, and other outreach efforts.

Our collaborations extend beyond live events. We partner with institutions like the Arizona Astrobiology Center to create free fulldome short films like Big Questions, or Journey to the Moon and we participate in international initiatives such as the "Observe the Moon Night" by producing various videos for NASA Marshall.

These collaborations strengthen the planetarium as a living resource for both our visitors and the scientific community, offering direct access to the people and ideas shaping our understanding of the universe. We aim to establish the INTUITIVE® Planetarium as a place of lifelong learning, where experts and the public come together to explore the cosmos.

BEYOND THE DOME: EXPANDING ACCESS TO ASTRONOMY

While our planetarium is a fantastic venue for exploring the universe, we recognize that not everyone can visit in person (or even knows that we exist). That's why we've developed a range of outreach programs to reach audiences beyond the dome.

Domecasting: We share live shows with other planetariums and venues, allowing audiences in different locations to experience our programming in real-time. We recognize that we have the resources and inherent NASA connection to bring in leaders in the astronomical community and we look forward to providing more opportunities for other planetariums to bring these unique experiences to their audiences.

Virtual Education: As traveling is often the largest expense for groups wanting to make a trip to the U.S. Space & Rocket Center, we virtually deliver live programs and educator guides to remote audiences.

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INTERNATIONAL NEWS

Dear fellow planetarians...

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Below you'll find information of some remarkable planetarium anniversaries, renovations of long-standing facilities but also new domes coming alive, new shows being premiered and many other activities being initiated. This is a proof of our special institutions being very much alive in these years of the planetarium centennial.

For this section I'm indebted to contributions from Ignacio Castro, Amie Galagher, Andrew Kerr, Loris Ramponi, Alexis Delivorias and Andreas Schmidt.

Let's start this tour around the world in Mexico.

ASSOCIATION OF MEXICAN PLANETARIUMS

Ana Angeles, head of the Felipe Rivera Planetarium in Morelia, Michoacan, had a fruitful experience while attending the Berlin/Jena IPS Conference. In a conversation with Ignacio Castro she mentioned her Planetarium Conservation Project of the Zeiss IV optomechanical projectors, and refered to it as a living heritage and talked about the implementation of a technical assistance and a spare parts supplier in order to keep it operational. She also spoke about the needed budget for it. She has recently received technical and educational assistance from the Xalapa Planetarium staff.

The Morelia Planetarium will be celebrating its 50th anniversary in 2025!

The Tuxtla Gutierrez Planetarium in Chiapas opened its doors on 28 September to its renewed dome projection system (see International News, September this year), science and educational exhibits and workshops, to enhance public interest in astronomy specially amongst children.

MIDDLE ATLANTIC PLANETARIUM SOCIETY

The Middle Atlantic Planetarium Society convened at the Mystic Seaport Museum in Connecticut in June for their annual conference. Over 70 MAPS members gathered for four days of networking, sharing, and connecting. The theme of the conference was, Launching Into the Next 100 Years. In addition to celebrating all the members have accomplished, they also looked ahead to what is in store for planetariums over the next century of existence. There was much to celebrate at MAPS 2024 including the fact that 20 of the conference participants were first-time attendees to a planetarium gathering! This year's Margaret Noble speaker was Lee Ann Hennig. No stranger to MAPS, Lee Ann has been involved with MAPS for decades and represents the characteristics that are also associated with Margaret Noble, who was a mentor, educator, planetarian, lobbyist and a dreamer.

The Edelman Planetarium at Rowan University in New Jersey was renovated this summer with 4K Canon laser projectors, ChromaCove lights, and Evans & Sutherland's Digistar 7 system. They also added a second laser graphics

MAPS (from top). Group photo from the annual meeting in Connecticut. Courtesy of Brian Koehler; NJ Meetup. Courtesy of Connor Marti; The new Cejka Planetarium. Courtesy of Kenneth Coles.

projector and beam projector from Laser Fantasy. The staff is loving the improved capabilities of the new system and was thrilled to show it off during the NJ planetarians gathering in September.

The new Cejka Planetarium went into operation in January at Indiana University of Pennsylvania. With a 10.5-meter dome and a two-projector Digistar 7 system, it seats 77. It replaces the old, 9-meter planetarium that hosted a Spitz A3P projector from 1967 to 2023. Programming includes undergraduate instruction and free presentations for the public and school groups.

The Alexandria City Public Schools planetarium, in northern Virginia, completed an upgrade in May from an old analog system to a new SSIA DigitalSky Dark Matter system. The new system has already greatly expanded the

MAPS. Dome display from the renovated planetarium at Howard B. Owens Science Center. Courtesy of Patty Seaton.

topics presented and enthusiasm for visitations that couple live interactive shows with amazing new visuals.

The Howard B. Owens Science Center planetarium reopened this school year with a brand-new GOTO Orpheus hybrid system with Digistar 7 projected onto a Spitz Nanoseam dome with ChromaCove cove lighting. This amazing system integrates all the latest technology under a 55-foot dome, and is part of the Prince George's County Public School system in Maryland. The staff continues to provide live, interactive programs for their school groups and public audiences using the amazing new tools/capabilities of this fabulous system. Removable seating was chosen to allow for flexibility in programming for music, dancing, theater, and even meetings.

The Planetarium at Raritan Valley Community College in Branchburg, New Jersey upgraded from an historic SkySkan DigitalSky2 system to a brand new SSIA DigitalSky & Dark Matter system, with 4K projectors and all new speakers behind the dome. The entire building vibrated when they tested the subwoofers.

The P-Tech Planetarium in Paterson, New Jersey is excited to announce that it has been awarded a Local Projects Grant from the International Planetarium Society. This prestigious opportunity will enable the planetarium to

MAPS. Back in Flight at P-Tech Planetarium. NASA Artifacts at P-Tech. Both courtesy of Carlos Miranda.

celebrate the centennial year of planetariums by creating an engaging Planetarium Escape Room. The upcoming escape room aims to inspire curiosity and foster a love for science through an interactive experience that combines space exploration with fun puzzles. This innovative project is designed to engage the local community, providing visitors of all ages with a hands-on STEM experience that emphasizes learning in a dynamic setting. The P-Tech Planetarium team expresses gratitude to the International Planetarium Society

for their support in making this project possible. They look forward to bringing this unique educational opportunity to life and engaging the community in new and exciting ways.

Through the NASA Artifact Module, the P-Tech Planetarium has acquired authentic NASA artifacts. The P-Tech Planetarium turned a typical high school hallway into a space ready to inspire the next generation of scientists and engineers while providing memorable experiences that extend beyond the classroom.

PACIFIC PLANETARIUM ASSOCIATION

PPA. Monthly Zoom Seminars are available at ppadomes.org.

The PPA hosts (nearly) monthly Planetarians' Zoom Seminars (PZSs). They are usually on the last Friday of the month, but date/time is flexible. Anyone is invited to present (not just PPA folk). To see schedule and dates (last Fridays of 2025) see the PZS schedule page: www.ppadomes.org/events/online-seminars/pzs-schedule.

Archive of all the PZSs dating back to 2018 is also on the PPA website: www.ppadomes.org/events/online-seminars/ppsarchive or through the PPA Youtube channel: www.youtube.com/@ppadomes.

PPA. Icon of the new program: Planetarium Pilots. Courtesy of Lawrence Hall of Science.

Planetarium Pilots is a novel program in which visitors to Lawrence Hall of Science can walk into the Planetarium and take themselves on a self-guided tour of the Universe. They use a touchscreen interface to control what is projected on the dome, choose which planets, moons, and more to explore. They listen to short narrations as they fly around the Universe, for more information see: lawrencehallofscience.org/exhibits/planetarium/

EUROPEAN/MEDITERRANEAN PLANETARIUM ASSOCIATION

The Eugenides Planetarium in Athens, Greece premiered on Tuesday 15 October its latest digital fulldome show production, titled Beyond Earth, which can be seen as a fascinating journey among the planets and satellites of the Solar System. For the same event it has also uploaded on its webpage a fully illustrated book that expands on the key theme of the show, as well as a shorter version suitable for school children. Khrumka and the Magic Rocket, produced by Fulldome Studio DN and aimed for the smaller children, also premiered on the same day and added to the planetarium's schedule. The Eugenides Planetarium's Space Series sequence of short videos on various astronomy topics has been further expanded with the addition of the 10th episode, titled Back to the Moon. The short video highlights NASA's efforts to send astronauts on the lunar surface for the first time after the completion of the Apollo program, and at the same time to develop an ongoing presence there. The 11th show of the series, titled Life in the Solar System, investigates the most promising solar system bodies that may harbor microbial life and will be uploaded later in the year.

ITALIAN ASSOCIATION OF PLANETARIA

This year the official start of the autumn equinox coincided with a beautiful sunny day, a short pause in the alternation of disturbances that have heavily affected the Adriatic coast, in particular Romagna. The presence of the diurnal star made it possible to see the equinoctial line drawn by the shadow of the gnomon of the sundials precisely in the days of the beginning of autumn and spring. The line appeared in Ravenna during the inauguration of the Circle of Hipparchus. It is an ancient astronomical instrument with which it is easy to explain the variations in the height of the Sun over the seasons. Precisely on the day of the equinox, on the initiative of the Planetarium of Ravenna, a reproduction of the Circle of Hipparchus was installed in the Baronio Park, one of those present in the urban area. The circle is inclined to coincide with the plane of the celestial equator. On the two days of the equinoxes the circle projects a line of shadow on the basement where it is placed. This only happens when the Sun crosses the celestial equator. Baronio Park is an excellent example of a city green area ideal for observing the sky. Street lights are low and shielded to reduce light pollution. The Ravenna Planetarium has adopted it as the city's astronomical point and has signed a collaboration

IAP. The Circle of Hipparchus inaugurated in the Baronio park in Ravenna. Courtesy of Planetarium of Ravenna.

agreement with the municipality (together with other local associations) for the care of this place.

The group photo is an image to remember at the end of Ken Brandt's lesson at the Ravenna Planetarium, one of the Italian cities involved during the initiatives Two weeks in Italy of

IAP. Ken Brandt at the Ravenna Planetarium.

IAP (from top). The LIS interpreter translates the expert's explanation. Courtesy of Starlight, a Handy Planetarium; The Maynard Jordan Planetarium staff with Elena Lazzaretto (third from the left, close to Shawn Laatsch), 2023 winner of the A Week in the US.

2024. Next year this Italian experience open for applications of US planetarians will celebrate its 30th anniversary.

The APS StarLight, a Handy Planetarium has started a collaboration with the UAI (Unione Astrofili Italiani), of which it is Delegation 2 in Umbria, in the field of inclusive dissemination of astronomy. In the belief that true inclusion is achieved by organizing events open to all, in which the same topic is conveyed to the entire public, each according to their specificity, the organisation is developing a programme of activities, which includes the organization of evenings four times a year (one for each seasonal period), in which to make the sky accessible to citizens, committing themselves to preparing what is necessary to immerse everyone in the same sky. The main objective that we intend to start is to create an engaging and interactive atmosphere, within which everyone can learn various basic concepts regarding the sky. To achieve this, we have structured the evenings, lasting two hours, with moments of music, readings, astronomical pills led by an expert, supported by a LIS (sign language) interpreter and tactile materials.

The Week in the United States, in which David Gruber (formerly working at the Planetarium Sud Tirol in Bolzano, today directing the Museum of Natural Sciences of Alto Adige) and Elena Lazzaretto (Planetarium of Padua) have already taken part, is open for the applications of all Italian planetarians. Each year the deadline for submitting proposals is at the end of the year. All information is published in the news on the planetari.org website.

Elena Lazzaretto recently recounted her American experience in a new episode of the series Voices from the domes. The planetarian was hosted for a week at the Maynard Jordan Planetarium (University of Maine, Orono, USA) directed by Shawn Laatsch. The host of the episode described her numerous activities, such as those she carried out at the INAF Astronomical Observatory in Padua, including those that took place in very particular locations, for example in some castles in the Euganean Hills. His website, Guardachecielo.it, is full of ideas and content, to be consulted and listened to, like the podcasts of the Stelle&TV series which in around hundred episodes tells the story of the Universe of series, films and cartoons. The video recording, created by Gian Nicola Cabizza, was published on the page www.planetari.org/voci-dalle-cupole/ last October, coinciding with the 70th anniversary of the foundation of the Maynard Jordan Planetarium where Elena Lazzaretto, in 2023, had carried out her American "Week". The Voices from the domes page collects recordings of online meetings with astronomers and planetarians. The initiative started at the time of the pandemic on the initiative of the Italian Association of Planetariums (PLANit).

SOCIETY OF GERMAN SPEAKING PLANETARIA

For the first time in six years, the IPS conference finally took place! The Zeiss-Planetarium Jena and the Stiftung Planetarium Berlin were honoured and happy to welcome 700 attendees from 55 different countries. During the week, attendees participated in the Fulldome Festival Best

GDP. Opening ceremonies ofIPS2024 in Arena Berlin; IPS 2024 group photo. Courtesy of SPB Stageview.

GDP. Exhibition achtzehn in Zeiss-Großplanetarium. Courtesy of Boaz Arad; Yoga under the dome at the Zeiss-Großplanetarium. Courtesy of Steffen Junghanß.

Of, IMERSA Day, LIPS Day and of course the conference itself, as well as exciting conference tours. Attendees also enjoyed varying types of paper sessions, workshops, posters, sponsor sessions and had the opportunity to spontaneously hold their own discussions. Every day had ample time for networking, which everyone greatly enjoyed. After six long years, it was really special to spend time with old friends and to meet new colleagues.

The other star of the conference besides the attendees, was the special surprise »guest«. Thanks to the gracious efforts of the Omniversum in Den Haag, Romke Schievink, Thorsten Thomas, IPS and the Stiftung Planetarium Berlin, attendees of IPS 2024 were able to see one of the only two ZEISS Modell I Star Projectors in existence. This particular instrument is 101 years old (just like her twin at the Deutsche Museum) and was restored by Romke Schievink. Those who visited the Modell I during the conference got to experience in full illumination, the first projection "stars [that] were just the beginning" for all of our careers today.

The Zeiss-Planetarium Jena and the Stiftung Planetarium Berlin once again thank every single person who made IPS 2024 a success: "It was truly a pleasure to have you all here and united under the sky, and we look forward to seeing you again in 2026 in Fukuoka, Japan!".

From 20 June to 1 August, the audiovisual exhibition eighteen at the Zeiss-Großplanetarium focused on young people and their lives, inviting visitors to enter the minds of a generation that is just coming of age. Climate change, global health crises, geopolitical conflicts and social changes are shaping the context in which they are growing up and developing their perspectives for the future. The exhibition by artist John Kolya Reichart in collaboration with the Museum für Werte (Museum of Values) in the foyer of the Zeiss-Großplanetarium marked the start of a traveling exhibition that is intended to spark important discourse at as many different locations in Germany as possible. The exhibition was free of charge and accessible during the planetarium's opening hours and reached over 25,000 people during this period.

John Kolya Reichart, filmmaker and photographer, embarked on a journey through Germany in 2023, the year after the much-cited turning point, to meet 18-year-olds and find out what moves them. Together, they each visited two places of their own choosing: One place of the past

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TALES FROM DOME UNDER

A TELESCOPE TALE*

Many of us who have been working in planetariums got their start through amateur astronomy, which may or may not have included the buying of a first telescope. If you listen to some of the adult members in my family, I apparently had an interest from an early age in picking up rocks here and there, followed by a curiosity of the night sky.

As I got older, my interest in the night sky (and rocks!) continued to grow, particularly after I was in junior high; even more so when I first joined the Boy Scouts. It was here I started to learn my first constellations. For some inexplicable reason, I never got the Astronomy Merit Badge, though I partly made up for it by serving as a resource from some scouts working to earn it in later years.

There was a younger scout, a friend of my brother, in our troop. I discovered he owned a small spotting scope, which had different levels of magnification via a zoom function. Mounted on a very short-legged tripod, this left it so low it could only sit just above the top of a table, or on a shooting bench at a rifle range. This was, after all, a spotting scope. I managed to borrow it from him for a while, allowing me to go out and perform a long series of Moon observations.

The famous British writer, and amateur popularizer of astronomy, Sir Patrick Moore (1923 – 2012), had published a book on observing the Moon using small telescopes. What was intriguing about this text to me was each chapter of the book covered one day of both its changing phase, and those additional surface features to be seen as it spent roughly a month going around Earth.

As you may guess, I was out every night with the borrowed spotting scope. Working my way through the book, I was following what I was supposed to be able to see on the Moon for each night.

Since its tripod was so short, I ended up using the wooden shelf for sitting on the edge of our aboveground swimming pool in the backyard as a base. Unfortunately, it was not quite high enough to stand completely upright, so I had to stand at a three-quarters crouch. This sometimes led to some short breaks to get out the kinks in my albeit teenage back from time to time.

This turned out to be a fascinating, and absorbing exercise in observing one subject on a routine basis. I was learning what each day's Moon had to offer as well as helping instill a sense of discipline. What was I going to miss if I skipped a night? Naturally, I didn't want to do that.

Unfortunately, there were a few nights during the four weeks where there were forced gaps in my observing due to cloudy weather; the enemy of every amateur astronomer who lives around Rochester, NY.

How often does it get cloudy there? On average about 200-nights-per-year. Here's a relevant story, which is no doubt apocryphal. When the local, world-famous Eastman Kodak Company picked the color for their well-known gray card used in setting photographic exposure readings with a camera's light meter, they used the color of Rochester's often-cloudy sky. Or at least that's what they told us when I took "Introduction to Photography (Black & White)" my freshman year of college. To put this into numbers, that's a reflectance of 18%; a relatively dark gray.

Taking Earth Science in high school, one of the subjects covered was astronomy, which was right up my alley. One of the requirements we had to meet was going over to our teacher's house to use the school's 15-cm (6") Newtonian reflector.

Going over to my Earth Science teacher's house to use the school telescope wasn't enough for me; I had to get one of my own, and therein lay the problem. I had an allowance for doing chores around the house, but I had to find a way to raise more money than this provided.

A part-time job as a busboy at a five-and-dime variety store's restaurant in a local shopping mall went part of the way. So did doing some babysitting on weekends. Babysitting? Why not? My brother, and I had once had a teenage guy who split babysitting jobs with his older sister. A job is a job, and money is money.

What particular telescope to buy was not going to be a problem after having had some experience with the school's. I would get the exact same thing, which also came with an assortment of three eyepieces of different focal lengths, yielding three different magnifications.

It had a good sturdy tripod, and an electric clock drive, which allowed the telescope to compensate for Earth's rotation, keeping objects being viewed in sight through the eyepiece.

The actual mounting holding the telescope on the tripod was an equatorial-type. Included were setting circles, which allow you to manually turn it to the celestial equivalents of longitude (Right Ascension) and latitude (Declination) for a celestial object.

Even though you couldn't necessarily see your target with the naked eye, this process allowed you to get pretty close to its position. Certainly within the field-of-view of its own low-powered 6x30 finder scope with optical crosshairs.

This smaller telescope was mounted piggyback, near the eyepiece, on the main telescope tube. Since the optics of both were parallel to one another, this one acted as a "sight" for the larger one.

There was a timetable involved with getting the new telescope into my hands. An unusually close opposition with the naked eye planet Mars coming up in early August 1971, which was driving the whole project. I couldn't let such a sight, something I had never seen before, slip away.

An advertisement for the Criterion RV-6 "Dynascope"
This is the typical kind of ad for Criterion's telescopes one would see in magazines, like "Sky & Telescope" during the early 1970s when I was looking to buy my first telescope. Criterion also had a 20cm (8") Newtonian at the time, but I had to realistically settle for what I could afford, while keeping in mind the early August 1971 opposition of Mars. (Source: the author's collection)

Those of you who have seen these for yourself know exactly what I mean.

Being so close together, the other, more distant planet would be at its best, brightest, and largest when viewed through a telescope. This revealed the most surface details possible as compared to the time before the next opposition. And that one, due to the shapes of the two planet's orbits, may not bring them as close as this time around.

And I made it moneywise! I got together the $194.95, and sent off a check to the Criterion Manufacturing Company in Hartford, Connecticut for my very own "RV-6 Dynascope." Then began the process of waiting for it to be delivered, and wait I did. It seemed to take an interminable amount of time for the thing to finally show up.

While there were no packing charges, there was one for crating (crating?). Not to mention a shipping charge, which was collectible when it arrived at the nearest train station. My new telescope literally shipped from Hartford, Connecticut to Rochester, New York, by rail.

How odd does this sound these days? Keep in mind, this was 1971. One didn't get things delivered via the postal service after ordering online because there was no such possibility available.

Large things like this often came by rail, then they had to be picked up. People without their own cars still traveled by passenger train (or intercity bus) if they didn't have the means to travel by commercial airline.

The telescope finally made its arrival known via a tan-colored postcard in our mailbox. Its manually typewritten text, with shipping number, announced it was sitting at the downtown Rochester train station waiting for someone to: 1) pay the charge for the freighting so it could be released, and 2) collect it. As luck would have it, my father worked on the other side of the city, so all he had to do was swing by, and pick it up on his way home from work.

Arriving at home a night soon after with my delivery from Connecticut in the back of the family station wagon, I could see why there was a crating fee.

The telescope tube was mounted in a long, very sturdy cardboard box with the telescope's fiberglass tube suspended by some large blocks of Styrofoam. Its unassembled tripod, the telescope's equatorial head having the setting circles, and the clock drive were all in a much larger wooden one.

It was fortunate we had the station wagon, so it wasn't too hard for freight handlers at the train station to load it in the back after the rear bench seat had been lowered. A common feature of station wagons then, it's pretty much this way in most cars nowadays.

Thrilled to have my very own telescope in my possession, it was still a little daunting as I sat there on our living room floor unpacking the boxes.

There wasn't anything to the telescope tube itself needing assembling, but there were all the parts of the tripod, and the actual equatorial head which went on top of the tripod's large upright support tube.

This unit cradled the telescope in a large set of two rings. These cast aluminum pieces opened up with a butterfly screw, the tube was laid inside them, it was then closed, and screwed tight again.

Black felt lining the inside of the rings held the tube steady when they were closed. One of the reasons you could loosen these rings up was so you could rotate the telescope tube. This then moved the eyepiece holder/focuser at its front end to be more conveniently positioned for looking through.

Getting the eyepiece at a comfortable viewing angle is a typical complaint with Newtonian telescopes, so it really is a must that you can adjust it. Otherwise, you can end up getting yourself into some ridiculous viewing positions.

Putting the three legs onto the bottom of the tripod's large center tube was quite easy via some butterfly nuts. The attachment surface of the legs' aluminum castings matching the circumference of the tube, making it very stable.

A small cardboard box, packed with the base, held the three eyepieces which came with the telescope, plus a set of Allen-type hex-headed wrenches. The smallest was for screwing the equatorial head onto the top of the tripod's tube.

The medium-sized one was for adjusting the 6x30 finder scope on its two, three-point mounting brackets so you could get it parallel to the main telescope tube. Otherwise it would be pretty hard to locate something through this, and then expect it to be within the telescope's much narrower field-of-view.

This just left the largest Allen wrench, which was used to loosen the bolt allowing you to tilt the telescope's whole equatorial head to match the latitude from where you were observing from.

This, as most of you know, allowed you to align the telescope with Polaris, the "Pole Star," in Ursa Minor, the Little Bear. If you didn't do this alignment, it wouldn't be possible for the telescope mount's electric motor to compensate for Earth's rotation. As a result, what you were trying to look at would not stay in the telescope's view.

As for the two setting circles—Right Ascension and Declination—you could now locate celestial objects, like nebulae and galaxies, below the limit of naked-eye visibility whose positions were listed in a catalogue of such things.

What you sought using the circles should at least be in the field-of-view for the low-powered 6x30 finder scope. Centering it on the finder scope's crosshairs would then show it in the telescope's viewing eyepiece.

If you were extremely careful about setting up the telescope on Polaris, it was often viewed through the eyepiece without any further adjusting (a.k.a. "hunting around until you find it").

As mentioned before, the astronomical event driving the whole timeline for getting the telescope in my hands to begin with was the early August 1971 opposition of Mars. When the time arrived, the event certainly delivered. The Red Planet looked like a tiny, orange-red LED among the background stars of the constellation Capricornus, the Sea Goat.

Through my own telescope, which I had not had a lot of experience with due to its recent arrival shortly before the actual date of the opposition, the view was both impressive, and inspiring.

I could easily make out dark surface features silhouetted against the reddish-orange body of the planet. Prior to this, I had only seen them in photos, or on maps of Mars' surface. Once the warm air rising off of our asphalt driveway—where I had set up to observe—had cooled sufficiently, I could even make out one of its two white polar caps in moments of good seeing.

Unfortunately, there was no one else outside to share these views with. Considering the time of night I was out observing, everyone else was already in bed. This just left me, my telescope, the occasional bark of some neighborhood dog, and the few streetlights illuminating our neighborhood street.

I had bought a small bound book of lined blank pages at a local book, and stationary store to keep notes of my observations. Much to my adult amusement, the earliest entries come off as being somewhat pompous. At this age, and with what I was doing, it wasn't too hard to get a little "big-headed" in the process. In my own defense, out of a high school class of about 250, I was the only student who was doing anything like this with their own telescope. But still, was it really necessary?

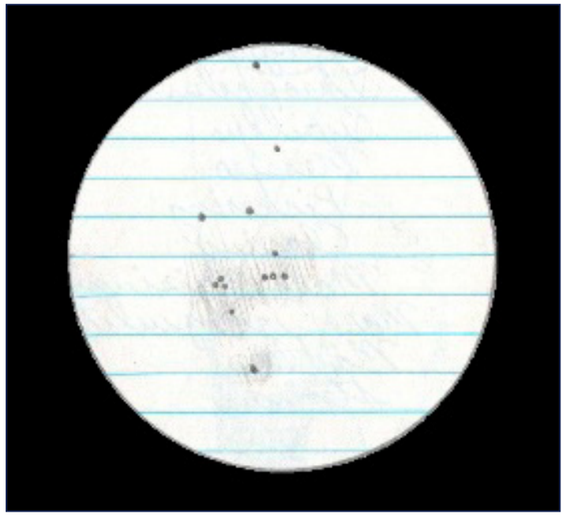
Some nights I went out with some sheets of white paper, a pencil, an eraser, and a clipboard, so I could sketch what I was observing. There was Jupiter, and the positions of its Galilean satellites, or the nebula in Orion, the Hunter, and how they looked through the telescope.

There was even a nice sketch of Mars I had done with colored pencil. All of these drawings were then later cut from the larger piece of paper the next day, then fastened into the record book along with my notes from the rest of the previous evening's observations.

Not satisfied with just observing visually, and making sketches, I saved up some more money. Buying a camera adaptor, this would allow me to mount my single-lens-reflex Minolta SRT-101 35mm camera on the telescope where the eyepiece normally went.

You could even put each one of the telescope's three eyepieces inside of the camera adaptor to get a magnified image. Shooting on color slide film, I got some passable images of the Moon, Mars, and Jupiter, plus one really good one of Saturn showing its ring system.

(Continued on pg. 66)



Early sketch of Messier 42, the Orion Nebula.
This fairly simple pencil sketch of this well-known object, made over 50-years-ago, is one of the earliest in my first observers book associated with the RV-6 telescope. At this time I was still making my drawings right in the book rather than on a separate piece of white paper, which would have been cut out, and fastened into it the next day when I wrote up my notes. (Source: the author's collection)

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MOBILE NEWS NETWORK
OUTREACH WITH A MOBILE DOME

MOBILE DOME PLANETARIUM MEETING - AUGUST 10, 2024

Presentations included:

- **Susan Button — USA: report about the IPS Conference 2024 in Berlin.**
  At least 37 Mobile dome directors from different 17 countries could be found at this year's conference! The vendor hall was full of mobile domes of all sizes. Inside and outside of mobile domes there were presentations of interest to mobile dome directors with subjects including outreach initiatives in various countries, the history of mobile domes, presentation techniques, education, filmmaking, examination of software and hardware, and opportunities for professional development through travel. Marco Avalos' presentation in one of the giant mobile domes was aimed specifically at the uniqueness of mobile domes and specific issues that concerned us. It was well attended and appreciated.
- **Oana Jones — New Zealand:** a simple mirror set up for portables
- **Lionel Ruiz — France:** Mobile Domes through History and how to build a digital planetarium today, with some elements found during the IPS2024 meeting. Up-to-date information for those wanting to build a digital system. *https://www.lss-planetariums.info/*
- **Andreas Wieck — Germany**: New options for light weight and fireproof Dome from ASE, Ukraine
- **Loris Ramponi — Italy:** a short written memory for the PLANit website
- **Dave Weinrich — USA:** Astronomy for Peace
- **Marco Avalos — Costa Rica:** How to participate in the IPS 2025 Centennial Celebration Closing Event *https://planetarium100.org/*;
- Invitation to IPS 2026 - Fukuoka, Japan - June 11-20, 2026 "One Earth, One Sky": *https://cdn.ymaws.com/www.ips-planetarium.org/resource/resmgr/pdf/2026_conference_bids/ips2026_in_fukuoka_japan.pdf*

The recording of this Mobile Planetariums Meeting is available at the IPS's YouTube Channel. Thank you everybody for sharing your experience and knowledge to the community. *https://www.youtube.com/watch?v=nUp4Sjll4s8*

The next Mobile Dome Planetarium Meeting will be held 18 January 2025.

NEW DIGITALIS SYSTEM – VERY PORTABLE

The Digitarium Mu Portable Digital Fisheye Planetarium System is their most portable system. It is a one piece design with built-in stereo speakers and weighs 25 lbs (11.4 kg); with the case, that has wheels and an extendable handle, it is 53lbs (24.1) kg). The system starts at $25,600 with the starter software package. It has a 4k UHD projector with 180 x 360 degree full sky projection using Niteshade G3 universe simulator software and 2 remote controls. It is a modular system to accommodate upgrades and service. This sounds like a nice beginner's package which is less pricy than most. *https://www.digitaliseducation.com/products-digitarium_mu.html*

"Hands-on, experiential learning builds creativity, connection, and the future workforce" *https://united.nysut.org/issue/january-february-2024/hands-on-experiential-learning-builds-creativity-connection-and-the-future-workforce/*

This article, by Molly Belmont and Kara Smith, in my New York State United Teacher's Union (NYSUT) newspaper is very relevant to what we do. New York State teachers are partnering with local business to learn what kind of 21st century skills are needed to drive the state's economy.

"Authentic learning looks different today than it did 10, or even five, years ago," said NYSUT President Melinda Person. "Kids don't need to sit down and memorize more facts for a test. They need to know how to think critically about the unlimited information at their fingertips. They need to understand how to work and play and collaborate creatively with their peers. They need training with the complex systems and equipment that they will encounter every day in the real world."

According to local businesses, the United States has always held the lead in creative problem solving. This trend has been declining in recent years and that indicated that we need to foster that skill again in a big way. This article gives some examples of school programs that are doing just that, helping students "…become adept at problem solving, strategic thinking, and situational analysis…"

LIPS CONFERENCE 2024:

Planetariums are perfect tools to foster these skills through interactive problem solving activities. Karrie Berglund's Live Interactive Planetarium Symposium (LIPS) conferences are helping planetarians to learn how to effectively use their facilities in this way.

A wealth of learning went on at this year's conference (as at every LIPS) which included presentations about interaction strategies, using theater skills to enhance presentations, special techniques to help seniors learn about their place in space and the celestial dances happening in their sky neighborhood (See below), audience ice breakers, story time under the stars, using themes from cryptids to dinosaurs to spice up a constellation program, how to create a live planetarium program featuring a live feed from an observatory, how to find/ hire/train fantastic moderators, creating an interactive show that also gives the presenter actionable feedback, addressing misconceptions and challenging questions, how you can bring Minecraft Astronomy into your public presentations, engaging a public discussion of light pollution, benefits of teaching astronomy from a multicultural lens, and an Interactive Exploration of Moon Phases with Moon Balls.

For more information about past and current LIPS conferences go to: *https://lipsymposium.org/*

BASIC ASTRONOMY FOR SENIOR CITIZENS:

At La Roche University in Pittsburgh, Pennsylvania lifelong learning seniors are explore ways to enhance their lives by discovering basic astronomy patterns and cycles and their place in the universe. These delightfully inquisitive learners are a joy to work with during a 2 hour once a week class. The class is held in a multi functional space so each session is composed of discussion and activities outside a 6 meter portable dome, a lab inside the dome, and then discussion and activities outside the dome.

At first a basic analog STARLAB system was used for these classes with the silver dome and tunnel entrance. The tunnel entrance proved to be very difficult for many of the 50+ year olds to navigate. So, Pat Reiff, Discovery Dome, (https://www.eplanetarium.com/about.php) was kind enough to sell me a second hand dome, with a stand up doorway, for an extremely reasonable price. (Thank you Pat!) The first dome was 5 meters and that accommodated 17 chairs in a circle; the second dome is 6 meters and so the number of students and chairs could be increased to 21. So far, after five sessions, the class always has a waiting list so the bigger dome is appreciated.

Students use the data gathered in the dome to assemble puzzles for each season.

(Continued on pg. 69)

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LIP SERVICE

LIPS 2024 WAS A BLAST!

As I write this, it's already been about three weeks since LIPS 2024. There are so many things to say that I hardly know where to begin...

LIPS 2024 was hosted by the Haile Digital Planetarium at Northern Kentucky University (NKU); it ran from September 4 - 6. Our host was the fabulous Christa Speights, and many of her students and colleagues helped out and even joined us in sessions as their schedules permitted.

I want to give an extra special thank you to Christa, her students, and the NKU professors who were able to join us. Hosting a conference is a lot of work, and I appreciated their can-do spirit, behind the scenes preparations, and attention to detail. We may very well go back to NKU for a future LIPS.

I also want to thank our LIPS 2024 sponsors (listed alphabetically):

- Astronomical Society of the Pacific, a first-time sponsor. Anna Hurst of the ASP did the sponsor presentation virtually, and she showed how even a virtual presentation can be interactive.
- Audio Visual Imagineering, who have sponsored every LIPS so far.
- Cosm/E&S, who have also sponsored every LIPS so far.
- Digitalis, of course, my own company; we have also sponsored every LIPS so far and hosted the very first one back in 2011.

NKU was a wonderful setting for LIPS. The planetarium, classrooms, and break space were all very close together, so time spent passing from one space to another was minimal. There were many areas near the planetarium and classrooms that were perfect for small group work. The food was good, and we even had delicious, locally-made gelato during the opening reception. NKU staff and students were all incredibly welcoming and helpful, and the department chairperson himself led a campus tour during the opening reception.

This year the LIPS group was a bit smaller than in the past: We had about 30 attendees in the core group (i.e., not counting NKU staff and students who had other commitments to work around). I believe the lower than usual attendance was primarily due to many people choosing to attend IPS in Berlin, which as we all know by now was the first in-person IPS meeting since 2018.

However, despite the smallish group, the energy level at LIPS 2024 was high, attendees were engaged, and everyone was incredibly generous with their thoughts and ideas. About half of the core group were attending their first full LIPS, and it was exciting to see how quickly they immersed themselves in the spirit.

One survey respondent commented, "This was a very welcoming community with a lot of great insight into creating engaging, educational experiences." As I have said before, the LIPS community is the most supportive and generous in the planetarium world. If you're not already a part of it, please join us! See the end of this column for ways to participate in the LIPS movement.

The first morning of LIPS 2024 we had our group introductions, aided by Haile Digital Planetarium teddy bear mascot Nebearla. Nebearla's tail can be extended from a standard Earth bear length to an Ursa Major/Ursa Minor length. As Nebearla made her way around the circle—often airborne—it was fun to see how different people interacted with her. Sometimes it looked like Nebearla was actually making the introduction or reacting to what the person was saying, while other times, she simply was cuddled close.

On the first morning we also had our keynote theater skills workshop with Dr. Dan Dennis. Dan has a Master's of Fine Arts in Theatre Pedagogy from Virginia Commonwealth University and a PhD in Interdisciplinary Arts from Ohio University, where he now teaches. He has decades of theater and musical performance experience. Some of you reading this may have had the opportunity to chat with him in July in Jena, Berlin, or Hamburg, and you may have even experienced him in action during the IPS Mini LIPS.

Dan is also a former supervisor of Pacific Science Center's Willard Smith Planetarium, which is where I met him nearly 30 (!) years ago. Since he knows from experience what types of skills are needed for successful interactive planetarium programs, Dan's LIPS exercises were specifically chosen to enhance planetarium presentation skills.

Dan started his workshop by asking what skills we were hoping to build or strengthen. This is an embodiment of the LIPS spirit and reflects Dan's comfort level in framing the workshop based on audience input as well as the extensive experience he can draw upon.

As I knew it would, Dan's workshop provided practical techniques and exercises in a fun, supportive environment. Several survey respondents included comments about the workshop:

- Dan's presentation helped me to realize that there are many ways to control the energy of my audience as well as my own energy while presenting to achieve certain effects.
- Many of the skills that were demonstrated are directly applicable to my presentations in the planetarium.
- It was really great to see a presenter who asked what the audience priorities are and then customize his presentation accordingly. I was kind of dreading this because I don't think of myself as theatrical, but he was so clear about the applicability of what he was doing to the planetarium, that I jumped on board.

(Counter-clockwise from top) LIPS days end early enough for people to relax and enjoy dinner together. Photo credit: James Bauman; Haile Digital Planetarium mascot Nebearla did a lot of traveling during group introductions on the first morning; Diana Steinkampf came all the way from Berlin for LIPS 2024. She led us through discussions on how to identify great moderators (presenters); Dan Dennis shared some lip warm up exercises during the theater skills workshop. After all, you can't ignore your lips at LIPS! ; LIPS sessions often feature both small and large group discussions; Sponsor Joanne Young of Audio Visual Imagineering led us through a fun activity using M&Ms and colored flashlights. Photos credit: Andy Kreyche

In addition to the theater skills workshop, we had a really fun session with several NKU theater students and professors studying Foley sound effects. There was a reading of the children's book Mr. Underbed held in the planetarium, with supporting visuals and sound effects. After the reading, the students and professors shared some of the tools and techniques they used for the audio. Let me just say that a squeaky chair back really does sound an awful lot like a creaking door!

There was a second storybook session at LIPS 2024, led by Erin Bennett of the Suffolk County Vanderbilt Museum and Planetarium. Erin shared information about a program they do in their planetarium that includes reading children's storybooks with accompanying visuals on the dome.

(Continued on pg. 70)

BOOK REVIEWS
NEW IN THE WORLD OF LIT

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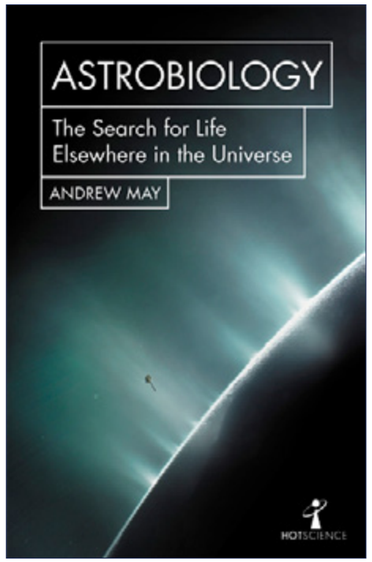
ASTROBIOLOGY: THE SEARCH FOR ALIEN LIFE



Andrew May, China: Unipress Books, Ltd., 2023, ISBN 978-1-9160896-7-9, Hardbound, NPL, US

REVIEWED BY FRANCINE JACKSON, LADD OBSERVATORY, PROVIDENCE, RI, USA.

For many of us, one of the first questions asked of us when we say we're into astronomy, is whether we believe in aliens. Today, though, alien life can have many definitions, including extremophiles present here on Earth. After reading this book, we shouldn't be worried about any answer we may give.

The author begins with the first question: Is there life on Earth? To us, this may sound like a "Duh!" moment, but "life" can have different meanings for different persons. In science, it can be any form of living thing; however, that may not be true elsewhere. If so, how do we even begin to look for living beings? And, what does "living beings" really mean? Are we forced to only attempt to find humanlike beings, as noted in almost every science fiction venue?

The author does introduce the history of attempting to look for life elsewhere. Of course, he does speak highly of Frank Drake, including his equation and the SETI work he performed in West Virginia. Also, the incredible work by Jocelyn Bell (Burnell) who, as a student, found what at first was thought to be messages from Little Green Men – what she found is now much more important.

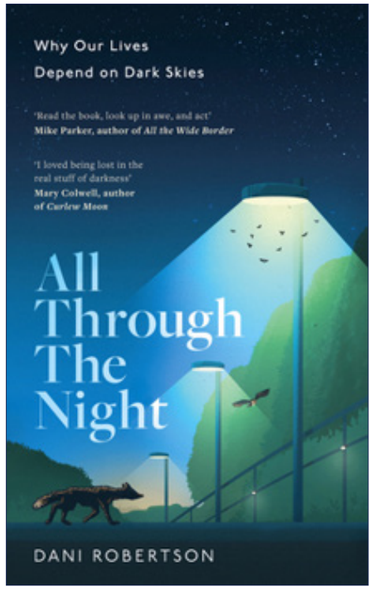
The study of potential alien life can't exclude Carl Sagan who, in addition to one of the most important science fiction books on the topic, was instrumental in designing the Pioneer Plaque.

And then, we go into the new concept of looking for life: searching for planets – exoplanets - around other stars. With such instruments as Kepler and TESS, we are discovering thousands of them, of all differing forms: Hot Jupiters, potential watery bodies, total ice spheres. Many of these new planetary objects are so close to their respective star that their orbital periods are as short as just several of our days. Can any life exist in such an environment? But, then, are we working on the bias of life as we know it – can we keep this concept, or must we change and actually throw out everything we know and hold dear?

Astrobiology takes us through every aspect of life, both here and possibly elsewhere. The author delves into the potential of planets around all forms of stars, and what type of "Goldilocks zone" that could be present. He gives us tidbits on every way a life could exist, including examining the science fiction views through the ages.

This book is full of beautiful images, depicting celestial bodies known to contain some form of water, portraits of exoplanets and their potential for any creatures, even nebulae where new planetary material might be in the birthing process. Both informative and entertaining, Astrobiology is a great and fun read.

ALL THROUGH THE NIGHT: WHY OUR LIVES DEPEND ON DARK SKIES



Dani Robertson, London: Harper North 2023, ISBN 978-0-00-858672-0 hardbound, $29.99 US

REVIEWED BY FRANCINE JACKSON, LADD OBSERVATORY, PROVIDENCE, RI, USA.

There's never before been a book so necessary to read concerning the issue of light pollution as this one.

The author begins with a simple question: "What if I told you one of the ways to save the world?" Her response: Flick a switch. For her, over lighting is causing much of the problems our world faces.

All her life, Robertson heard her father concentrate on the beauty of the night. He would have her outside in the dead of winter, walking up a hill behind her house, and looking up. She was amazed. Her father also introduced her to many of the constellations and their myths, many of them, as she was born

(Continued on pg. 70)

A DIFFERENT POINT OF VIEW

A LITTLE BIT OF EVERYTHING

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As usual, the number of visitors dropped over the summer. I would like to believe it was the super hot record breaking summer heat, but I can't blame that entirely. My little town of Cave Creek is about thirty miles north of Phoenix and supports the lifestyle of about 2,500 people in the summer. Some say it swells to double that amount in the winter months but I have my doubts about that. Anyway, as you can imagine, if we go by the adage that an average person visits a planetarium only twice in their lifetime, I have used up the goodwill of nearby residents. Like all of the small businesses in Cave Creek (most of which are small restaurants) my little planetarium would be out of visitors if it were not for those from the valley of the sun, most notably Phoenix and Scottsdale, all of us would have been out of business years ago. Last millennia when I was younger, we would call a visit to a nearby small town "going slumming" though I am not at all sure what that actually meant nor where it originated.

Being in the heat is not all that bad, especially in the winter when we are inundated with literally thousands of people affectionately called "snowbirds", who keep our economy going and get us through the hot summer months when even the most encrusted desert greaser retreats to the comfort of an air-conditioned space. We do not go out, we just stay in one place and absorb the cold. Now when the winter comes, many of those visitors to the valley want to "go slumming" in some of the small towns and the various shops and restaurants which provide a more colorful atmosphere then the more reified atmosphere of the larger valley cities. So they come to eat and spend some time in the various shops in our little town. And, low and behold, some of them actually come for one of my planetarium programs.

Like others in this town, I look forward to the winter months as the number of visitors increases. I wonder about this year however. Since I retired some sixteen years ago (where did the time go) I have noted that money just doesn't go as far as it once did. This I am sure is effecting all who both use or provide services. For myself, I've found that I really enjoy giving shows and this is my tenth year. I wonder if I will make twenty. Not that I think the economy will totally crumble, but that I will. This summer I was blessed with a kidney stone which took its own sweet time moving to an exit point. My biggest so far. (place picture here) I feel so good I might just go slumming in Phoenix or Scottsdale.

KEITH'S CAPTURED QUIPS ~ CHAPTER TWENTY- NINE

- "I ecpecially loved...the sits (they were very confey)."
- "You're a cool. Awesome, dude. I think we have the same imaganations, My mind is all ways soinning. I all ways think about space and stars."
- "My mom went on the trip to and she felt a little dizzy doring the movie but I was fine."
- "P.S. I really want your lazer pointer." (It displays an arrow rather than just a dot).
- "My favorite part was everything."

10 YEARS AGO (DECEMBER 2014):

As anyone who reads this column knows, I am caught in the past and love the old optical-mechanical projectors. Thus, I stopped at Glenn A. Walsh's article on "The 76th Anniversary of America's 5th Major Planetarium". Now, being from Chicago I must support the Adler who has found their original Zeiss II (yes I know it was converted to a III), but if the Adler folks clean it up and put it under a dome, it would be the oldest working dumbbell projector around. Come on Adler, if you can make the Atwood sphere rotate again, you can certainly make the Zeiss project again. If not, I will have to fall back on one of the original Zeiss I's, still operating after 100 years,

25 YEARS AGO (DECEMBER 1999):

I wonder how many were "sweating bullets" when this issue arrived as none of us knew what the change from 1999 to 2000 would do to our various computers. Would we get the "blue screen of death" or could we "skate by" with little or no problems. Those with the old fashioned optical-mechanical projectors had no problems at all as the gears just moved us into the new year. Many of the articles published during this time supported these older style planetariums.

Take Planetechnica: Zoom Tune-Up by Richard McColman for instance. He talks about the maintenance of a zoom slide projector which added motions to the static slides. While many now rely on computers and video projectors to do this today, I'm sure there are still many (including myself) who would benefit from a revival of this article.

If you're still doing your own scripts you might enjoy John Mosley's "The Real, Real Constellations of the Zodiac", as well as Wayne Wyrick's "Possible Origin of the Pawnee Creation Story. Some of this can be melded into our various "What's in the Night Sky" programs adding some new spice and flavor.

If you never go back and read any of these back issues, or if you sometimes go back, I offer up an article in Steve Tidey's "Forum" column. Easy to find: December 1999, Vol.28, No. 4, Page 23. Written by Dennis L. Mammana, it could have been written today in this 100th anniversary year of the projection planetarium. So true that one of the original Zeiss I projectors is still doing its job of educating and entertaining just as it did a century ago. I would even suggest to the editor to re-publish this article in today's

(Continued on pg. 66)

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SEEKING WHAT WORKS
CONNECTING WITH A LIVE IN-PERSON AUDIENCE

WHY CONNECT?

When you connect with your audience, you build better relationships, you improve your sense of community, and you present more effectively. Connecting requires the ability to identify with people and relate to them, which demands focusing on others and not yourself. Connectors inspire people and get more enjoyment out of what they do.

HOW DO YOU KNOW YOU CONNECTED?

- Your audience will
- make eye contact,
- engage either with answers or questions, and
- return for another program.

HOW TO CONNECT—PREPARING THE PROGRAM

1. Make an idea relatable

I have presented a program about aurorae[1] for over a decade. The bones of the program are the same: where and why aurorae occur, how we get all the colors we see, how can someone see aurorae, and whether other planets have aurorae. Over time, the program is evolving. I always tweak the graphics and the live presentation, especially about the causes of this beautiful celestial phenomenon. Here are the ways this program has been honed:

Take 1. In 2012, I hired design and film majors to incorporate movies and animations. As I explained various aspects of aurorae, I treated the pretty pictures from all over the world as "spoonsful of sugar" that help the medicine go down (the "medicine" being electron transitions). The images have trees or clouds or interesting landscapes to give them texture as well as color. Even though the imagery was compelling, the program still felt like a lecture.

Take 2. In 2016, I made a point of adding personal touches to what we know about aurorae. I started by describing the three times that I have seen aurorae in my life. One was when I first met my in-laws in Calgary, Alberta. The second was when my spouse and I were taking a fussy baby for a late-night stroll on the east side of Milwaukee. And the best aurora I saw was while flying in the stratosphere on NASA's SOFIA, Stratospheric Observatory for Infrared Astronomy (Fig. 1). Personal stories compelled the audience to listen with more interest.

Take 3. In the current show, I keep the imagery and the stories. I add another level of involvement from the audience when explaining how aurorae form. I ask people

The author in her SOFIA jacket next to the planetarium projector. . Photo by Andreas Beyer-Bowden

to make a fist for the proton and have a finger buzzing around the proton to be the electron. I focus on the electron as it jumps to a higher energy level which we enact while adding a funny "boing" sound effect. The light released as the electron jumps back to the lower energy level is what we see as aurora. I invite the audience to add any gesture or sound they please for when the electron goes back to its basic level. I am delighted when people tell me at the end of the show that they enjoyed performing that demonstration.

2. Practice and be prepared to adjust

Rehearse your program, record yourself, and ask for feedback from trusted parties. Invited audience members will certainly give you good suggestions, but they can be too gentle. Review of one's own performance provides insight about non-verbal or verbal tics that you want to be aware of. I wasn't aware, for example, how often I start a sentence with the word "now" followed by a pause. Listen for your tone, volume, pacing and timing. This is how I found that sometimes I lower the volume of my last few words. Do you give your audience enough pauses to consider what you told them?

3. Look for humor that works for you

The most useful feedback I get during rehearsals is where a missed opportunity for humor could have led to better engagement. Many things considered funny assume a set of common references and experiences, which are hard to share with a general audience of different ages and backgrounds. I have come to see the futility of making jokes that I don't find funny. But a delightful surprise is almost as good as a joke. When I describe a website that shows the current probability

1 Creighton, J., DeVasto, D. and Gallagher, S. (2017) Illuminating the Aurora in Planetarian, Journal of the International Planetarium Society, Vol. 46, No. 3, p. 8.

(Above) The author with her sitting mother. Photo by Panagiotis Giannakopoulos. (Right) A watercolor painting by the author that attempts to capture the colors of the sky near the Saronic Gulf at sunset.

of seeing aurora, I ask my audience to name the countries that had a better than 50% of seeing aurora. People say Iceland, Canada, Norway etc. —all in the northern hemisphere. What about countries in the *southern* hemisphere? Who gets to see aurora australis? On click, a penguin comes on to dance to some fun music. Ha!

HOW TO CONNECT—DURING THE PROGRAM

1. Greet your audience members

The best advice I got from seasoned planetarian John Surendonk (now retired) of the Gifford Planetarium in the Racine Unified School District (Wisconsin, USA) was to greet every member of the audience as they walk in the planetarium. I make eye contact, I recognize people who are regulars, and I make a point to be particularly warm toward people who might feel hesitant to enter the space.

How do you connect with your audience before a show if you have mic checks or other things you need to do before the show begins? How can you build that connection into your routine?

2. Bring the whole you to your presentations

There are some interesting things about me that I can talk about: growing up in Greece, observing on Mauna Kea, and flying on NASA's largest moving observatory in the stratosphere. These things might impress. But I have noticed that people lean in closer when I talk about my phone calls to my mother with dementia (Fig. 2), or about pushing a hysterical baby in a stroller, late at night, all over the east side of Milwaukee, under the aurorae borealis, just to calm him down. Personal connections, both big and small, help humanize you, and build trust with your audience.

3. Use appropriate, respectful language (more than one if you can!)

Of course, we do not want to alienate our audience by using obscure terms, unnecessary acronyms, or highly technical terms. We need to strip our story to its bones, figure out what terms are required, and make sure we explain them.

Yet, there is no reason to strip our language from every interesting, nuanced, suitable word particularly when talking to mostly adults. For example, when I am showing the Big Dipper, I prefer "hind" legs rather than "back" legs. Even with kids, this gives us a chance to augment their vocabulary since they understand the context.

Nelson Mandela said "If you talk to a man in the language he understands, that goes to his head. If you talk to him in his language, that goes to his heart." I make a point in my planetarium programs to say something in at least three languages: English (mostly), Greek (my native tongue), and one regional Indigenous language/culture. I like recognizing that many people in my audience have various identities that

(Continued on pg. 64)

PLANETARIUM EDUCATION

100 TIPS FOR TEACHING IN A PLANETARIUM

COMPILED, CREATED, AND EDITED BY KEN BRANDT, CO-CHAIR, IPS EDUCATION COMMITTEE, AND FELLOW OF THE INTERNATIONAL PLANETARIUM SOCIETY.

My colleagues and I are presenting in this series some ideas for a list of 100 of the best practices for teaching in and out of the dome, in concert with and supporting the centennial of the planetarium. This edition features the fifth set of seventeen tips that concern Interaction Outside the Dome.

I'll launch this set of tips with techniques from my own observations, impressions, and 30+ years of managing behavior and eliciting engagement under my dome, as well as beyond its walls. I have found that with 8-19+ year olds, reinforcing what's taught inside the dome outside of the dome can be done with some fairly simple activities and techniques, such as follows:

1. Cherilynn Morrow has created numerous kinesthetic activities to teach basic astronomical concepts such as Earth's rotation and revolution. Students make a circle around one of their teachers (the Sun). The students' head represents Earth in different places in its orbit. I'll go around the circle, naming off holidays to help students understand where they are in relation to the Sun, and each other. They turn once around in place. This simulates one day, using their noses as their current location on Earth. After spinning once, they then follow Earth's path around the Sun, to simulate one year. I then ask them how many orbits of the Sun they've personally made, getting them to equate the birthday idea with the idea of orbiting the Sun. This link https://www.spacescience.org/eduresources/KAAssessmentSkyTimeAug04.pdf takes you to the activity mentioned here, as well as several further modifications.
2. I help this activity along by being in the circle with the students, which brings up my next tip: be an active participant in the activity when possible. In this way, students can see you doing the activity and can model your behavior. This requires the cooperation of the teachers and chaperones to manage behavior, and help keep students on task, so you can concentrate on modeling the behavior so the students do it as well.
3. Tennis balls and the moon: from "late" crescent through waxing gibbous, and then again from waning gibbous to crescent; the moon is visible in the daytime sky. Believe it or not, many students have never seen the moon in the daytime! Of course, this activity depends upon clear skies. Hold a tennis ball up next to the Moon. I ask students to tell me how much of the ball is lit by the Sun. Answers should approximate that it is lit like the moon. You can extend this activity by demonstrating the angle between Sun-Earth-Moon is what causes the phase seen.
4. Speaking of the Moon, let's unpack the "supermoon" phenomenon with a simple kinesthetic activity. Hold your thumb at arm's length, and let your thumb rest naturally, without pulling it toward your nose or dropping it down onto your hand. Try to approximate the apparent diameter of your thumbnail. Now, flex the thumb towards your nose without bending your elbow. Did you notice a big difference in apparent diameter of the thumbnail? Probably not. This is a pretty good approximation to the change in the moon's apparent diameter when at perigee. If the students are learning about solar eclipses, this is good. You can point out that the length of totality, and the width of the moon's shadow on Earth is longer and wider during a "super" new moon. A data table from previous eclipses could be used to compare time of totality, width of shadow, with the distance of the Moon from Earth.
5. This next tip comes courtesy of a ten year old's question shortly before a solar eclipse: "What's going to happen to us when the Moon hits the Sun?" This time, their right thumb will represent the Sun, and it is placed at arm's length. Their left pinkie is held very close to their nose. Once again, their head represents earth. Keeping the two elbows at the same angle, students should try hitting their thumb with their pinkie-can't be done. After about five seconds of this, the student asking the original question said; "Oh! They can't hit each other, can they?" Mission accomplished.
6. Scaling out the earth-moon distance using a globe and string (original idea demonstrated by Jason Talley): Showing students how far the Moon is from the Earth can be made easier by using a long string. We know that the Earth's circumference is roughly 25,000 miles, or 40,000 Km. We also know that the Moon's distance is roughly 250,000 miles, or 400,000 Km. Ask the students how many times one should wrap the string around the globe to get to the right miles or Kilometers to the Moon. Once they get to 10 times, ask a student to help you hold the loops of string as you wrap Earth's equator 10 times. You can enhance this activity by asking students to estimate how far they think the Moon is from Earth before beginning. I always point out the scale difference between traveling to the Moon, vs. traveling to Low Earth orbit (roughly 40 feet, vs. inside the brass ring holding the globe together).
7. Proving that "...Mr. Galileo was correct!"-Dave Scott. I ask the students to show me what Venus' orbit would look like if it went around earth? How much would Venus change apparent diameter? I then have them extend their thumb, and swing it back and forth, without changing the length of the arm. Once again, their single eye represents the view from Earth. I ask how much the apparent diameter of their thumb changed? I then tell them that this is roughly what Venus would look like if

it orbited Earth. Then I position myself on a far side of the room, relative to them. I use a central object, such as the planetarium's starball as the Sun. I then put my thumb into the air, and ask them to compare their thumb to mine. I ask them to tell me why their thumb is so much larger than mine? They come to the notion that distance affects apparent diameter of an object, if they didn't know that already. I "orbit" the Sun with my thumb outstretched, beginning at the inferior conjunction point all the way to superior conjunction, briefly walking in front of as many of the students as practical. I then show them Galileo's sketches of Venus, and ask them which "thumb model" best represents what Galileo sketched.

The remainder of this series of tips is provided by contributions from some of the members of the IPS Education Committee:

8. Ursa Benedicic: During teacher training we talk about the moon a lot. We tell stories from different cultures about what they saw in the darker areas. For example, in Germany, they see "a man on the moon" who was punished by God for working on a Sunday - so now he always has Monday ("Montag" in German, and "der Mond" is the moon). Here we emphasize the role of language and how it can be helpful - it takes around one month (1 "Monat") for the moon to go around the Earth..
9. "moon crater activity": we use baking trays (with flour and cocoa powder) and drop different items from different heights and angles to see what happens. The kids are also encouraged to collect the materials they want to try out themselves, but we also have a bag with rocks, cotton balls, and marbles ready. We observe and compare the created craters + discuss.
10. We also talk about constellations - what they are, and how we can see something else from a different perspective - from different locations on the planet. This can again be connected to different cultures and their own interpretations of the patterns.
11. Tomas Graf: Sun oven With a group of children or students, there is an explanation about solar energy, sun observation and other activities. At the beginning of the lesson, a solar oven is introduced, which is made practically out of waste. The instructions are here https://www.youtube.com/watch?v=ZIrgluKJBmY but we used an oven made from an old TV set. For example, a metal object is put into the oven. At the end of the lesson, the students have to touch the metal object. They're surprised that even on a cloudy day it's warmer than it was. With clear weather and a longer lesson, even a portion of rice could be cooked! (Note that students wouldn't be asked to touch the metal object during full or partial Sun).
12. Chrysta Ghent: Outside or in a large space, have the students act out an orrery with planets, moons, asteroids, comets, and the Sun (great for getting out energy!)
13. The one I remember from my childhood planetarium visit is lighting pieces of metal to simulate a star's brightness. At this point, I can't remember what the material was, but someone out there might! That one stuck with me!
14. Dorothea Holzschuh: One thing we did in the past and I try to simplify at the moment is a model visualizing space-time: We had a self made wooden frame with a big stretchy cloth (usually used for bathing suits) tightened in it. Small weights, marbles, wooden balls etc. made small dents in the fabric similar to objects such as planets or stars make dents into space-time. We then played through different scenarios such as a black hole: big weight in the middle and a cup filled with marbles put upside down onto the fabric so that no marble can escape yet. Then with a bit of movement you lift the cup and all the marbles start to move in a spiral to the black hole similar to an object captured by the black hole. The marbles spread out and you can talk about spaghettification.
15. Sara Surico: We don't organize a lot of experiences outside of the dome, only sometimes we use sundials and solar telescopes. With young people we build the sundial and then we teach them how to use it. We explain the difference between astronomical time and civil time, and after that, with the group of people, we prepare for the experience outside.
16. Jean Creighton: A fun one on a sunny day: the group of students is split in pairs. Person A stands still. Person B traces person A's feet and the person's shadow with chalk. Person A guesses where the top of their shadow will be in 1 hour. Then the students switch. Take them back outside in an hour to see what happens to their shadow when the student stands in the same place they were before (which is why they outline their shadow).
17. Guilherme Frederico Marranghello: When it is sunny or, at least partially sunny, we use magnifying glasses to burn some pieces of paper to explain about focal length and why you should never point your telescope to the Sun. We also have an infrared thermometer that we use to measure the temperature on the ground in two parts: one painted black and the other white.

Our last installment of this tips series will feature the great misconceptions. What are some of the most challenging, and how are they addressed? If you have ideas about these, please contribute them into this google spreadsheet: https://docs.google.com/spreadsheets/d/16mTqskIy8LeudRm9WGS8_JKX-ZCe_twvh8X06XGxTCk/edit?usp=sharing

CALL FOR 2026 IPS AWARDS AND FELLOWS NOMINATIONS

MANOS KITSONAS, AWARDS COMMITTEE CHAIR, MAK@EEF.EDU.GR

The IPS Awards Committee members are Kris McCall at Cernan Earth and Space Center of Triton College in the USA (planetmccall@gmail.com) and Tatsuyuki Arai at Katsushika city museum Planetarium in Japan (tats.arai@nifty.com).

Time has come to nominate people or institutions for the 2026 IPS Awards and Fellowships. The next IPS Awards and Fellows will be presented at the IPS Conference in Fukuoka, Japan, in June 2026. The IPS Board will decide which persons or institutions nominated will be honored, at the 2025 IPS Board meeting. The decisions will be based on the Awards Committee presentations regarding each potential Awardee or Fellow candidate.

Nominations for the 2026 IPS Awards and Fellows must therefore reach the Awards Committee on time and in any case no later than the 31st of May 2025. Please send your nominations to my email address (mak@eef.edu.gr) and include the reasons why you think your nominee should be awarded an IPS Award or named an IPS Fellow, along with any additional information that may support the nomination. Also, feel free to contact fellow members of the Awards Committee or your IPS Affiliation representative in case you want to get more information regarding rules and procedure.

As you well know, the IPS Awards that require nominations from the members are the following:

- The IPS Service Award. This, according to IPS Standing Rules "shall be bestowed, from time to time, by the Society upon an individual or institution whose presence and work in the planetarium field has been, through the years, an inspiration to the profession and its members." Since 1982 there have been 26 people awarded the IPS Service Award.
- The IPS Technology and Innovation Award. This "shall be bestowed, from time to time, by the Society upon an individual whose technology and/or innovations in the planetarium field have been, through the years, utilized or replicated by other members and/or other planetariums." So far, there have been 10 persons awarded with the IPS Technology and Innovation Award.

For these two Awards the nominees must have a broad, deep and concrete effect in the profession and its development.

- The IPS Inclusive Excellence Award. This "shall be bestowed, from time to time, by the Society upon a member of the International Planetarium community whose work exemplifies and elevates equity, diversity, and inclusion through consistent and sustained efforts that create more inclusive environments in Planetariums and improves opportunities for the diverse communities we serve. This is a new award and will be given for the first time.

Deserving IPS members can also be named IPS Fellows and in order to be named the IPS Standing Rules state that "a member must have continuous active membership in good standing in IPS for at least five years and substantial contributions in at least two of the following respects:

- Serving IPS in effective office, diligent and/or devoted committee work, and the organization of conferences and meetings.
- Relevant and significant publications and/or conference presentations.
- Cooperation with professional societies, organizations and groups which bring attention to the importance of planetariums' existence.
- The development of new methods in the planetarium field."

So far, there have been 278 people named IPS Fellows.

I would like to encourage you to consider possible Awards or Fellows nominees not only from your region but from all over the world.

More information regarding previous Awardees and Fellows can be found in the IPS Awards Committee web page (*www.ips-planetarium.org/?page=awardees*).

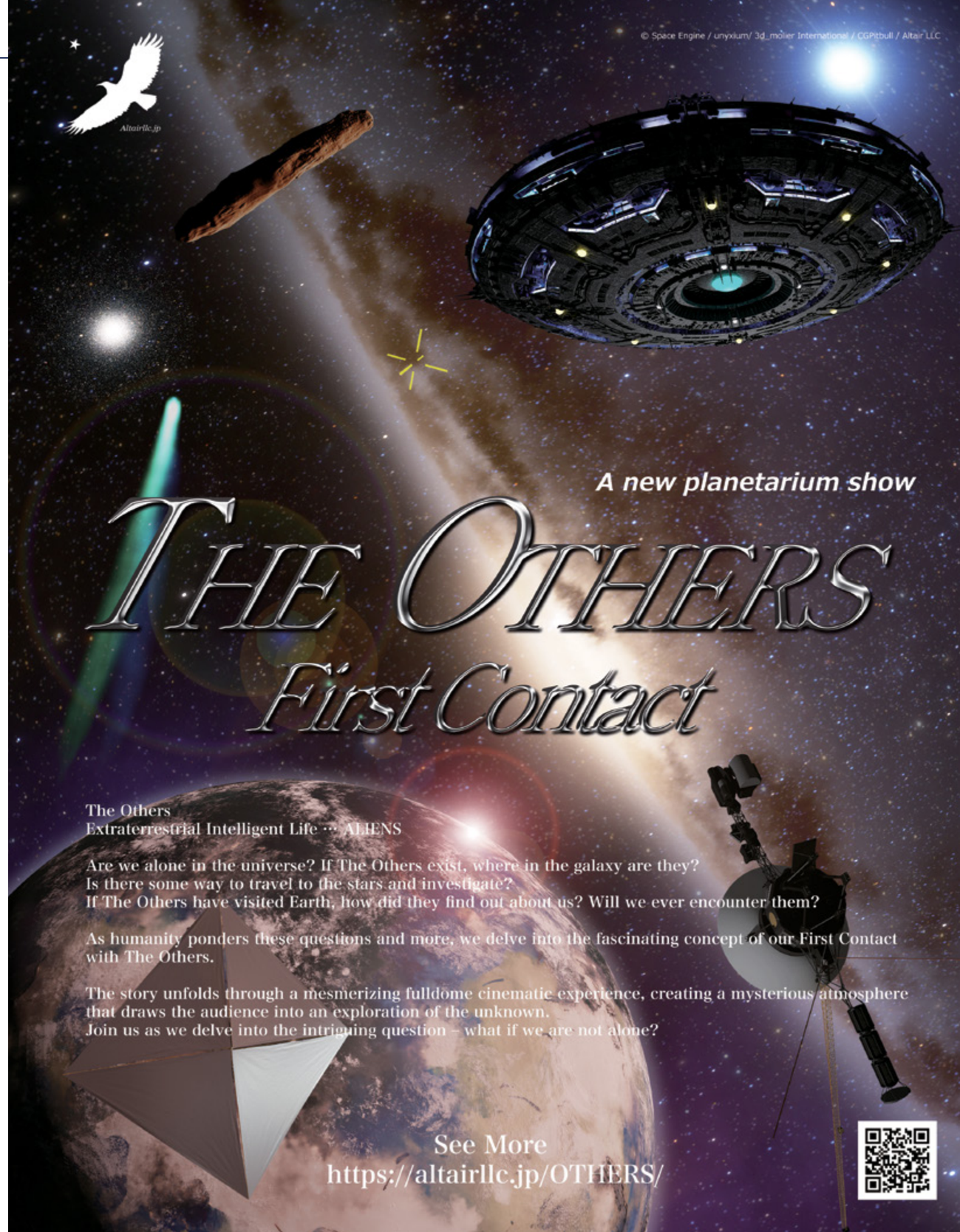
Complete rules are found on Appendix A in *IPS Bylaws and Standing Rules, http://www.ips-planetarium.org/?page=rules*

"A WEEK WITH THE GDP" NOW OPEN!

After two very successful exchanges in Berlin and Jena in 2024, I am happy to announce that we are now accepting applications for "A Week with the GDP" in 2025. We will return to normal procedure, with an exciting opportunity to host one international colleague at the Galileum Solingen in Germany.

The planetarium offers a dome with a diameter of 12 meters including a Goto Chronos II Hybrid projection system. For observations of the night sky the Galileum Solingen also features a 14 inch Celestron telescope.

The city of Solingen is part of the Metropolregion Rheinland and in very close proximity to Cologne, Düsseldorf and Wuppertal. The Galileum Solingen is well known for it's excellent work and will guarantee a wide spectrum of experience during the stay, as well as a superb taste of German culture. If you are interested in our program, please consider applying. For more information and how to apply, refer to the dedicated "A Week with the GDP" page of the IPS website, or contact Tilo Hohenschlaeger.



INTERNATIONAL PLANETARIUM'S CALENDAR

COMPILED BY: LORIS RAMPONI

2024

- **20-22 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 the United States". For information and application requirements go to: *ips-planetarium.org/?page=WeekinUS*
- **31 December.** Deadline for the contest "A week with the GDP". Gesellschaft Deutschsprachiger Planetarien e.V., (GDP) is the Society of German-Speaking Planetaria. For information and application requirements go to: *https://www.ips-planetarium.org/page/WeekwithGDP*
- **31 December.** Deadline of the prize "Page of stars" organized by IPS Portable Planetarium Committee in collaboration with Serafino Zani Astronomical Observatory. Contact: Susan Reynolds Button, *sbuttonq2c@gmail.com*
  http://www.ips-planetarium.org/?page=pagesofstars

2025

- **2025** - International Year of Quantum Science and Technology
- **18 January.** 7th Worldwide Meeting online dedicated to traveling planetariums and in particular to operators, producers and sellers. Begin at 02:00 PM Universal Time UTC. Contact: Susan Button, *sbuttonq2c@gmail.com*; Marco Avalos Dittel, *info@planetarioaventura.com*
  http://www.ips-planetarium.org/
- **31 March.** Deadline of 13th PLANit Prize for an original video production, organized each year by Italian Association of Planetaria (PLANit), Italy. The prize is open to everyone. First prize 500 euro.
  Contact: *segreteria@planetari.org*
  www.planetari.org
- **4-6 April.** Gesellschaft Deutschsprachiger Planetarien e.V., (GDP), Annual Conference of the Society of German-Speaking Planetaria, Halle, Germany. Contact: Voss, Björn Dr., *bjoern.voss@bkm.hamburg.de*
  www.gdp-planetarium.org
- **11-13 April.** Italian Association of Planetaria (PLANit), 40° National Conference of Associazione dei Planetari Italiani, SPARKme Space Academy, Matera, Italy. Contact: segreteria@planetari.org; Dario Tiveron, *dario@fddb.org / www.planetari.org*
- **7 May.** International Day of Planetariums, 100th birthday of Centennial of the Planetarium
  https://planetarium100.org; ips-planetarium.site-ym.com/?page=IDP
- **7 May.** Astronomy Day. Astronomy Day is a world-wide event designed to celebrate all facets of astronomy.
  https://www.astroleague.org/astronomyday/news
- **18 May.** International Museums Day, *http://icom.museum*
- **3-5 June.** European Network Science Centres & Museums (ECSITE), Annual Conference, Copernicus Science Center, Warsaw. Poland.
  https://www.ecsite.eu/conference
- **10-12 June.** 10th Fulldome Festival Brno. It will again offer its visitors with the newest content on the fulldome market from all around the world, Brno Observatory and Planetarium, Brno, Czech Republic.
  fulldomefestivalbrno.com
  Contact: *director@fulldomefestivalbrno.com*
- **30 June.** Asteroid Day. *https://asteroidday.org/*
- **6-9 September.** Association of Science and Technologies Centers (ASTC), Annual Conference, San Francisco, California, USA. The Conference will be hosted by a consortium of ASTC members: Bay Area Discovery Museum, California Academy of Sciences, Chabot Space & Science Center, Children's Creativity Museum, Computer History Museum, Exploratorium, Lawrence Hall of Science, The Tech Interactive
  https://www.astc.org/
- **10-12 September.** Nordic Planetarium Association, NPA meeting, AHHAA Science Centre, Tartu, Estonia. Contact: Üllar Kivila, NPA President, *ullar.kivila@ahhaa.ee; https://www.npa-planetarium.org/*
- **24-26 September.** Association of French Speaking Planetariums (APLF), Annual Conference, Cosmodrome, Genk, Belgium. From 22-23 September workshop about education. Coordinator Olivier Moreau. Contact: nicolas fiolet, *nfiolet@lacoupole.com* (APLF); *seppe.canonaco@genk.be* (Cosmodrome); *www.aplf-planetariums.org*
- **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
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2026

- 28th International Planetarium Society Conference, Fukuoka City Science Museum, Fukuoka, Japan.
- **18-19 June**. Fulldome Festival.
- **20-21 June.** Council Meeting.
- **21-26 June.** IPS Conference.
- **27 June.** Post Conference Tour.
- **12 August 2026.** Total solar eclipse (Artic, Greenland, Iceland, Atlantic Ocean, northern Spain and very extreme north eastern Portugal).
  https://nso.edu/for-public/eclipse-map-2026/

2027

- 1st August 2027. XXXIII IAU General Assembly, International Astronomical Union, Rome, Italy.
  https://www.iau.org/science/meetings/future/general_assemblies/2760/
  Access to virtual platform available. See as example:
  https://astronomy2024.org/registration/

LAST LIGHT
CHATTING WITH FRIENDS

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Robin Byrne shared some of her students' suggestions:

"My favorite student suggestion for the OBAFGKM mnemonic:Ob i-Wan Beats Anakin For Going Kinetically Mad"

She continues:

"I've decided to create my own catalog, in the spirit of Messier, to keep track of the things that aren't comets but look like them on my laptop display. I can number all the spots in the Byrne catalog.

Zooming in to several on-line meetings this year has been a pleasure. While travel can be expensive and time-consuming, it's great to share what's happening with colleagues over the internet. Depending on your time zone, of course!

During one of the Pacific Planetarium Association's monthly meetings, Rosemary Walling mentioned a children's program they'd developed: Rocky Planet Picture Show, concentrating on the inner worlds of our solar system. Jon Bell suggested a sequel: Outer Planets: It's a Gas!

And during the sign-in segment of another meeting, he noted that he was "tempted to introduce myself as Commander Qalt of the Klingon High Command" but then thought better of it."

The solar activity of May and October sent auroras all over the planet further south than usual. Since absolutely everyone saw the Northern (or Southern) Lights except me in the cloudy Southeast US, I was delighted to get the chance in late October.

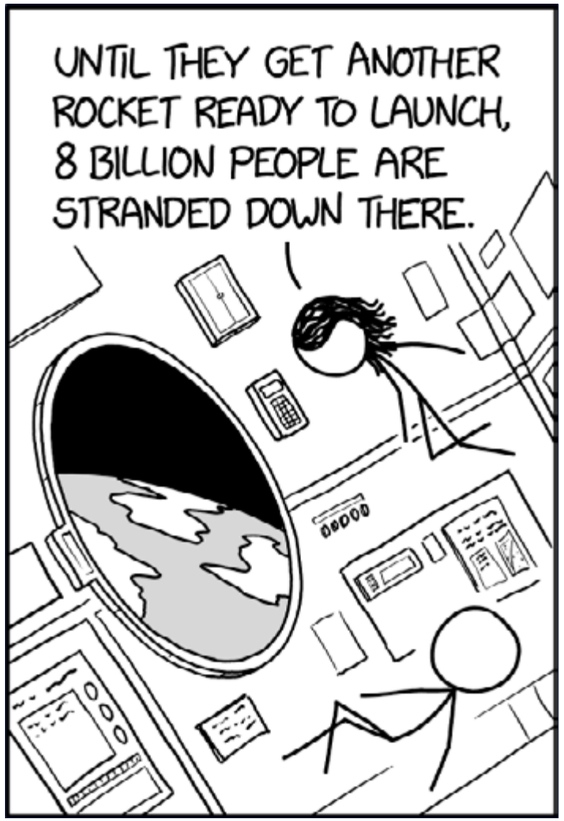
My sister and I joined a Road Scholars trip to Iceland. Learning that Iceland's rainiest month is – wait for it – October, I was doubtful of any success. But the clouds parted. Twice.

And finally, Sam Storch's annual holiday greeting (slightly edited) is one of my favorites:

Many years ago when my kids were very little, I used to enjoy a New Year's Eve ritual with them in which I'd take them outside into the back yard just at the moment the new year began.

The best of those nights back up on Long Island found me reveling in a crisp, clear December 31, exulting in the beautiful snow or at least some nice frost on all the tree branches, the crunch of fall's golden and red and brown leaves still underfoot, and enjoying every breath of cool, clean, dry air at a temperature of perhaps 20°F.This is, of course, very different from what we experience here in South Florida, where the air is very humid and it reaches 80°F or more even in late December.

I had promised my kids to wake them up to see something very special that happened on New Year's eve. Keeping my promise, I awakened the kids from their beds; it was past 11:45 PM on New Year's Eve, and the skies were crystal clear.



"At least they're not alone down there." https://xkcd.com/2978/:

The little guys were snuggled up stiff and nearly immobilized in their snowsuits, like the kid in that old Christmas movie... .

Out in the back yard, I had long ago hammered metal stakes into the grass so that I could set down my RV-6 telescope and have an almost instant polar alignment for its equatorial mount. The stakes had been driven in so that one of the three pier legs faced exactly north, and I enjoyed calm, stable visual observing. That precise alignment depended on two very long nails of the sort driven through rain gutters into the roof. These had been driven a while back into the flat part of our roof on a clear night, thus forming a meridian line visible from the back yard in the place where Polaris was could be seen. Polar alignment had become very easy for all

(Continued on pg. 67)

Audience Reach (con't.)

news in 2019. This press interest may have disproportionately affected the viewership for the film on that topic. Viewership results may be different from a repeated survey focusing on a different selection of films.

Moreover, many planetariums were closed during the COVID pandemic, which likely led to lower attendance in recent years. Recent viewership totals may be smaller than they would have been under normal circumstances.

Visualizations created for planetarium dome shows are often re-used in a flat-screen format and shared with the public on numerous platforms. For instance, versions of Solar Superstorms and Birth of Planet Earth are available on Amazon Prime[4,5], and a single YouTube video[6], which repurposes visualizations from Solar Superstorms has 3.4 million views as of this writing. Thus, the reach of a cinematic scientific visualization may be an order of magnitude greater than the estimates provided in this paper. Future work could study the reach of cinematic scientific visualizations more broadly, beyond the context of only planetariums.

Throughout our analysis, we aimed to underestimate to avoid over-reporting. For example, we found from our survey and subsequent internet searches that some planetariums were screening films not in the license database, but only used the license information to estimate viewership from non-respondents. Thus, there may be more screenings we did not account for due to incomplete licensing information.

5. DISCUSSION AND FUTURE WORK

Our survey highlights the enormous potential that cinematic scientific visualizations have for engaging the public in planetariums on a global scale. Just four visualization projects from one visualization lab have reached millions of viewers. At the most conservative estimate, only including the responses with specific estimates (68 out of 315 planetariums which provided survey responses about at least one of the four films), we can claim that 1.2 - 2.6 million people have seen the films (mean: 1.9 million). Extrapolating to all 315 planetariums and their 459 licenses in our database, we estimate a global reach of about 16.5 - 24.1 million (mean: 20.3 million). If these four films can be considered representative of all dome shows, then a producer can expect a single dome show to reach 4.9 - 6.5 million people over a 10-year lifespan (mean: 5.7 million). These are conservative estimates as films may be licensed for over 50 years.

Based on annual viewership, Black Holes: The Other Side of Infinity (2007) and Birth of Planet Earth (2019) are the most popular films from this study, and Solar Superstorms (2015) is the least popular, by a wide margin. Surprisingly, the star-power of Solar Superstorms's narrator, Benedict Cumberbatch, did not make the film a bigger draw than Birth of Planet Earth which is narrated by Richard Dormer, a comparatively less-known actor. Considering that a celebrity narrator can have a large impact on the overall budget of a film, future work could study whether celebrity narration contributes to viewership, enjoyment, trust, or other measurable metrics for dome show films.

We studied planetarium shows that combine cinematic scientific data visualization with animated illustrations, recorded videos, and other media. Further work is needed to assess the impact of the data visualizations with respect to the other parts of the films on factors like audience comprehension, memorability, and trust. Investigating audience response across these mediums along with factors that amplify or attenuate their differences would aid in effectively creating future such films.

ACKNOWLEDGEMENTS

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4 https://www.amazon.com/Birth-Planet-Earth-Thomas-Lucas/dp/B07W89HPNQ
5 https://www.amazon.com/Solar-Superstorms-Journey-Center-Sun/dp/B015R1B10M
6 https://www.youtube.com/watch?v=inuCAqj8UgQ

Geoscience Visualization (con't.)

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Seeking What Works (con't.)

may or may not be obvious. Acknowledging more than one language makes more people feel welcome in our spaces.

4. Show them where you are going

Sometimes as experts we can be guilty of building detailed narratives about topics that we know so well without telling our audiences where we are going. A presentation is like a jigsaw puzzle. You can put a lot of pieces in front of an audience, but if they don't have the box top, it is much harder to put the pieces together. Start with the main point you are going to make.

Recently, I tried an experiment while talking about the life of a star. I told an audience of unresponsive high school students at the beginning of the program that the elements that make us alive and interesting are cooked in stars. I said I was about to show them how we are directly connected to stars and how we wouldn't be here if they didn't exist. The high school kids were hooked earlier than when I had held that climactic idea until the very end. Perhaps it is obvious this would be so, but it was nice to see the effect in practice.

5. Give the audience an action item after the show

"Which idea you learned today will you share with someone" I ask the audience at the end of the presentation. My hope is, by putting in their mind the action to share the idea, it will help them remember what sparked their interest and give them a chance to connect with someone else.

HOW TO CONNECT—AFTER THE PROGRAM

You might find useful, as I have, this Connection Checklist[2]

- Did I do my best?
- Did I understand and relate to the audience?
- Did I add value to the people?
- Did I give people a game plan?
- Did I make a difference?

Connecting requires energy. Figure out what fuels you

I need opportunities *not* to think about planetarium related stuff or indeed anything. I have discovered two things that make that possible: While I swim laps, my brain goes to a lovely neutral position and my thoughts can flow with my strokes. I have discovered painting with watercolors helps me get absorbed by a different creative process that relaxes me (Fig. 3).

What fuels you?

2 Maxwell, J.C. (2010). Everyone communicates, few connect: what the most effective people do differently. HarperCollins Leadership.

Under the Classdome (con't.)

be? Again, the planetarian has the role of questioning the audience, promoting the discussions and keeping the show alive. Finally, the planetarian can introduce the last part that will tell what was science and what was fiction in the show.

The discussions are very important because the show was developed with the aim of promoting debates and encouraging kids to build and share their arguments. To enhance this experience, we visit the school. We discuss the space race from the development of the rockets to current times when we have thousands of satellites around Earth which has become a serious issue. We also explain about space law and end with a simulation of an assembly of the committee.

Initially, we just split the kids in groups and asked them to create new laws that could mitigate the problems of having too many satellites and debris, but now we give them roles. One group is a space power nation which has technology to build and launch rockets with their own satellites. Another group from a nation capable of building satellites, but not launching them. The third group is a nation totally dependent on rocket and satellite technology from a private institution.

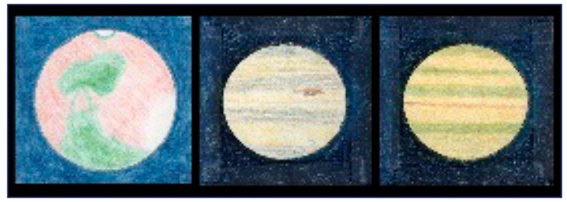
We produced a booklet about the show which we give to every student that visits the planetarium and watches the show. The idea is to keep the show alive for a longer time in kids memory and make it reach the students' parents, siblings and friends.

What have we found so far? Regarding mining authorization, kids have worries about possible pollution of outer space, but they are favorable to granting permission to the Kingdom of Syldavia. Adults have other concerns, like leaving the power in the hands of a powerful nation.

When we talk about answering the signal from Trappist-1, kids have more curiosity and fear. The adults have shown some worries, but they are curious too. In the school setting, the kids have brought some interesting laws to the assembly, which is an activity we didn't do with adults.

Most of the show was developed using the software Blender. We are also sharing the Blender files with all planetariums so you can change them as you wish. In addition to making new language versions, you are free to update the data discussed in the show, improve with the script or change something you didn't like. You can even create a new topic for the show. Just, please, share it with us and others.

Tales from Dome Under (con't.)



Later color sketches of the outer planets

By this time I had gotten around to using a piece of paper, colored pencils, and a clipboard to draw on. Seen left to right, in spite of my artistic skills, its Mars, Jupiter, and Saturn. In the case of Jupiter, I had found a template for drawing the planet, which duplicated the gas giant's oblate spheroid shape, so I didn't have to try and draw it by hand every time. The brown-colored line across Saturn's equator is the shadow of the planet being cast onto the upper atmosphere of its equatorial region. There are no actual rings seen because they were edge-on at the time according to the observational notes associated with this drawing. (Source: the author's collection)

It was going to be some more years until astronomers discovered Jupiter, Uranus, even Neptune, also had ring systems of their own. But at that time, Saturn was the only known ringed wonder of the solar system.

The majority of the time I was out observing with my telescope from our asphalt driveway on the front side of the house after it had a chance to cool down. Unfortunately, this always left the streetlights to contend with, and no other places in our suburban yard to try from. Being without a driver's license didn't help matters either; no car, no travel to a darker site.

It wouldn't be for about another 15-years before I bought another telescope—a Meade Schmidt-Cassegrain with a 20cm (8") mirror—on a different kind of forked telescope mount. Such an altitude-azimuth set-up, still using the same system of celestial coordinates, now became the way to shoot photographs with the same camera and adaptor as before. This time, though, it was through a telescope with much better, and more light-gathering optics.

Third-party digital versions of setting circles were just starting to come out at the same time, but the ones on this telescope were strictly "old-school," and manual.

Another three more years passed before I bought a third, smaller telescope, a Meade Maksutov-Cassegrain, which has a 8.8cm (3½") mirror. This one could be mounted piggyback on the back of the larger 20cm telescope, with adjustable counterweights offsetting its putting the 20cm off-balance. The 35mm camera adaptor worked just as well on this.

These turned out not to be the only telescopes I would ever have access to. There was the 31.75cm (12½") Newtonian reflector in the telescope tower of the Strasenburgh planetarium when I was working there. The largest I ever got to use was the Boller and Chivens-built 61cm (24") research-grade Cassegrain at the observatory of Michigan State University when I was in graduate school.

There was also the "Galilean telescope" we had at the National Air and Space Museum's Albert Einstein Planetarium. Our Chief (Smithsonian museums only have one Director apiece), Jim Sharp, had someone make it for us, but that's a story for another time.

All of these telescopes provided me with a variety of different experiences over the years, but it was certainly that first RV-6, used in both Earth Science class, and then the one I owned, which hold a special place in my observer's heart.

* Note: this is a condensed version of a chapter from my upcoming book, "Boomer Boyhood: Growing Up in the Shadow of the Silent Generation."

Point of View (con't.)

Planetarian. While there are others who took up the gauntlet and responded to Steve Tidey's request, Dennis L. Mammana says (in my humble opinion) it all.

45 YEARS AGO (DECEMBER 1979):

George Reed suggests that we have an "International Planetarium Week". He feels that planetariums should have equal time to international pickle week. I totally agree with his thinking. While we are all enjoying the celebration of the 100 year of the projection planetarium, I must admit that I only had one person interested in my planetarium history show.. I wonder what happened to International Planetarium Week.

Jack A Dunn in his "Sky Notes" column talks about the virtues of the new digital recordings. Telarc CD's are among the very best, which I must agree. I wonder what his thoughts are as now, forty-five years later, many people are going back to old fashioned vinyl records. He mentioned DBX encoded discs which I must admit are my favorite. Perhaps that was the best of both worlds. Wouldn't I like a DBX disc or better yet a DBX reel to reel tape of some of the great recordings made by RCA in the 60's and 70's with engineers like Lewis W. Layton who knew how to place microphones.

Charles F. Gronaues provides a condensed version of his original 1055 page report, "A Study Of Distortion Resulting From Viewing Angles In The Planetarium Theater". I'll just leave it at that.

Last Light (con't.)

of my visual observing- the two nails plus the finder on the telescope confirmed a straight line that pointed to Polaris.

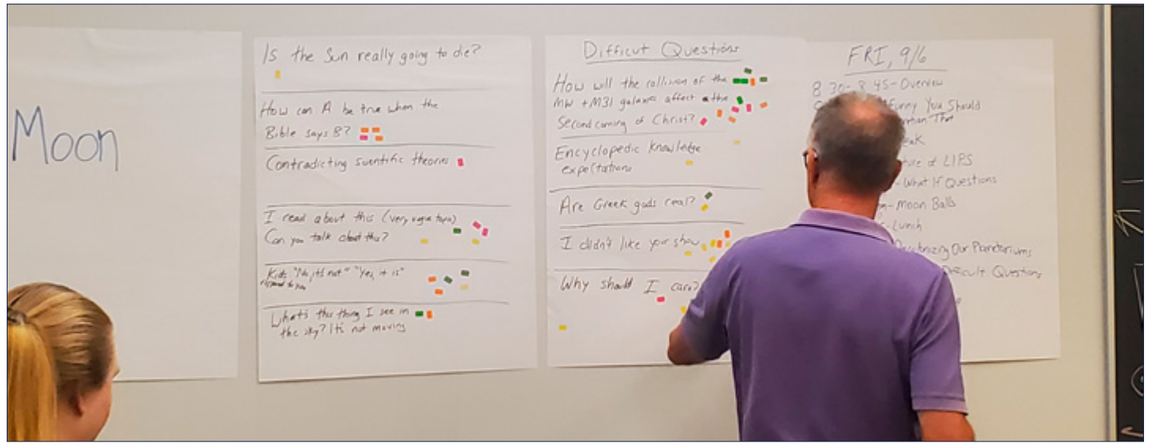
Growing up in my house as a little kid you quickly learned to look for things on the sky- the Moon, Orion's belt, and so on. In fact, trying to please me, the kids would spot any three stars, in any season, and exclaim "look, Daddy! 'Ryan's belt!" This could happen in summer or winter, but I was always happy because they were looking at the sky- a kind of personal victory for me, even if it was summer and Orion wasn't actually visible. I avoided the wisecracks about Orion not being an Irishman... .

Imagine the excitement the kids felt- it's New Year's eve, the smells of all the candy and special treats set out "for the big people" as well as the rich aroma of good strong coffee fill the house, and they have been taken out of their beds and into the back yard at night, all to see something very, very special, something that happened only one time each year!

Now, besides knowing "Ryan's belt," my kids also knew each winter how to use Orion's belt (or, 'Ryan's belt) to find the Dog Star, Sirius. Even before they could pronounce "Sirius," they knew how to find that Dog Star.

While not as crammed together as the houses where I live now in Florida, if you peered through the rows of hedges or shrubs it was still possible to see the adjacent houses next to or behind my own, and as such, sound could sometimes carry from house to house.

LIP Service (con't.)



(Above) In the Tackling Difficult Questions session, small groups generated lists of difficult questions or comments, then attendees voted on which of those questions/comments they'd like to tackle as a group. Photo credit: Charlie Eder; (Left)Anna Hurst of the Astronomical Society of the Pacific led a virtual sponsor demonstration about ASP's numerous resources and programs. Here LIPS 2024 attendee Mark Percy is taking advantage of the opportunity to ask Anna a question.

In her session, Erin first presented several techniques that can be used to bring stories alive, such as changing vocal volume, speaking in different voices, varying pace, and more. After this introduction, we worked in small groups to select an excerpt from a story of our choice to dramatize for the group. After these dramatic readings, I know that I would be excited to have any of the LIPS 2024 attendees read me a story any time.

There were so many fantastic sessions, and I learned something from every single one of them. Some of the other standouts for me were Ka Chun Yu's workshop using the And-But-Therefore technique for framing storytelling; Diana Steinkampf's session on how to identify and train fantastic moderators (presenters); Amanda Wimmer-Flint's interactive pre-K fulldome show Postcards from Rosie; and Suzy Gurton's workshop about using On the Spot Feedback.

And I wasn't the only one who enjoyed LIPS 2024. Here are some comments collected on the (anonymous) survey.

- It was incredibly refreshing and enjoyable. I experienced no desire to leave which is not normal. LOL!
- Having sponsors integrated into the schedule is the way to go!
- It was great. My brain is full. I can't wait to share with my team!

I'll share one other survey comment that really warmed my heart: "You are awesome, Karrie! You created something that, if we could recreate the atmosphere and camaraderie of LIPS into our work, most all students/guests would want to return time and time again." If the person who wrote that is reading this, thank you for the wonderful compliment.

I can share early stage plans for LIPS 2025 and 2026. For LIPS 2025, we will be returning to the Fiske Planetarium at the University of Colorado Boulder. They did such a fantastic job in 2022 that I asked if they'd be willing to do it again, and luckily they agreed. Exact dates are still TBD, but LIPS 2025 will be in late July.

For LIPS 2026, we will swing back to the southeast to another veteran host. Derek Demeter of Seminole State College in Sandford, Florida volunteered to bring LIPS back there. SSC's facilities have changed a bit since they hosted in 2013, and I am looking forward to getting back there and seeing the updates. That will be in late July or early August, 2026.

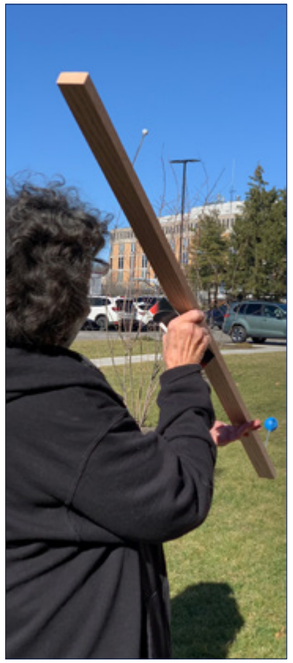
And of course, Mini LIPS-style events are happening several times per year. These are one day events that give people a taste of what LIPS is about, since not everyone can get to the full three day annual event.

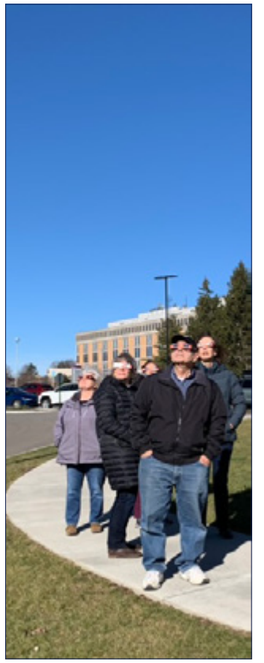
As always, I end this column with reminders about the LIPS Google Group, Live Interactive Planetarium Symposium Facebook group, and the LIPS team chat. Contact me (karrie@DigitalisEducation.com) if you need information about any of these, or if you'd like to share any ideas or feedback.

Mobile News Network (con't.)

Seniors do have more difficulty adapting to the dark so our initial discussions and activities are held under lower lighting in the room. In the dome, when the night sky is projected, we close our eyes and count slowly to ten before touring the star studded sky. I also opened the base of the projector and moved the regulator to increase the brightness of the stars; it does not seem to shorten the life of the bulb as expected. This basic class does not require a digital system; The STARLAB cylinders with the basic bulb project a more than realistic sky for Pittsburgh and surrounds and is perfect for the topics covered:

- **Session One:** Our Place in the Universe (our address starting with our home, city, state, planet and one out to the edge of the universe); using a Basic Sky Map to find Stars and Constellations; discuss Star Brightness-distance, size and temperature; discussion of eye structure (pupil, rods, cones and averted vision) before entering the dome; demonstration of finding stars and patterns in the dome. Story of Bear Hunters; using Star Clock/Calendar (Pacific Science Center). https://cdn.ymaws.com/www.ips-planetarium.org/resource/resmgr/education_materials/pass/v5constellations-tonight.pdf ; https://www.jpl.nasa.gov/edu/resources/lesson-plan/moon-phases/
- **Session Two:** Moon facts. Gazing at the Phasing (Moon Phases and Eclipses); properties of light on a sphere and model moon phases using a ball on a stick and a light source; ordering actual pictures of the various phases of the moon, Moon Phaser Dial, Earth/Moon Distance stick model (Adam Thanz ajthanz@gmail.com). https://www.jpl.nasa.gov/edu/resources/lesson-plan/moon-phases/
- **Session Three:** Discussion of the seasonal changes in Pittsburgh and elsewhere. Reasons for the Seasons worksheet (record hours of daylight, draw the sunrise position, altitude at noon, and sunset position on the equinoxes and solstices) in the dome; direct/indirect light demo with a flashlight; use four globes and a light source to demonstrate the sunlight on the Earth during the four seasons; discuss cross quarter days; learn to use a solar motion demonstrator. https://www.njesta.org/docs/solar_motion_demonstrator.pdf
- Session Four: Solar System/Planets (the wanderers); discuss properties of planets/dwarf planets/exoplanets; build a Venn Diagram (properties of Stars/Planets/Moons); view the circle of Zodiac Constellations on the ecliptic and find the day's planets in the dome; Circle of Zodiac Constellations physical activity outside the dome;





(Clockwise from top left) Students were able to discover how far apart the moon and earth are and use the apogee position of the moon to create a total solar eclipse; You never know when these seniors might travel to see an eclipse so here they are learning all about eye safety; "What a clever devise," one student exclaimed after learning to use a solar motion demonstrator.

in the Welsh countryside, different from the norm, yet still fairly easy to identify.

However, as she grew up, the world around her made the stars disappear, blocked by the brilliance of artificial lighting. Robertson began to study the consequences of this nighttime brightness. She quickly noted the cones of light which attract insects of all kinds to their demise, and with that the animals that need them to survive.

We are all aware of the horrible numbers of birds lost each year, as they are unable to properly navigate to their seasonal destinations; we also have seen the perils of young turtles attempting to find their way to the ocean. She also reminds us that many other animals, including humans, need darkness, as constant light can and does affect us.

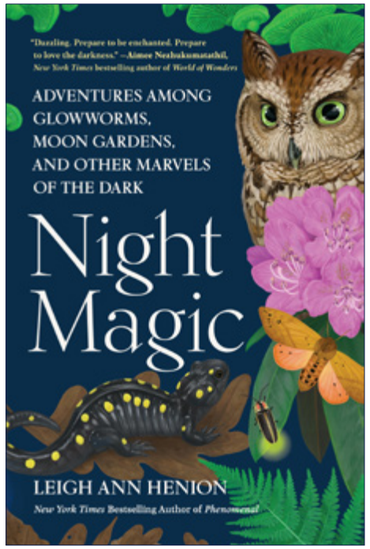
We are also given many ways to do our parts to lower our individual lighting, many of which will hardly seem to be a change. The author is looking for small steps from us all. With this book in hand, we can all realize how easy it can be to help change the world.

NIGHT MAGIC

Leigh Ann Henion, New York: Algonquin Books of Chapel Hill, 2024, ISBN 978-164375-336-2, hardbound,$30.00 US.

REVIEWED BY FRANCINE JACKSON, LADD OBSERVATORY, PROVIDENCE, RI, USA.

The full name of this book is "Adventures among Glowworms, Moon Gardens, and other Marvels of the Dark." The premise of it is the author's nighttime treks to organizations that introduce the public to nature only found in darkness.



Living in a region where night walks can be done without many streetlights and roaring traffic, the author joins others to attempt to observe the main glowing flora and fauna that so many of us have never seen or possibly never heard of: Finding caterpillars that will become beautiful moths at the annual Mothapalooza; losing her fear of bats by joining the overnight Bat Blitz; spending time with night-moving salamanders.

Often she takes her young son with her, hoping he will become aware of the wonders of the night that so many miss, and surprisingly, he does begin to see why his mother is so adamant to be have him understand what so many are not aware: the owls in her neighbor's tree, the amazingly different colors present on fireflies, even the array of flowers that bloom only after the Sun sets.

Also, the author attends a "firemaking" class, learning to start a fire using only what nature donates. This is surprisingly more difficult than she could ever have dreamed. And then, her mentor asks her a question she never believed she would hear when it's time to leave: What would she like to do with her fire? How does a fire "power down" naturally?

This book must be read slowly, as there is so much to learn. It introduces the concept of the natural world at night, when people normally aren't looking for the varied plants and animals that depend on darkness to perform beautifully. The author, in alerting the reader to what most of us are missing by staying inside after dark, clearly admits that by writing this book, she understands she can't save the planet from light pollution, but she does hope that the reader will stop and think of the wonders that are waiting for all of us in the dark. All we have to do is venture outside, and hope the area around us is dark enough to see what is waiting for us, often just in our backyards

Night Magic was the first book of choice for a newly formed DarkSky book club. For all of us star lovers, this is a wonderful way to introduce the public to the need for darker evenings.

Mobile News Network (con't.)

make a Pocket Solar System. https://www.nasa.gov/stem-content/exploring-the-solar-system-pocket-solar-system/

- **Session Five:** Review (put paper plate moon phases in order; seasons puzzles); Practice using star maps; prepare for the observatory visit; buying guide for Binoculars/ telescopes; discuss differences of Reflector/Refractor Telescopes; learn to use planispheres; test various binoculars; demonstration of a Sun Spotter Telescope.
- **Session Six:** Optional Class: A trip to the historic Pittsburgh Allegheny Observatory with activities and a tour conducted by Kerry Hadron, outreach coordinator. https://www.observatory.pitt.edu/

Immersive Matters (con't.)

Portable Planetarium: We take our programming on the road, visiting (often underserved) schools and communities that may not have easy access to a traditional planetarium. These outreach programs are especially valuable for reaching young students who might not otherwise have the opportunity to explore space in such an immersive way.

Pop-Up Telescopes (Day and Night): We bring astronomy outside with our pop-up telescope events. In addition to the obvious pros of teaching observational astronomy, these events act as a great marketing tool to promote our various events in a personalized way within the local community.

GLOBAL NETWORKING

We continue to refine our process and programming by learning from other planetariums and our experiences. As part of our commitment to advancing astronomical education, we actively collaborate with other planetariums. Whether it's sharing fulldome films, visuals, or training resources, we believe that working together helps all of us provide better programming. We actively participate in conferences every year, hosting sessions on our experiences to share what we've learned with other domes and all-the-while learning from the many others who excel in so many unique ways.

Planetariums across the world have different specialties, which are essential for addressing diverse needs in astronomy education. It is imperative that we support one another and share our experience, so that we can collectively inspire more people to look up at the stars and wonder what's out there.

INSPIRING THE SPIRIT OF DISCOVERY

The successes we've experienced so far during our short tenure as the INTUITIVE® Planetarium can be directly credited to the collective strength and dedication of the people who work here and are made possible by the support of INTUITIVE® and the U.S. Space & Rocket Center. Our team brings a wide range of perspectives and expertise to the table, which allows us to create programming that is engaging, innovative, and educational.

We're not sharing this to encourage others to follow one particular way of planetarium programming, but rather to inspire fellow planetarians to discover and harness their own unique strengths. Every planetarium has its own assets, and the key to success lies in leaning into those strengths strategically. In our view, the greatest asset of the planetarium field is the people who work within it. The passion and diversity of planetarians around the world will continue to drive this field forward, inspiring the spirit of discovery in us all.

International News (con't.)

and one place of the future. The resulting audiovisual work provides very personal insights and takes us across Germany: from the mountains to the sea, to big cities and villages, to playgrounds, highway blockades and military barracks – the realities of the 18-year-olds' lives are as varied as their visions for the future. The Museum für Werte develops exhibitions, workshops and concepts for social and socio-cultural topics that invite people to critically examine the big questions of our time in an original and low-threshold way.

Downward-facing dog, lotus position or cobra – since 13 September, the Stiftung Planetarium Berlin has been offering its visitors a special kind of yoga program under the sparkling starry sky of the Zeiss-Großplanetarium. Once a month, the planetarium hall is transformed into a place of peace and serenity where yoga lovers can enjoy a guided yoga class led by experienced yoga teachers from the Mahalaya Yoga Studio under the projected starry sky. The Yoga under the stars offer already met with an enthusiastic response on the anniversary weekend for 100 years of the planetarium and beyond at the beginning of June 2024. The unique atmosphere of the planetarium hall, where participants sit on the open space between the stage and the star projector, makes every yoga session an extraordinary experience, even if the planetarium seating remains in place. With this offer, the Stiftung Planetarium Berlin is expanding its diverse program and invites all those interested in yoga to take a break from hectic everyday life in a unique setting and find inner peace under the stars. "With our new yoga offer, we want to give visitors the opportunity to bring their body and mind into harmony with the universe and experience the calming effect of the starry sky. The wonderfully positive response on our anniversary weekend has shown that there is great interest in such innovative offers", says Tim F. Horn, president of the Stiftung Planetarium Berlin.

Corrections

- A graph from the article "A Survey of Planetarium Finances..." was misprinted; it has been corrected on the online version.
- The authors of "Astronomy in Appalachia" were misidentified; it has been corrected on the online version.

The editor apologizes for the mistakes.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