Vol. 51, No. 1 March 2022

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Journal of the International Planetarium Society

ISSN 2333-9063

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PLANETARIAN

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This issue's cover features an image taken by A. David Weigel of the INTUITIVE Planetarium at the U.S. Space & Rocket Center during *Music of the Spheres*, a concert featuring Itamar Zorman and custom visualizations that were created in-house David and his time. The image of the iconic Pillars of Creation were 3D-ified by the team, using both the visible and IR wavelengths.

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

Planetarian (ISSN 0090-3213) is published quarterly by the International Planetarium Society.

Also known as The Planetarian from Vol. 1 No. 1 through Vol. 6 No. 4. Titled Planetarian starting with Vol. 7 No. 1 forward.

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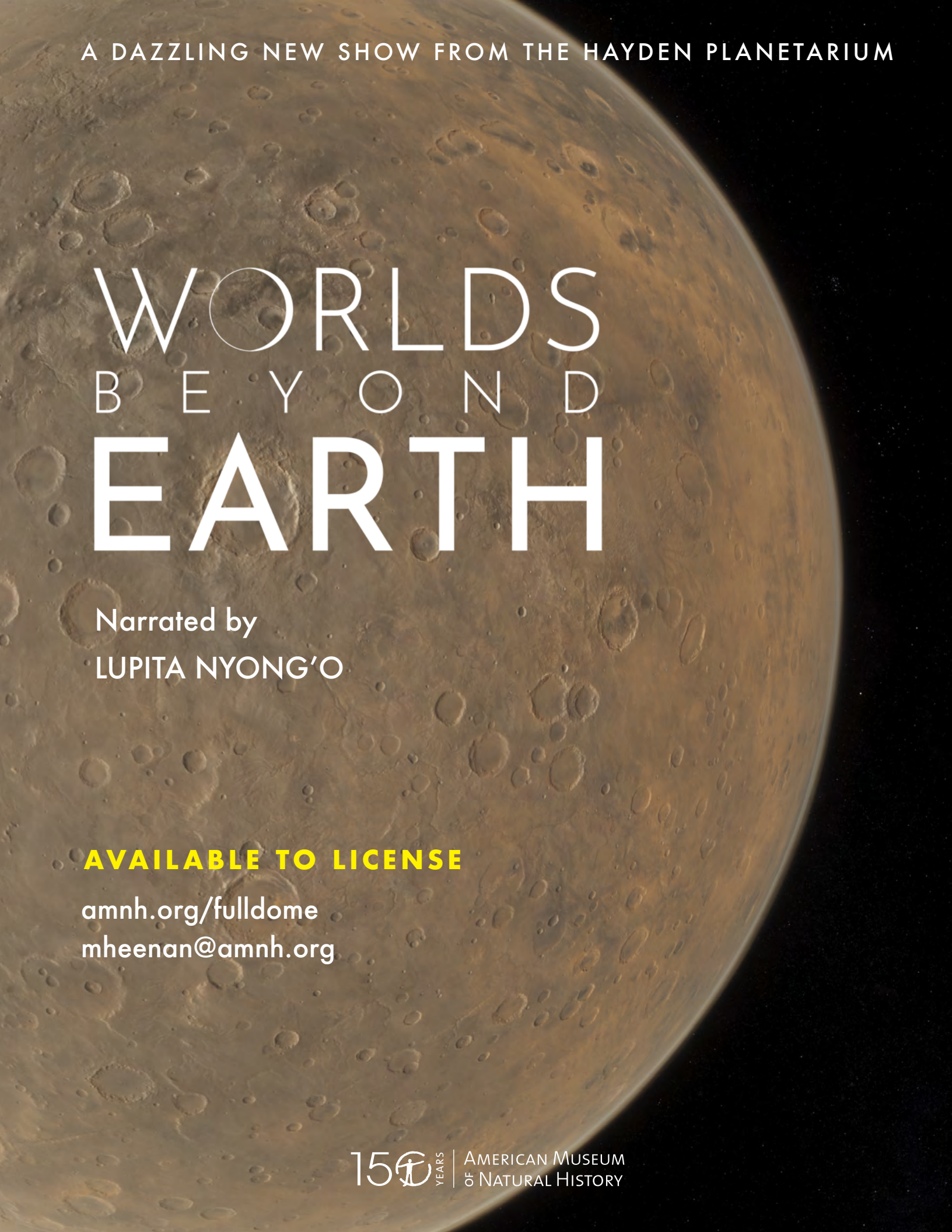
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HELLO 2022, NICE TO SEE YOU!

IN FRONT OF THE CONSOLE

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Well, we made it. Here we are - finally - in 2022.

Much of 2021 didn't seem all that different from 2020 – most likely since it seemed like history was repeating itself over and over, like a bad version of "Groundhog Day". Although unfortunately COVID is still affects many today, it has been great to see our colleagues around the world being able to reopen and begin welcoming guests under the dome once again.

Much of 2021, and through the holiday season in particular, the complications of the pandemic made staffing very difficult. After some crazy schedule re-arranging, flexibilty of staff, and some serious multi-tasking, we were able to make our way through.

As crazy as it was, I am thankful for for the experience.

One might think that is a strange notion, but hear me out - it reminded me of why I love what I do in a planetarium theater. It is not often that I get to run shows anymore. I spend so much of my time managing and working on more behind-the-scenes aspects of the theater with Michael Magee, our planetarium director, and Lucas Snyder, our planetarium technician, as well as working with Bill Plant, our exhibits director, to design and create our new exhibits (including one of our largest to date called the "Wild World of Bugs", keep an eye out for it!). It keeps me out of the show arena more than I would like, but we have a wonderful team of undergraduate students who do a great job running shows so I have no reason to worry.

With the scheduling complications, however, I was able to fill in and run shows for some of our first school groups back since the pandemic started, and it was a rush. Having just had small groups here and there, it was great to see dozens of bounding kids excited to head to space. Their smiles were beneath masks, of course, but the glimmers in their eyes were not; one could tell they were glad to be here.

And the questions! Oh, the questions. I enthusiastically ran over allotted time more than once answering audience questions. Kids have not lost their thirst to learn everything, to ask questions - sometimes the same question that their friend down the row asked, but with extra excitement. Yes, they know more than ever these days (most likely thanks to the internet), but it was just so rejuvenating to get to spend the time with the students, guiding them through space – constellations, planets, and the universe – and encouraging them to continue to ask questions. Forever.

And of course, everyone still giggles when we visit Uranus.

Running through show content with Lucas Snyder. *Credit: Shiloe Fontes*

I hope that the wild laugh of children when they see a funny scene in a show (for us, its the "methane" joke in "We are Stars"), or "ooh" and "ahh" when we first head into space, never stops reminding me of why it is so important to encourage and cultivate a love of science in them. It actually happens to be a big part of my thesis that I am currently writing, so it has been on my mind nearly full-time these last few years. Still, after being mostly at a computer for over a year and a half, it is great to experience it again.

What I'm Reading

Aside from all of the reading I am doing for my thesis, I have been fortunate enough to receive books on various astronomical topics. April Whitt actually reviewed one that I received, "New Horizons and Pluto", which, while a behemoth of a book, is an incredible recollection of data from the mission. I have a fondness for Pluto and am quite happy to have it.

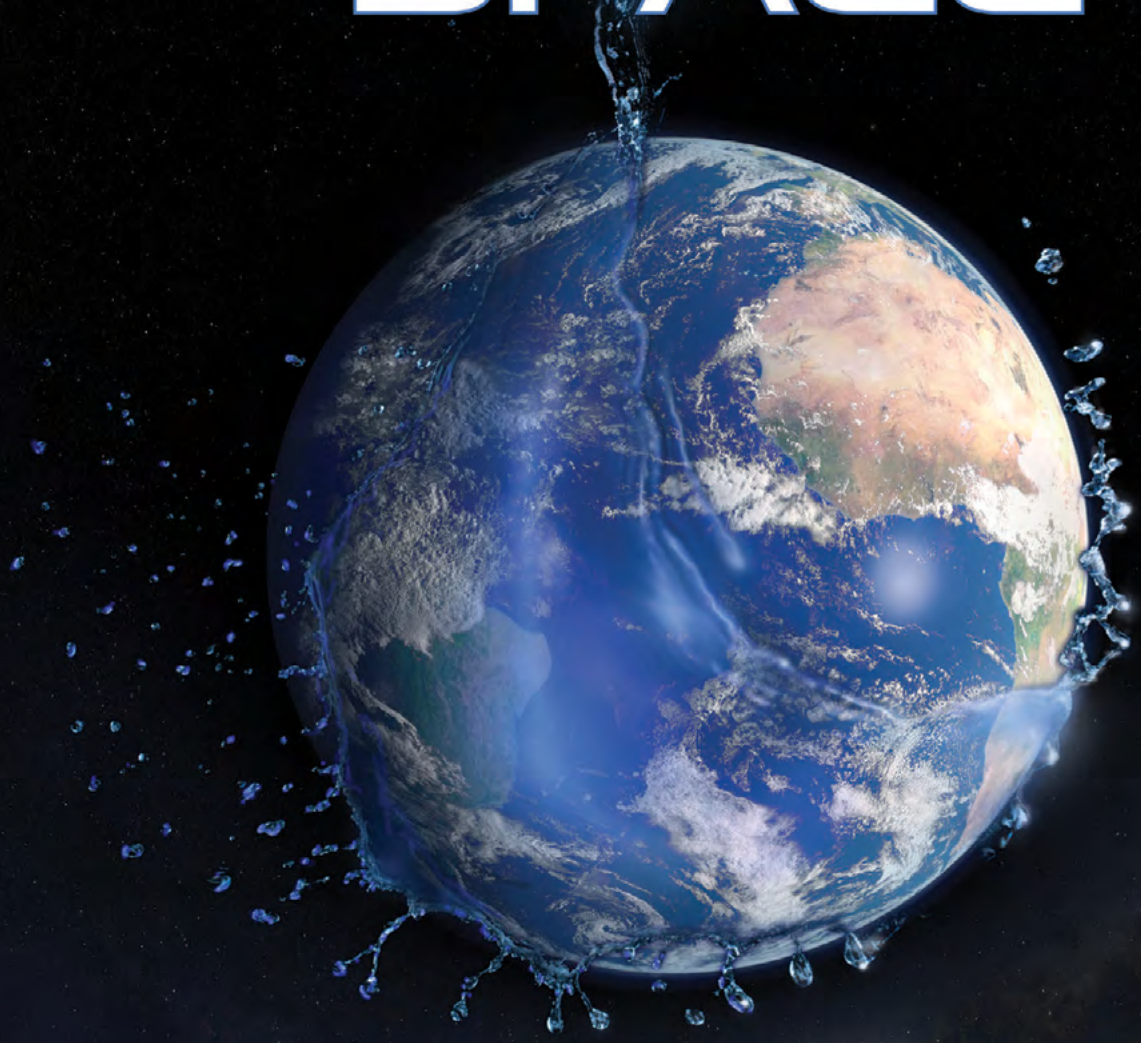
Another book that I have just received and have really enjoyed is "Discovering Mars", by William Sheehan and Jim Bell. It tells the fascinating story of our love affair with the planet Mars, from first observations to recent missions in an engaging manner. If you get the chance to read it, I highly suggest it.

Letters to the Editor?

A few have asked if I would be interested in recieving "Letters to the Editor", and the answer is a resounding YES. I think that this would be great – whether they would be for me, or for the community in general, I think that they could be great conversation starters. If you'd like to submit, please visit the *Planetarian* section of the IPS Website. This, of course, holds for submissions for the cover as well. I know this is a talented group, and I would love to showcase the work that is being done.

ALL NEW SCIENCE AND VISUALS

OASIS IN SPACE



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INTRODUCTION TO THE 2021 IPS CULTURE AND CLIMATE SURVEY REPORT

Shannon Schmoll, Dayna Thompson, Dani LeBlanc,
with support from the IPS Equity, Diversity, and Inclusion Committee; *edi@ips-planetarium.org*

The International Planetarium Society (IPS) is guided by its mission to provide the planetarium community with professional development, science literacy and arts/humanities awareness, innovative ideas, and partnerships in order to enhance the world's appreciation and understanding of our universe. To help us in this mission, we remember to uphold the society's values: science as a way to understand the world, inclusivity of and respect for cultures, sharing knowledge, openness to discovery and new ideas, service excellence, and leadership in our field.

We know that these values and our mission alone do not promise progress. In order to make a meaningful impact, we have goals, objectives, milestones, and strategic imperatives to help guide us. Therefore, in December 2019, the IPS established the Equity, Diversity, and Inclusion (EDI) Standing Committee to ensure the IPS fully benefits from the talents of all its members and is inclusive and respectful of all cultures. The functional description for this new standing committee was originally developed by IPS Officers and Society members, and later revised by committee co-chairs, Dani LeBlanc and Dayna Thompson. The full function of the EDI Standing Committee, as well as current information about the committee, can be read on the IPS website at *www.ips-planetarium.org/equity*.

Led by Dani and Dayna, the 20+ person committee finalized a strategic plan to move the IPS forward in its work towards "Inclusive Excellence" and its commitment to "respect and embrace equity, diversity, and inclusion in people, ideas, and opinions." The IPS Inclusive Excellence plan is structured around five goals:

1. Culture and Climate of Inclusion
2. Inclusive Policies and Systems
3. Inclusive Conferences and Events
4. Recruitment and Retention for an Inclusive Organization
5. Professional Development for Inclusive Excellence

The full plan outlines objectives for each goal in an effort to recruit, support, and retain a diverse population of active and engaged IPS members, affiliates, and leaders, and to create and maintain a culture and climate where all are welcome and feel valued within the professional community.

In order to achieve this vision, we look toward **Goal 1: Culture & Climate of Inclusion** for guidance on building the foundation for this work:

> *We strive to develop a culture and climate within the IPS, and throughout its activities, where all community members experience a sense of belonging and engagement—a place where each individual's professional well-being and contributions are valued and supported through respectful, authentic, and positive interactions with other members.*

The first step to developing an inclusive culture and climate is to establish where we are as a community, where we have work to do, and what barriers currently exist that prevent people from fully participating in the organization and its work. To that end, a Culture and Climate Survey was created and distributed to planetarium professionals around the world in December 2020.

There exists much diversity in our planetarium community that extends beyond how a person appears to those around them. This diversity can never be truly understood or lived by an outside observer, but by learning about their unique experiences, ideas, and opinions through surveys like this one, we can begin to gain some insight into their lives.

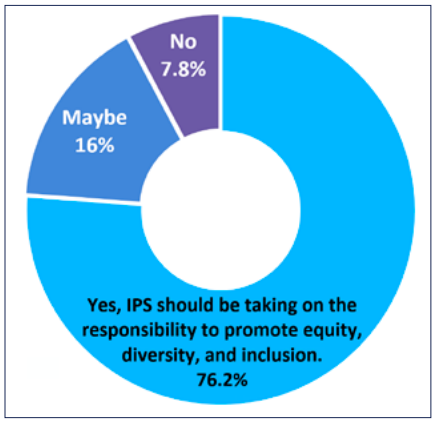
Therefore, one major goal of the survey was to determine and address barriers that prevent people from becoming IPS members. Therefore, the survey was open to all planetarians, regardless of their IPS membership status (active member, inactive/lapsed membership, or nonmember). The survey was advertised via the IPS email lists, the Facebook group Dome Dialogues, the listserv Dome-L, and through other communication platforms. In an effort to ensure participants were comfortable with the information they provided, none of the questions in the survey were required for a person

to participate in. Additionally, respondents were allowed to give more than one answer for questions where appropriate (such as for questions regarding race, languages spoken, etc.).

With support from IPS members, the survey was translated into 8 languages for better dissemination to the global community. The survey remained open for approximately 6 weeks. During that time, 361 responses were collected through the survey platform, Qualtrics. From these, there were approximately 250 completed surveys, as 111 responses were duplicates or the result of someone opening the survey and not answering any questions.

This survey was completed in an effort to establish where we are as a community, where we have work to do, and what barriers currently exist that stop people from fully participating in IPS and IPS-related projects and events. The intent of this report is to show the results, not to make recommendations of how to move forward or to offer interpretations of why we might see what we see; that work will come later as these results will be used to guide the EDI Committee and IPS Board over the next few years. As the IPS Inclusive Excellence plan is vast in scope, with many objectives that need guidance and prioritization, this information is invaluable. We also recognize that these results represent a snapshot in time, and that they can provide a basis against which we can measure any progress or change. The intention is to repeat this survey at some regular interval, perhaps every 3–5 years, which will allow the EDI Committee to identify any long-term trends in these areas.

Should the IPS be promoting Equity, Diversity, and Inclusion?



In the survey, respondents were asked the question "Do you think the IPS should be taking on the responsibility to promote equity, diversity, and inclusion?" in order to assess how members and potential members felt about the role IPS should be taking in equity, diversity, and inclusion work. Overall, a majority of respondents, 76.2%, felt that "yes," IPS should be taking on this responsibility, while another 16% thought that "maybe" it is the responsibility of IPS to take this on. The remaining 7.8% of respondents did not think it was IPS's responsibility to promote equity, diversity, and inclusion.

There were some notable differences between subgroups of respondents for this question. The most significant indicator of whether or not respondents thought IPS should be doing this work was the respondent's age. Respondents ages 70 or older answered in a much larger percentage that IPS should not be taking on this responsibility at about 30%, while 24.1% responded with "maybe." Therefore, less than half of respondents ages 70 or over thought it was IPS's responsibility to promote equity, diversity, and inclusion at 45.9%.

For respondents under the age of 45, the responses skewed in the opposite direction. For this subgroup, 86% responded that "yes," it is IPS's responsibility to promote equity, diversity, and inclusion. Less than 5% thought "no," it is not IPS's responsibility. Less than 10% responded that "maybe" it is IPS's responsibility.

Also, a much larger fraction of those in the Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, Intersex, or Asexual (LGBTQIA+) community feel it is our responsibility at almost 93%. The remaining 7% was evenly split between "no" and "maybe" responses. Additionally, women were more likely to respond with "yes," IPS should be taking on the responsibility to promote equity, diversity, and inclusion at 82% than "no" (approximately 3%).

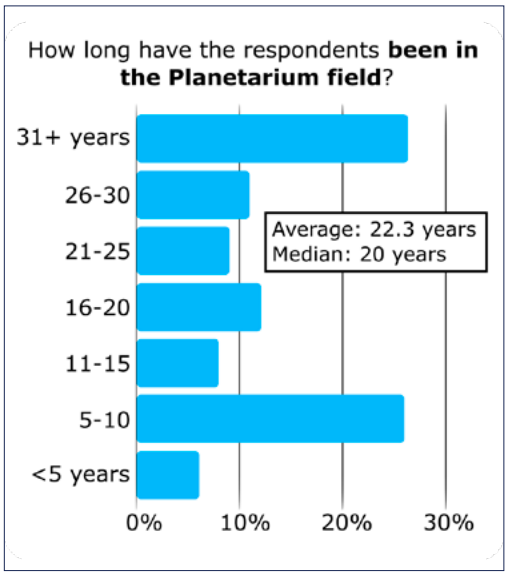
Below we offer examples of the types of questions that were asked in the survey and results from those questions. This is not a comprehensive representation of the report, but only a teaser for the complete report. The full report includes a demographic breakdown of who took the survey, a summary of question responses from the community as a whole, and a summary of question responses separated by select demographic subgroups.

The full report can be found at https://www.tinyurl.com/IPSCCSFullReport or through the IPS EDI Committee website at www.ips-planetarium.org/equity.

Report Sample: Demographics

We asked several questions about the respondent's demographics, including those relating to their age, race, gender, etc. We also asked demographic questions as they relate to the planetarium field, including IPS membership status, work environment, etc. We can see one result in the following example.

For this question, we asked how long a person has been in the planetarium field. This was a write-in response question. Some respondents estimated their time in the field (e.g., 30+ years or <1 year). In these cases, each response was rounded to the closest approximate number. For instance, if a person answered 30+ years, their response was processed as 31 years. If they answered <1 year, this was estimated at 1 year in the field. The results are as follows:



When broken down by

ranges, we see the most representative groups are those who have been in the field for 31 years or longer at 26.3%, followed closely by those who are relatively new to the field (5–10 years) at 25.9%. The average number of years in the field for respondents was 22.3 years and the median was 20 years.

Report Sample: Potential Barriers

We asked several questions regarding potential barriers to participating in IPS. One of the many ways for people to participate in the planetarium community is by attending and presenting at conferences. Therefore, we offer an example of the results as they relate to why people may not attend more IPS conferences.

The largest factors reported for why people do not attend IPS conferences are that the travel costs and that conference fees are too expensive at 18.5% and 39% respectively. Other responses of note are "I feel unwelcome or uncomfortable in some conference cities/countries" (3.9%), "I do not think it is worthwhile for me to attend" (3.6%), and "I do not feel comfortable communicating in English" (1.6%), which may identify areas of potential growth for the organization. The "other" category for barriers to conference participation includes responses that fall into existing groups such as financial or limited employer support, current status in the field (such as someone who is very new or who is retired), COVID-19 preventing travel, health concerns, or a personal preference. *(See Figure 1)*

We also do see barriers that are more prevalent for some groups over others. Those who are older in age, who are women, who have at least one disability, or who are Black, Indigenous, and People of Color (BIPOC) were more likely to respond saying the conference fees and travel fees are too expensive. Additionally, these same subgroups were more likely to say that their employers do not support them attending, or that they have professional obligations which prevent them from attending. For context, these subgroups have been historically excluded from education and professional environments. This historical exclusion has had some long-lasting effects, which may contribute to what we see here. Women and people with disabilities were also more likely to say that personal obligations prevent them from attending IPS conferences.

Additionally, those in the BIPOC community were more likely to say that they are not comfortable communicating in English at conferences. Those who feel unwelcome and uncomfortable in the IPS community are all either over 45 years old, members of the LGBTQIA+ community, or have at least one disability. LGBTQIA+ respondents are also more likely to feel unwelcome or uncomfortable with a conference host city. While these are not highly represented feelings, they are still present in our community.

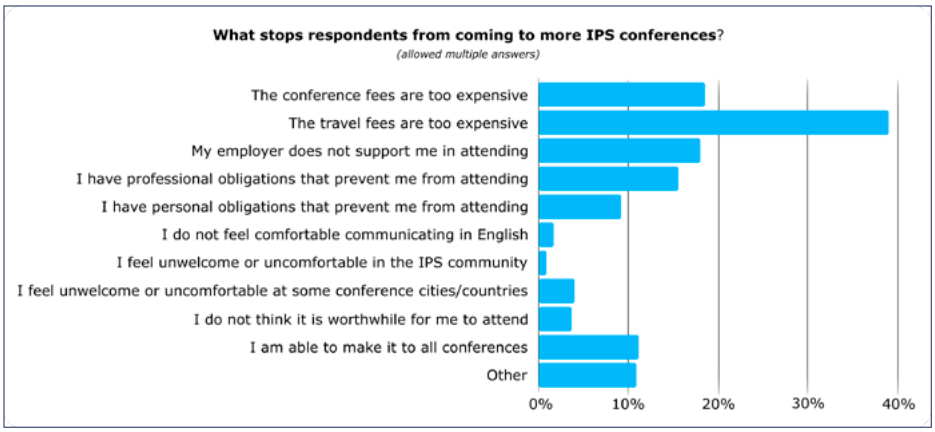


Figure 1

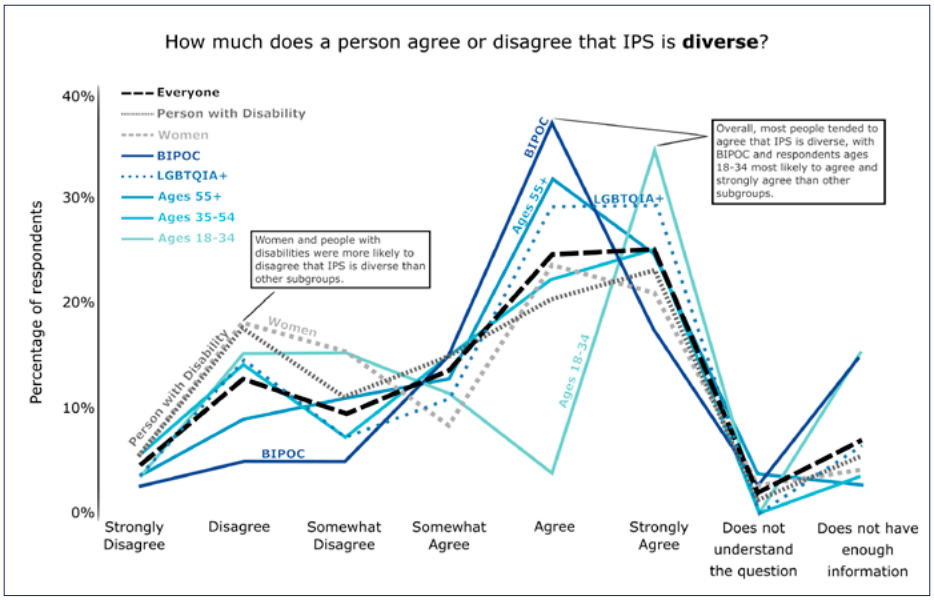


Figure 2

Report Samples: Opinions about IPS

We also asked many questions about the respondent's perception of IPS as an organization and as a community. To gather insight, we asked how much they agreed or disagreed that IPS possessed different traits such as ableist, anti-racist, ageist, diverse, etc. Additionally, we asked respondents to assess various questions as they relate to their own participation in the community (e.g. do they "feel valued by other members of the IPS community?," have they "considered leaving the planetarium field because [they] have felt isolated or unwelcome by the IPS community?," etc.). Here, we offer an example of both types of questions and the survey responses.

Is IPS Diverse?

This section addresses the overarching question of whether or not IPS is diverse. In the survey, it was left to the respondent

to decide what was meant by "diverse," as diversity can mean many different things to an individual. The overall trend was toward agreeing to some extent that IPS is diverse. However, the curve is rather flat, with a higher percentage of respondents disagreeing to some extent. BIPOC respondents were more likely to "agree" that IPS is diverse than "strongly agree" as compared with the full sample, and less likely to disagree on some level. Respondents ages 18–34, were more likely to "strongly agree" that IPS is diverse than other subgroups. Women and people with disabilities were more likely to "disagree" that IPS is diverse compared to other subgroups. *(See Figure 2)*

I have to work harder than others to be taken seriously in the IPS community

The responses here show a majority of respondents saying they "disagree" that they have to work harder to be taken seriously in the IPS community. However, there is not a lot of cohesion, perhaps suggesting that different subgroups of respondents have a lot of different experiences. For instance, the respondents ages 18-34 were most likely to "somewhat disagree," compared with the overall response, which was more likely to "disagree." LGBTQIA+ respondents and women were most likely to "somewhat agree" that they have to work harder than others to be taken seriously in the IPS community, with LGBTQIA+ respondents much more likely to respond with "somewhat agree" compared to women.

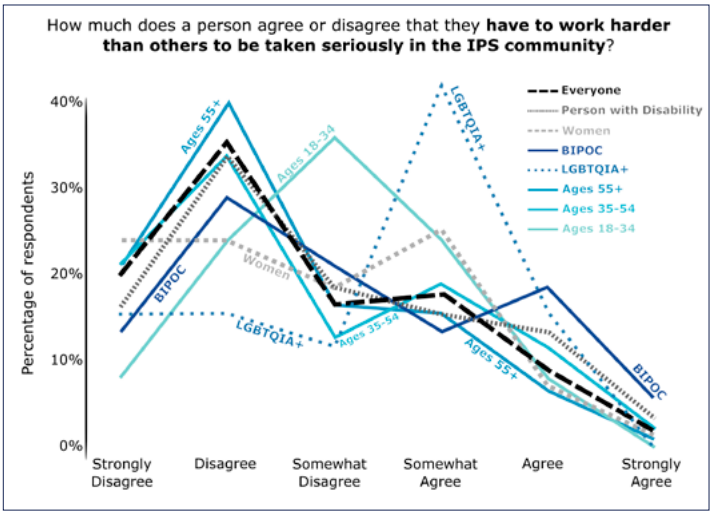


Figure 3

BIPOC were most likely to "agree" or "strongly agree" that they need to work harder to be taken seriously compared to other subgroups. *(See Figure 3)*

Read the full report for more information

We ask that you remember that this is just a sample of the results from the different types of questions asked in the larger survey. Please consider reading the full report online at *https://www.tinyurl.com/IPSCCSReport* or access it through the IPS EDI Committee website at *www.ips-planetarium.org/equity*.

SURFACE VS. VOLUME
GALAXIES

By Nico Koning & Wolfgang Steffen

Galaxies and their clusters are the largest units of the small-scale structure of the universe. Everything above that is considered the cosmic scale and is part of a network of interconnected filaments. This cosmic network of galaxies, according to current wisdom, is permeated by mysterious dark matter and dark energy.

Galaxies are at the focus of the fourth part of our series on surface and volumetric 3D models of astronomical objects for live presentations in planetariums. We will try to answer the question of how to overcome the flatness of image-mapped spiral galaxies and still achieve a high level of detail for close-up views as well as an authentic appearance of a particular galaxy.

Let us first have a look at how far we can get with 3D surface models using texture mapping.

A viable application of flat texture mapped galaxies is in animations of the large-scale structure of the universe where the camera quickly moves between myriads of galaxies. The idea of such a flight is to generate spatial awareness of the cosmic, large-scale structure of the universe as described above. That works pretty well. With a closer look, however, there are a few things that seem to be a bit off in this kind of visualisation.

While the camera is moving, the perspective towards individual galaxies usually doesn't change, even when you fly by. Furthermore, if you freeze such an animation and look around carefully, you are bound to find galaxies, especially among spirals, that look suspiciously alike.

The reason for these oddities is that the galaxies are, of course, flat images from a limited number of actual galaxies that have been mapped onto small, planar surfaces. They automatically maintain their orientation with respect to the camera, so they don't reveal their flat nature. Since the number of galaxy images is limited and the number of objects in the visualisation is much higher, each image is assigned many times. So, as long as you focus on the large-scale structure and keep your attention away from individual galaxies, using flat image mapping will do the job. The amount of data that would be needed to represent each galaxy with a more realistic volumetric model is, of course, prohibitive. Therefore, the approach of using planar galaxies with image mapping is currently the only practical way to do this. Since the focus is not on the details of the individual galaxies, this is a perfectly valid way to represent the large-scale structure of the universe.

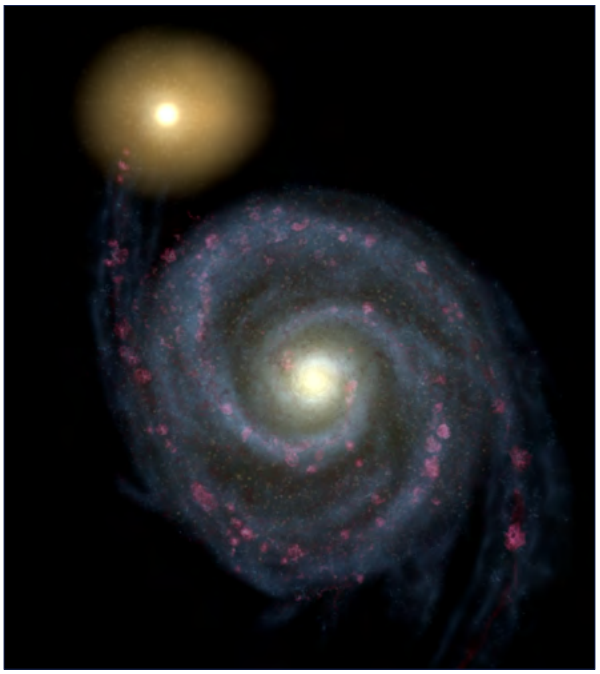


Figure 1: Volumetric model of the spiral galaxy Messier 51. *(Image: ilumbra.com).*

Revealing the 3D structure of an individual galaxy by flying around or into one requires a different approach than flat image mapping. Particles are a useful way to generate a large number of stars that make up galaxies. This is fine for elliptical galaxies, which usually don't contain much else other than stars. Spirals are, however, a different ball game altogether.

Spirals are complex, matter-recycling machines made of stars of a variety of types, luminous gas, and a lot of dark, light-absorbing dust. In these galaxies, gas and dust are converted into new stars. During their lives, i.e., while they generate energy from nuclear fusion, the stars turn light elements into heavier ones. Eventually, the new elements return, for the most part, to the interstellar medium as the raw material for the next generation of chemically enriched stars.

Wouldn't it be wonderful to visualise the evolution of a spiral galaxy in a timelapse over the lifetime of several generations of stars?

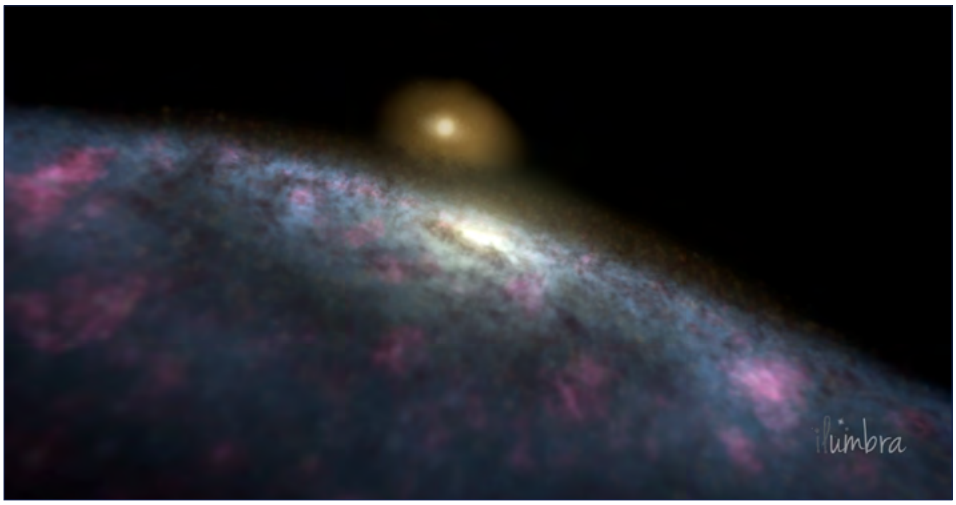
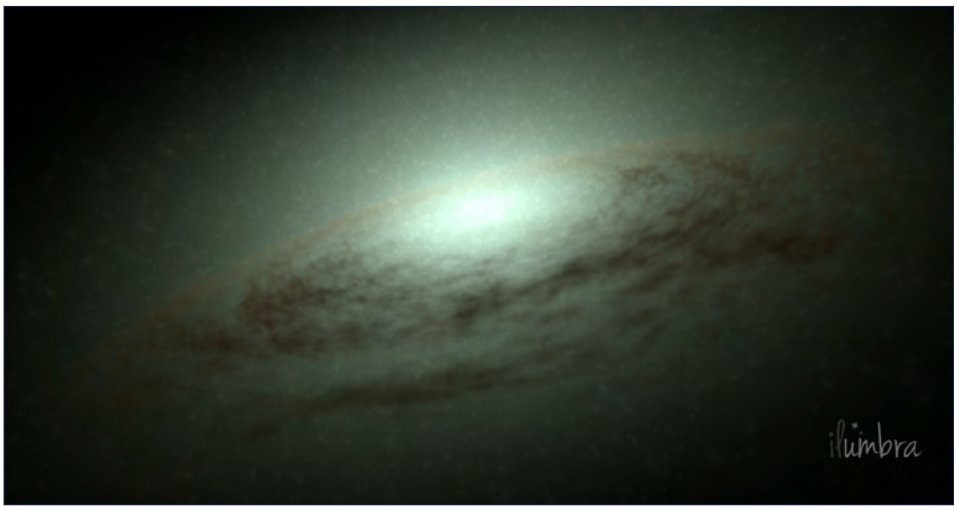


Figure 2 (above): The volumetric model of the spiral galaxy Messier 51 from a vantage point just above the galactic plane. **Figure 3 (below):** A generic volumetric model of an E0-type galaxy with a pronounced dust lane (*Both images: ilumbra.com*).



Someday! Wait for it. The prospect of that is very exciting. At ilumbra, we are always working with that long-term goal in mind.

Let's not get carried away with the wonderful physics of spiral galaxies and get back to the central issue of this article: surface versus volumetric models. A flat surface texture of a face-on galaxy on a plane in space just doesn't cut it. Try flying around it to look at it edge-on to see the dust lanes… good luck with that. One could generate a lenticular, 3D mesh, texture it with a face-on galaxy image, and blend it with a suitable texture for the edge-on view. This would still only show a sharp-edged lens-like object that won´t have the brightness tapering off away from the plane of the galaxy. Flying into such a model is not a good idea either, because it is empty inside.

So, while surface texture mapping works well enough for fly-through visualisations of the large-scale structure of the universe, it is unsuitable for the 3D-visualisation of individual galaxies.

In order to appreciate the amazing nature of spiral galaxies, detailed, volumetric, 3D models are in order. The challenges to obtain a satisfactory volumetric model are very different from those of expanding nebulae that we discussed in a previous article in this series. You will remember that, for those, spatially resolved spectroscopic velocity data is very useful to infer the structure along the line of sight. Such information is not very helpful for finding the structure of spiral galaxies, which are rotating around their centers.

So, how do we find the 3D structure of a particular galaxy? How accurate can we expect our result to be?

Spiral galaxies are kind of planar with optical-diameter-to-central-thickness ratios on the order of 5:1. The disk gradually gets thinner with distance from the center. Therefore, one's attention usually focuses on the "design" of the spiral structure itself rather than the stratification perpendicular to the plane of the disk.

This means that if we are building a model based on a galaxy that is observed face-on, the most salient features can be readily derived from a single image. Still, for a volumetric model, we need to provide the structure perpendicular to the plane, too.

There are a few general characteristics for the vertical disk structure. For instance, overall, the dust is more concentrated near the plane of the galaxy than the stars. This can be seen in edge-on pictures. The "scale-height" is a measure for the concentration of a given component (stars, dust, gas) near the plane. It is different for each component.

For a particular feature, such as a pink-glowing star forming region, it is difficult to determine whether it is located on the near or the far side, or how far from the galactic plane. However, since star-forming regions are associated with dense dust, they are also concentrated near the plane of the galaxy. If the dust is very dense and absorbs emission from the far side, we have no means of knowing what is behind it using optical observations. We then need infrared or radio observations to tell us whether there is something hidden behind the dust veil.

Observations using radiation with wavelengths longer than the optical (which can penetrate the dust) become even more important for galaxies that are more strongly tilted from face-on to appear edge-on. Then, the line of sight through the galaxy quickly becomes very large. Small features may then be anywhere along the line of sight, with the uncertainty on the order of the width of a spiral arm, or more. There is not much we can do to resolve this ambiguity based on conventional observations. For galaxies with angles of

(Continued on pg. 48)

CHARTING THE FUTURE
A CULMINATION OF WORK BY INDUSTRY LEGENDS

By Wendy M. Grant and Judith Rubin

In 2002, after 50 years of rising temperatures, a massive shelf of Antarctic Ice, known as Larsen B, developed cracks and fractures – and finally collapsed, dumping 3000 square kilometers of ice into the sea.

Credit: Cosm Studios (formerly Spitz Creative Media)

Atlas of a Changing Earth is the climax to a series of fulldome shows about our planet and the culmination of work by industry legends.

A new, immersive fulldome documentary, *Atlas of a Changing Earth*, shows how images from space are shedding new light on our planet's evolution in the wake of rising global temperatures. Released in October 2021, the show was directed by Thomas Lucas and is a co-production of the Advanced Visualization Lab at the National Center for Supercomputing Applications/ University of Illinois, Spitz Creative Media, NASA's Scientific Visualization Studio, and Thomas Lucas Productions. *Atlas of a Changing Earth* is being distributed by Cosm Studios and is available for booking now as a 24-minute fulldome show for planetariums, museums, and science centers. It will also be released as a 50-minute, 4K flat screen show for television and streaming distribution worldwide. Principal collaborators included Ohio State's Byrd Polar and Climate Research Center, University of Minnesota's Polar Geospatial Center, the University of Illinois Blue Waters Project, the National Geospatial-Intelligence Agency, and the National Science Foundation. Actress January LaVoy narrates the show.

About the Show

Scientists are now mapping every square meter of the planet in unprecedented detail, including remote polar regions in Antarctica and Greenland critical to Earth's climate. *Atlas of a Changing Earth* explores these efforts and takes viewers into the dynamic processes that are causing coastal glaciers to melt and sea levels to rise. Scientists now conclude that if the current pace of global warming continues, coastlines around the world will be inundated in the decades ahead.

The show reveals cutting-edge visuals that were produced by the confluence of new satellite mapping techniques and the power of supercomputer visualizations, revealing Earth—and its future—in ways that have never been seen before. Through these technological advancements, audiences are able to see what our planet may be like in just a few decades. Global temperature increases of just a few degrees and sea rise of only six feet would have devastating effects, making huge swaths of land uninhabitable and flooding entire cities around the world, from New York to Amsterdam and New Orleans to Shanghai. *Atlas of a Changing Earth* underscores that these risks of climate change are real...but they are not inevitable.

"This documentary is so timely and important," says Kalina Borkiewicz, director of the Advanced Visualization Lab (AVL) at the National Center for Supercomputing Applications (NCSA), University of Illinois, "because *Atlas of a Changing Earth* conveys the extent to which climate change has already altered the environment. But it also demonstrates that there is still time to act. Reducing greenhouse gas emissions now can protect polar ice sheets while slowing the floods, wildfires, and extreme weather events caused by climate change."

Donna Cox, director emerita of the AVL, says, "We want audiences to explore the questions that we raise. We want to engage them and inspire them to find solutions. Especially young audiences. After all, it's their future."

A Long and Productive Collaboration

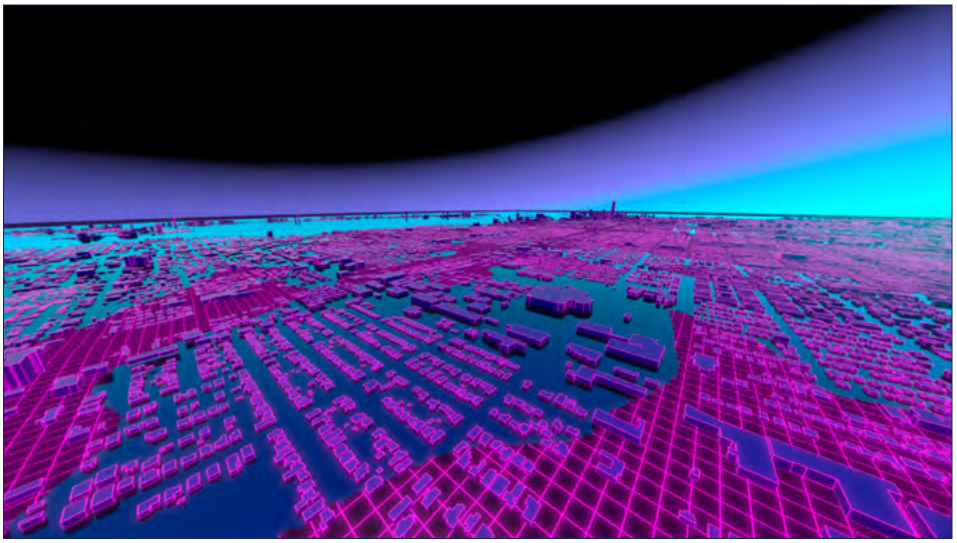
Atlas of a Changing Earth is the culmination of a series of highly successful fulldome shows about our planet directed by Lucas and produced by Cox and Robert Patterson of the AVL, and by Spitz, now operating under the Cosm umbrella. The team has been collaborating since 2005, and the three "Earth" titles began with *Dynamic Earth: Exploring Earth's Climate Engine* in 2012 and continued with *Birth of Planet Earth* in 2019. Those two shows have

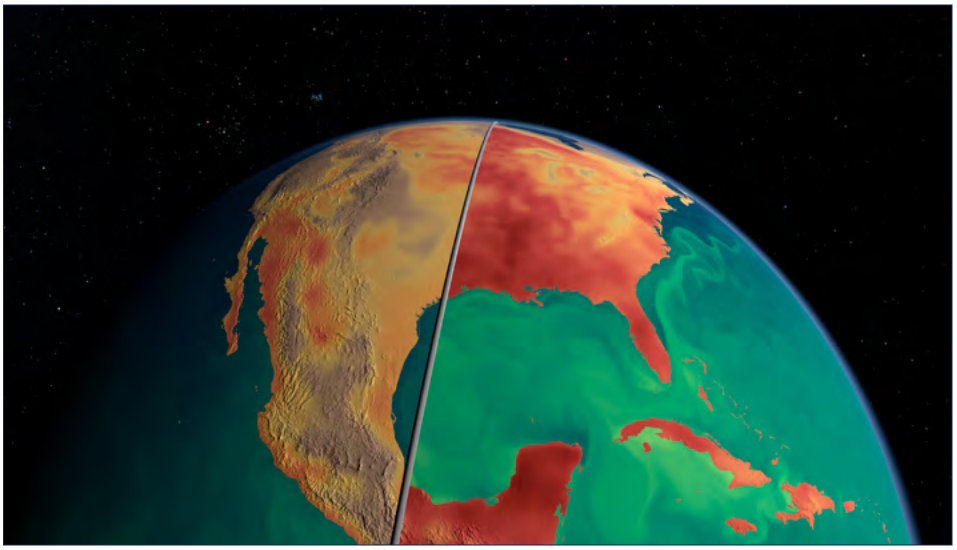
been seen by hundreds of thousands of viewers in theaters and planetaria around the world. Both have won multiple awards and *Atlas of a Changing Earth* is already following in its predecessors' award-winning footsteps, taking the title of Best Environmental Film at Dome Fest West in 2021.

The three shows also connect thematically. "For each of them, we sought to convey the view of Earth as a planetary climate system," explains Lucas. "Earth has its ocean systems, tectonic systems, its atmosphere, and relation to the sun that have turned it into a habitable place. The particular and rare circumstances of Earth generated life."

"*Dynamic Earth* introduced the idea of Earth's climate engine and explored how humans are releasing carbon into the atmosphere and how that is a driver for climate change," says Brad Thompson, who served as animation director and CG supervisor for Spitz Creative Media during the production of the series. "*Birth of Planet Earth* goes way back in time and talks about how Earth itself was formed, and also how this amazing series of unlikely events led to life on Earth. It asks the viewer to consider how special—and possibly unique—our place in the universe is. *Atlas of a Changing Earth* builds upon that by illustrating how fragile our position in the universe is and talks about this huge challenge that civilization is facing with climate change."

Both Lucas and Cox say that this final film in the series was born out of their longtime collaboration with one another and with media director Mike Bruno of Spitz (now retired). "Human beings have always tried to understand the world through maps," Cox says. "There's a mapping revolution going on, because supercomputers can now process massive amounts of stereo satellite data to make dynamic maps showing rapid changes on the Earth." The AVL has been involved with making maps for decades; Cox and AVL cofounder Robert Patterson created the first dynamic data-driven map to visualize a major part of the internet when it was still in its infancy. "So that's in our DNA at the AVL," she says, "to create visualizations that help people understand the future."





Above: As this visualization demonstrates, rising sea levels are threatening to render coastal cities, such Miami, Amsterdam, and New Orleans, uninhabitable. *Credit: Cosm Studios (formerly Spitz Creative Media);* **Below:** If greenhouse gas emissions continue to increase unchecked, predicted temperatures on a late-spring day in 2100 (at right) are much warmer than on a similar day in 2000 (at left), especially over land. *Credit: High-Resolution Community Earth System Model v1.3 Timeslice Simulation of Years 2000 and 2100 by Susan Bates, Nan A. Rosenbloom, et al., National Center for Atmospheric Research. Visualization by Advanced Visualization Lab, NCSA, University of Illinois*

Satellites and Supercomputers

In early 2019, Cox saw a compelling story in the marriage of satellite data and supercomputers, and she set up a meeting for Lucas with William Kramer, director of the supercomputer Blue Waters for the NCSA. After that meeting, Lucas knew Cox was right. "I said, 'This is going to be a show about climate change and a revolution in cartography that is illuminating change in all sorts of ways,'" he recalls. "That was the vision we came up with initially, and then we narrowed it down to the North and South Poles and used that to frame our story."

From there, Lucas says, the AVL team, led by Cox, went to work to understand what they could do with the data. Lucas notes, "It's not as simple as pulling data into some visualization software. It's extensive programming. They are deeply committed to visualizing science in cinematic ways to reach viewers. The images have to be truly 3D and handled with a degree of artistry."

Cox agrees, saying, "The challenge was converting the data without artifacts and rendering it in a beautiful, production-quality way for such a high-

Typhoons on July 9th, 2015, caused flooding and power outages in the western Pacific basin. Over 1 million people were evacuated. *Credit: Himawari-8 Satellite imagery provided by the Japan Meteorological Agency. Visualization by Advanced Visualization Lab, NCSA, University of Illinois*

resolution environment as fulldome." The elevation data was like a dynamic jigsaw puzzle of images, she says.

Patterson explains, "It's not just one big image. There were thousands of elevation images processed on a supercomputer from thousands of stereoscopic satellite images. We blended these over time to visualize an evolving mosaic map of the entire Arctic."

Borkiewicz, who was senior research programmer at the time of *Atlas of a Changing Earth*'s production, adds, "Each data set comes in a different data format and different coordinate system. Getting them all to work together in a 3D environment in one piece of software requires a lot of customization, data wrangling, and writing custom tools."

The result, says Patterson, allows audiences to see change on a global scale, over time. "You see these dynamic, topological timelapses happening, sweeping over many years. They are amazing scenes," he says.

Production During a Pandemic

While the AVL tackled bringing the scientific data to life and Lucas honed the script, which evolved in tandem with the images, Thompson and his team were working on their end to recreate real-life places through computer graphics. Thompson says, "We had planned a trip to Florida and to Greenland to shoot melting ice and glaciers. But that was during the height of the pandemic and there was no traveling. So, we opted to do all of the shots in CG. That was a fun challenge."

COVID brought additional obstacles to the production and necessitated changes in workflow. "Normally, my team works in a dome," shares Thompson. "But with *Atlas of a Changing Earth*, it was different because of COVID. Everyone was working from home. I developed a virtual-reality application that is like a virtual planetarium. We loaded our shots into that and looked at them on a virtual dome. That was hugely helpful."

Working from home also presented challenges for Cox's team. "We are a very close, collaborative team. Our work truly is a team effort," says Cox. Normally the AVL team members drop into each other's offices to ask questions or review footage and they regularly hold standup meetings to resolve problems. But starting on March 13, 2020, they were forced to work remotely, and the team members took their equipment home, along with terabytes of data. Cox recalls, "I couldn't just pop over to Kalina's office, but we managed. We had meetings at 9 a.m. every day. And we had regular producer meetings with Mike Bruno in Philadelphia and Tom Lucas in New York."

Cox says that during the pandemic, the AVL team found inspiration in their work on *Atlas of a Changing Earth*. She elaborates, "We were putting in long hours and we were very passionate about this project. And we realized that we were working on conveying the present and the future of climate change. The current effects of COVID will pale in comparison to what we are facing with our changing Earth. Through this show, we would be sending out a message to the world, of real images and real science that is undeniable."

A Career Capstone

Cox also knew that this would be the last time she and Patterson would work with Lucas, Bruno, and Thompson. Cox had been with the University of Illinois for 36 years; Patterson had worked for the university for nearly as long, for 32 years. The two are life partners, and they had decided to retire together. Cox says, "To me, working on this show was fitting at the end of my career. Earlier in my career, we looked at holes in the ozone layer and there was a political banning of fluorocarbon aerosols. That made a change, and that was back in 1979. Today we have even more of a crisis. I'm hoping *Atlas of a Changing Earth* will be a catalyst for positive change."

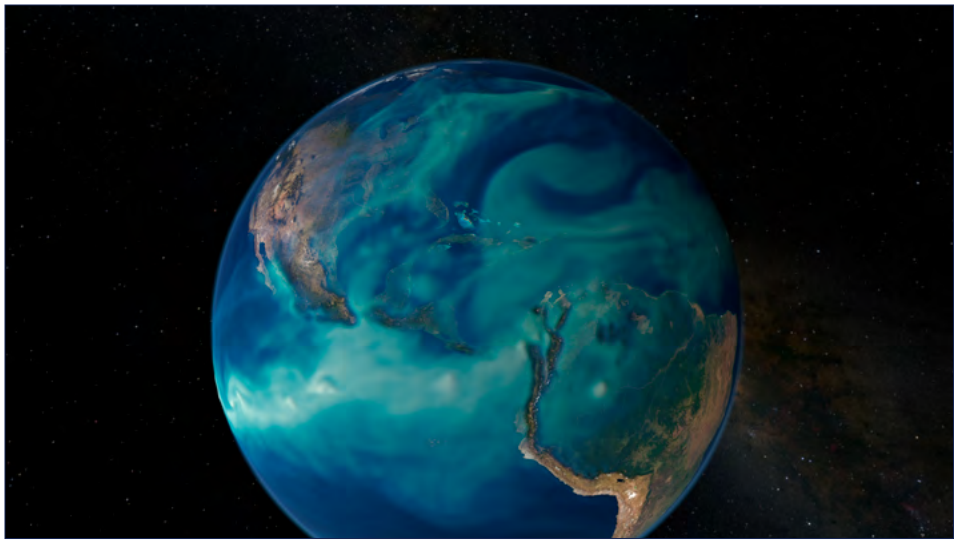
Patterson adds, "Hopefully it casts a ray of hope that we can do something."

Additionally, Bruno retired after a 39-year career with Spitz once *Atlas of a Changing Earth* was finished. Thompson says, "Mike Bruno was my boss for 24 years, and a hugely important mentor to me. Spitz will continue to do great things, and this will be part of his considerable legacy in the planetarium industry."

Spitz Creative Media itself has gone through recent changes. Spitz, Inc., and Evans & Sutherland were acquired by Cosm in 2020. The Spitz Creative Media and Evans & Sutherland production teams have combined forces to form Cosm Studios. The full Spitz and E&S catalog of content and their rich legacy of science education provides the foundation of a very bright future with new fulldome and planetarium productions.

Looking Ahead

Cosm Studios promises to continue to create quality, science-focused content. Their latest production, Oasis in Space, which they worked on in tandem with



With a warming climate, rising temperatures increase evaporation, implying more extreme rainfall events and greater storm intensity. Cloudlike haze represents precipitable moisture in the atmosphere, in late April of 2100, simulated under the assumption that global greenhouse gas emissions continue to increase unchecked.
Credit: High-Resolution Community Earth System Model v1.3 Timeslice Simulation of Years 2000 and 2100 by Susan Bates, Nan A Rosenbloom et al, National Center for Atmospheric Research; Visualization by Advanced Visualization Lab, NCSA, University of Illinois

Atlas of a Changing Earth, is slated for release this month. Thompson has a long relationship with this show. He explains, "It's one of our most popular solar system shows. It started as a traditional planetarium multimedia show. When I started at Spitz in 1997, one of my first tasks was to remake it for panoramic video. Then we remade it again for fulldome in 2002. Now, twenty years later, we've completely redone Oasis in Space again. It uses the same script with updated science and all new visuals that are stunningly beautiful and meet today's expectations."

Additional content is in production, though details aren't yet available. But Thompson promises, "We're working on some really cool stuff for Cosm Studios."

The AVL's work will also continue. Borkiewicz says the team has ideas for future planetarium shows. "Currently, we are working on a flat-screen, black hole visualization of data from recent Nobel laureate Andrea Ghez," she shares.

Meanwhile, the flat-screen, 50-minute version of *Atlas of a Changing Earth* is in production. Lucas notes that it will have additional sequences and expanded information. "We really have a chance to inspire people," says Lucas. "We want to reach as wide of an audience as possible."

Engaging the Next Generation

The fulldome show is reaching audiences across the country. Taylor Planetarium director J. Eric Loberg booked *Atlas of a Changing Earth* to pair with the exhibit "Environmental Impact II" at Museum of the Rockies. He says, "We were excited to present a new Spitz show. They have consistently had both excellent visuals and audio, backed with strong science. This show was a perfect, up-to-date, well-cited production that allows us to show our audience the worldwide changes that can be felt locally but are better visually observed at a global scale." Loberg also notes that the show will meet science standards for years to come.

Sally Brummel, planetarium manager at the Bell Museum in Minnesota, also booked it. She says, "We are incorporating content from many new disciplines into our planetarium programming, and the immersive nature of the dome makes it the ideal place for our visitors to experience the effects of climate change on a global scale."

"We licensed *Atlas of a Changing Earth* mainly for our geosciences courses and our high school earth science classes," notes Joseph Eakin, technical director of the Ho Tung Visualization Lab and Planetarium in New York. "Students, teachers, and our professors love the science data visualizations, which are based on actual science datasets. It's an absolute gem of a show," he says.

Lucas, and the rest of the team that created *Atlas of a Changing Earth*, hopes that more domes and planetaria will book the show and that it will make a positive impact on audiences. The entire Earth series: *Dynamic Earth*, *Birth of Planet Earth*, and *Atlas of a Changing Earth*, is available for booking through Cosm Studios.

Lucas says, "A planetarium show can reach people in a different way. They can help a kid see the world, see the universe in a different way. They might choose a career because of it."

"We're always hoping we're inspiring new generations of scientists," adds Patterson.

One of the show's biggest takeaways is that we are all connected to each other through our planet's environmental systems. *Atlas of a Changing Earth* aims to inspire audiences to help preserve the world that nurtures us all.

Additional AVL team members who worked on *Atlas of a Changing Earth* are Stuart Levy, Jeff Carpenter, and AJ Christensen (now at NASA-SVS).

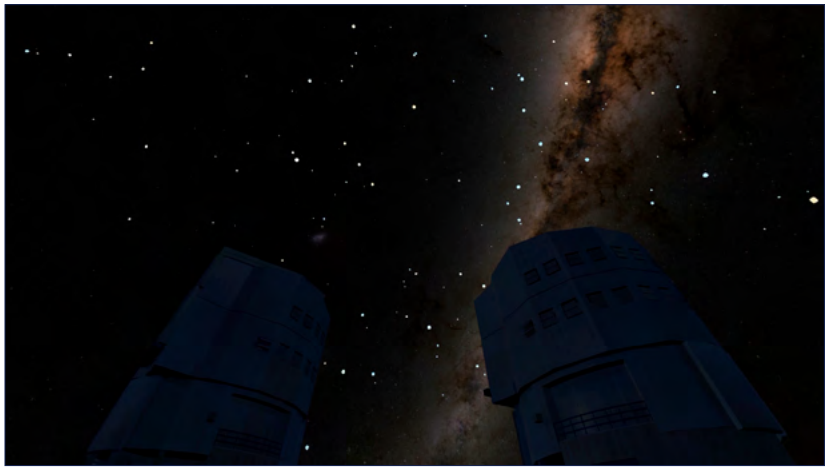
The AVL team collaborated with Paul Morin of the Polar Geospatial Center and Ian Howatt of the Byrd Polar and Climate Research Center on the selection and treatment of the data for the close-up regions that are visited in the show. The main Arctic data came from the ArcticDEM project, and the Antarctic data came from the REMA project. More information can be found at: *https://www.pgc.umn.edu/data/arcticdem/ and https://www.pgc.umn.edu/data/rema/*.

Additionally, the team worked with Susan Bates and Nan Rosenbloom of the National Center for Atmospheric Science to visualize their high-resolution time-slice climate model to compare the year 2000 with the projected year 2100. This simulation was computed on NCSA's Blue Water supercomputer, as were all of the AVL's visualizations.

AUDIO UNIVERSE:

A MORE ACCESSIBLE APPROACH TO CREATING SHOWS

By Dr. Chris Harrison & Theofanis Matsopoulos



Top: A still from the show. Above left: Chris Harrison of Newcastle University. Above right: Theofanis Matsopoulos, planetarium producer. *Credits: Audio Universe project.*

Nearly the entire Universe is invisible to the unaided human eye here on Earth. The light produced by most celestial objects is just too faint or is outside of the visible part of the electromagnetic spectrum. When we consider that most of the Universe is made up of non-light producing dark matter and dark energy, we really can not learn much from simply 'looking' at the Universe. Nonetheless, we almost entirely present Astronomy, for both research and for communication, using visual approaches. Importantly, this also means that now only are we underusing our multi-sensory abilities, we are placing barriers to accessing Astronomy knowledge for people who are blind or sight impaired.

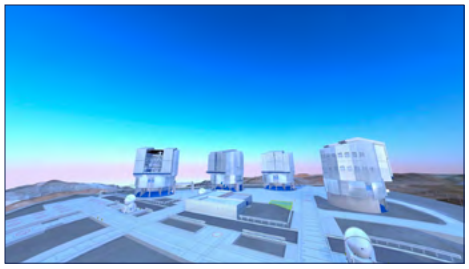
Moving beyond standard visual approaches, our new project '*Audio Universe*' (*www.audiouniverse.org*) - launched in December 2021 - is investigating how we can communicate Astronomical data and concepts through sound. Our goals are to: (1) enhance scientific discovery for research and (2) to make Astronomy more accessible to people who have a sight impairment or to people who simply prefer to learn with aural formats. We celebrated our project launch by releasing our first audio-centered planetarium show: 'Audio Universe: Tour of the Solar System'. Here we describe the concept behind, and the design approach, to producing the show.

Concept to the design and the team

We set out to create a planetarium show about the Solar System, suitable for upper elementary school or lower high school children (and their families) that was accessible to people with little or no vision. The fundamental principle was that the show should be fully understandable and enjoyable from the sound-track alone. Therefore, we wanted the objects and concepts being discussed to be represented through sounds and to be described with clear and comprehensive narration. We took the unusual approach of designing and creating the sound track first. A professional planetarium producer, Theofanis Matsopoulos, added the visuals that were required to be perfectly timed to the sound track.

Crucially, we had focus groups of sight impaired adults and children, as well as qualified teachers of visually impaired children, to work with us throughout the design process. Furthermore, a core member of our team, Dr Nic Bonne, is an Astronomer who has had a severe sight impairment since birth. Due to the importance of the sounds and creating a musically pleasing audio track we also enrolled a composer, Dr Leigh Harrison, to provide advice throughout the whole design stages. The final core team member was Dr James Trayford, an Astronomer, who has created a computer code that we used to create the sound representations of celestial objects and concepts.

The story-telling framework for Audio Universe Tour of the Solar System, is that the audience are located inside a spacecraft that will take them on their tour. There are two narrators: (1) the captain of the ship and (2) the expert tour guide, who is a real-life blind Astronomer Dr Nic Bonne (replaced by Dr Enrique Perez-Montero in the Spanish



A still from the show. *Credit: Audio Universe project.*

version). This spacecraft is fitted with a special 'sonification' machine that turns the light it detects into sound.

Application of Sonification

Sonification is the process of turning data into sound. For the show, we applied Dr Trayford's sonification code, STRAUSS (github.com/james-trayford/strauss), in various ways. For example, we created a sequence where the audience listens to the stars appear above the Paranal Observatory in Chile. Each star (based on the real data), is assigned a musical pitch based on its color, where bluer notes have higher pitches and redder stars have lower pitches. In the sequence, the notes of the brighter stars are heard first and the fainter stars later to represent how the stars appear to the naked eye after sunset. The STRAUSS code also calculates how much volume should appear in each speaker in a 5.1 surround sound system, so that the stars behind the audience sound in the rear speakers etc.

In another sequence, the audience listens to the planets orbit around the Sun. The relative orbital speeds of the planets are used to create sounds that move at different speeds around the planetarium's speakers. Each planet is also represented by a musical note, with the higher notes representing the less massive planets and vice versa. Furthermore, rocky planets are represented by woodwind instruments and gas giants by brass instruments to convey the concept of these two different groups of planets. All of these choices were carefully made to both communicate the properties and characters of the planets, whilst also ensuring an overall musically pleasing result when the notes representing all of the planets were played together.

Next steps

Our sonification code 'STRAUSS' is open source and is extremely flexible. It can create synthesized sounds based on input data or it can manipulate pre-recorded audio samples based on input data. These sounds can be moved into different locations on an artificial sphere, and the output can then be projected into standard speaker set-ups (e.g., stereo and 5.1). Therefore, there is a huge potential for both creating new planetarium shows covering different topics as well as applications for research purposes of analyzing data. We are currently exploring both of these applications in our ongoing work.

More broadly, we encourage the community to consider how they can utilize sound in new planetarium shows in a more meaningful way (i.e., beyond

FORWARD!
TO THE MOON

Join the adventure as Fiske Planetarium and Tend Studio take you FORWARD! To the Moon

FORWARD! To The Moon, a feature length planetarium film featuring narration by Kari Byron from Crash Test World and MythBusters, launches us on a journey beyond the Earth towards a sustainable future in space.

BOULDER, CO – FORWARD! To the Moon, a new feature length planetarium film by Fiske Planetarium at University of Colorado Boulder and Tend Studio makes its VIP Premiere Wednesday at Fiske. FORWARD! explores NASA's 21st century Artemis program, named after the Greek moon Goddess and twin of Apollo, and its next steps in our mission to explore the universe. Fiske and Tend are proud to share FORWARD! To the Moon with the community and with planetariums around the world, beginning later this month. Check the Fiske website for updates on showtimes. The film is accessible to all ages, with a goal of attracting NASA's Artemis generation to pursue careers in space exploration.

Tend Studio weaves over 51,000 4K frames of full dome 3D animated and live action footage to bring the Artemis program to life. Kari Byron of Crash Test World and MythBusters narrates the 25 minute adventure. Featuring a custom music score by Ryan Lofty of Future Vega, FORWARD! takes viewers on a journey through astronaut training, to launch, to the moon and beyond, exploring new frontiers in space. The film has been executive produced by a team from Fiske led by Dr. Jack Burns, with support and consultation from Lockheed Martin, NASA, JPL / Caltech, NESS, Smithsonian National Air & Space Museum, Astrobotic and Deep Space Systems.

"Creating FORWARD! To the Moon during the pandemic has been one of the most challenging, mind bending endeavors of my life. I've learned more than I ever thought possible about space, about patience, and about creating photo real planetarium animations." says Tom Ludlow, Tend Studio Founder and Creative Director. "I've loved immersing myself in this out-of this-world project. I often tell people that at Tend, we've been taking space walks, but we're home in time for dinner. It's exciting to get to share our two-year 'moon mission' with the world."

FORWARD! To the Moon is available in 4K HEVC, 2K, 1K , 4K VR and 4K Domemaster format. To request a planetarium show for your facility, please complete this request form.

Tend Studio

Tend Studio is a Longmont, CO based motion design & video production studio, creating high impact cultivated content: 2D & 3D animated ads, compelling videos, and unforgettable experiences. Forward! To The Moon is Tend's first (but hopefully not last) planetarium film.

Fiske Planetarium

Located on the University of Colorado Boulder campus, Fiske Planetarium has been showing a diverse range of fulldome films, star talks, live talks, laser and liquid sky shows, concerts, and special live events since 1975.

CONTACT:

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Studio Manager, Tend Studio
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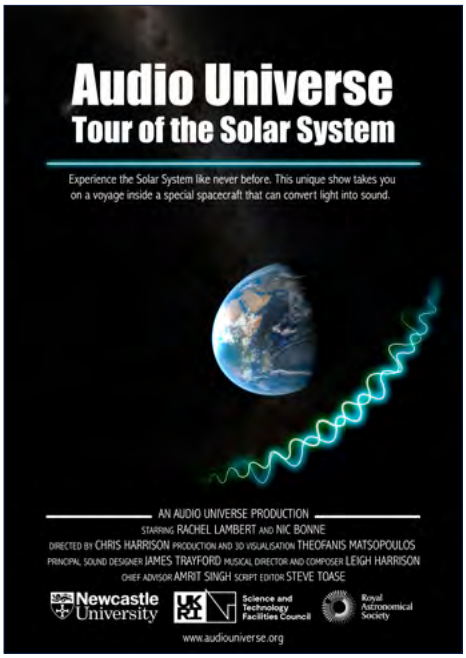
Audio Universe (con't.)



simply using sound effects and musical soundtracks). As well as making the show more accessible to members of the sight impaired community, this will lead to a more rich and engaging multi-sensory experience for all of our audiences.

Accessing the show and acknowledgements

The 4K full-dome version (with a 5.1 soundtrack) of the show can be downloaded, for free, from the European Southern Observatory's archives (*www.eso.org/public/videos/au-totss-fulldome/*). A flat screen version can also be downloaded (*www.eso.org/public/videos/au-totss/*), or simply watched on YouTube (*www.youtube.com/channel/UCAmThCYWuORVPasrV6Z1Kog*). Currently English, Spanish and Italian versions are available, with Japanese and German versions being prepared. Audio Universe Tour of the Solar System was part-funded by grants from both the Science and Technology Facilities Council and the Royal Astronomical Society.

Audio Universe YouTube channel: *https://www.youtube.com/channel/UCAmThCYWuORVPasrV6Z1Kog/videos*

IMMERSIVE MATTERS
EXPANDING OUR IMMERSIVE REACH

Carolyn Collins Peterson
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By now, most of us in the field of immersive content and performance have accepted a series of pandemic-related paradigm shifts and learned to work around them as best we can. The world at large continues (as of this writing) to grapple with successive waves of pandemic-related shutdowns, or, at the very least, curtailments of activities in order to emphasize safety and good health. Immersive venues are certainly part of that mix, and the opening weeks of 2022 continue to see careful openings, schedule changes, and even a few more shutdowns among all levels of theaters. That will likely continue to be the outlook for our communities for some time to come. The good news is that we've all learned to deal with the uncertainties and move ahead.

For IMERSA, the year 2021 saw a series of successful online IMERSA Days continue. We're very pleased with the results of those events, and 2022 promises more of our online "virtual" get-togethers. Our current plans are to offer a virtual event every two months, focused on some special aspect of the immersive experience. We are also planning to offer a virtual IMERSA presence at the upcoming IPS meeting in St. Petersburg, Russia. In addition, if all goes well, the autumn of 2022 will see us involved in a pair of "in-person" live events.

IMERSA Days Finales for 2021

We rounded out 2021 with a pair of virtual IMERSA Days that brought dozens of attendees together on Zoom to explore some special subjects. The first was a "mini" version of the very successful Dome Fest West event that occurred last October. IMERSA invited several speakers to summarize their DFW presentations on the November 19th IMERSA Day. Joining the team were Ryan Moore, Michael Daut, Carolyn Collins Petersen, Kate McCallum, Will Nix, Mike Smail, Dayna Thompson, Michael McConville, Eric Hanson, Ed Lantz, Brett Leonard, Jenni Ogden, and Hilary McVicker.

Panelists, hosted by Michael Daut, gathered to share their insights into fulldome and immersive content and its audience effectiveness during the November virtual IMERSA Day. The panel featured speakers from the entertainment community, dome producers, and live-performance artists.

This "speed dating" encapsulation of the Dome Fest West event featured four seminal sessions. The first was *The Potential of Immersive Storytelling in a Transmedia Age* in which Carolyn, Kate, and Will explored the distribution landscape (specifically, what theaters want and have been licensing), a dive into the essence of transmedia (storytelling across multiple platforms beyond just fulldome including companion programs, VR experiences, merchandise, etc.), and finally, a look at social impact entertainment, which has intentionality about broadening horizons to bring audiences a deeper understanding of key issues in our society through themes in fulldome stories.

The next session was *Masters of the Universe*, in which Mike, Dayna, and Michael McConville explored how planetariums have been expanding beyond space science programming through innovative, live experiences and collaborations between departments on college campuses.

In the next session, *Virtual Production Tools for Immersive Media*, Eric Hanson shared short presentations from industry innovators who are developing and using new tools to create virtual environments, create 360º live-action video performance capture, and apply clever photographic techniques to create spectacular new experiences for the dome.

Finally, in *The Future of Immersive Venues*, Ed, Brett, Jenni, and Hilary explored ways that immersive venues can extend the power of fulldome into extended immersive experiences such as domeplexes, location-based immersive venues, interactive immersion with XR components, and even immersive emotional healing centers.

This event was a powerful look at the future and potential of the immersive fulldome format over the next five to ten years.

Immersive Audio in Depth

On December 3, 2021, IMERSA hosted its last virtual IMERSA Day of the year and celebrated the topic of "Sound in Immersive Spaces: An Exploration of Immersive Audio Design." Monica Bolles moderated this fast-paced, in-depth look at techniques and technology for the best sound in immersive spaces. She was joined by Jean-Pascal Beaudoin (Headspace Studios), Mourad Bennacer (The Société des Arts Technologiques), Pierre Brand (Primetime Studios), and Ana Monte (Delta Sound

IMERSA's final virtual day of 2021 featured host Monica Bolles (middle row, center) and a panel of audio experts, including Jean-Pascal Beaudoin (middle left), Mourad Bennacer (middle right), Ana Montes (lower left) and Pierre Brand (lower right). They shared insights into the audio projects they've produced and best practices for immersive audio.

Labs). The panelists brought their unique perspectives and diverse approaches to the topic of spatial audio production and the challenges of creating and mixing content for extended reality (XR), virtual reality (VR), and fulldome spaces.

The panel focused on discussing some of the different approaches that audio designers, artists, and engineers take when creating content for different dome audio configurations, and VR and XR environments. There are currently a number of challenges, particularly since there are currently no standards in place. In addition, different skillsets are needed to create audio content for different immersive environments. In the end, the conversation held the promise of future discussions, especially as the industry continues to push forward and explore what the future holds for immersive audio. Please look for an upcoming survey that Monica and her team are coordinating about your current audio practices and future immersive sound goals.

DomeFest West Rides Again in 2022!

Dome Fest West is an immersive dome film festival and conference taking place in Los Angeles, California on September 29 - October 2, 2022. The first one was held jointly with IMERSA in October 2021, and we will be involved again this year. This year's event will bring together the immersive dome community again with Hollywood's up-and-coming content creators! It is a great way to share immersive experiences within the dome space between a wide range of producers and directors.

This year Dome Fest West is accepting entries for the Best Live Experience. Entries may include theatrical shows, VJ/DJ performances, audience interactive productions, and more. One or more Live Experience entrants may be selected to perform at Dome Fest West.

Dome Fest West itself will be a four-day event that includes dome film screenings, technology presentations, industry panels, exclusive parties, and interactive workshops. Immersive creators from across the globe will have a chance to watch the most cutting-edge experiences and programs, learn from the best producers in the entertainment industry, and ultimately take immersive dome content to another level.

Key dates for Dome Fest West content submissions are:

- January 17, 2022 – Submissions Open
- March 25, 2022 - Early bird Deadline
- June 10, 2022 - Regular Deadline
- July 1, 2022 - Late Deadline
- July 22, 2022 – Final Extended Deadline
- August 15, 2022 - Notification Date
- September 29 – October 2, 2022 – Dome Fest West happens!

Submissions are being collected through FilmFreeway at *https://filmfreeway.com/DomeFestWest*. More information about the event is available at *DomeFestWest.com*

In-Person in Montréal

We are deep into the planning for our first "in-person" IMERSA Summit since 2019. It will be held in Montréal, Canada, from October 14th through 18th and will be hosted by IMERSA, Planétarium Rio Tinto Alcan, and the Société des Arts Technologiques. We are currently working with the local hosts on programming for the event. We are assembling a series of exciting panels and immersive content and will welcome participants in our vendor Expo. More details will be posted on the IMERSA.org website as they become available.

Our Advisory Council Grows

We are pleased to announce the appointment of Ryan Moore, an immersive producer at Experience 360 in Los Angeles and executive director and co-founder of Dome Fest West, to our Advisory Council. He brings tremendous filmmaking experience to the council and offers a link to the West Coast creative community. Ryan's work in spherical, ultra-high-definition 360° media for VR brings an added dimension to IMERSA's pool of advisory talent.

Join IMERSA

IMERSA membership is open to anyone with an interest in immersive content in domes, AR, and VR, whether live or pre-recorded. Dues-paying members are welcome to attend our virtual events free of charge and have access to recordings of past get-togethers. If you are involved in any aspect of the immersive theater or content production/performance experience, please consider joining IMERSA. Details about membership are available on our website at *IMERSA.org*.

Many thanks to Michael Daut, Dan Neafus, Monica Bolles, Ryan Moore, and Ryan Wyatt for their contributions to this column.

Carolyn Collins Petersen is CEO of Loch Ness Productions and member of the IMERSA board of directors. She can be reached at *carolyn@IMERSA.org* or *carolyn@lochnessproductions.com*

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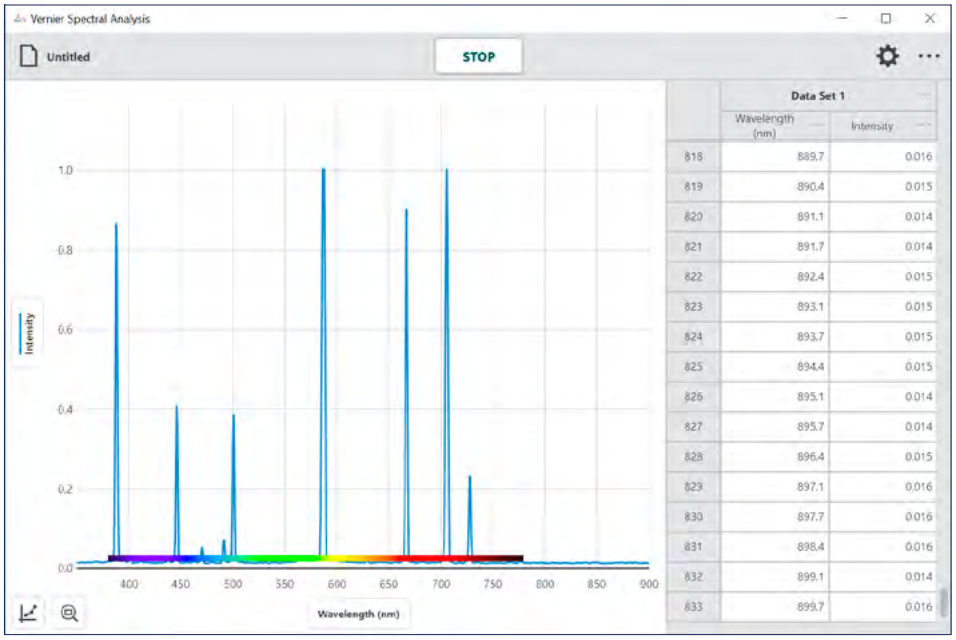
UNDER THE CLASSDOME

WHAT'S THE CATCH?

At the end of the last *Under the ClassDome* column, I told you that I was working on figuring out how to incorporate the best parts of my virtual lessons as I went through each one with the kids IN the planetarium this year. The Chemistry Spectrum Lab was going to be coming soon, and I wanted to use the spectrometer that I had used with the virtual lab. Well, the teachers that visited me for that chemistry lab were all so happy to have their kids be able to visit the planetarium at all that they didn't seem to care if I modified the lab from the "before times." The trouble for me is that I know many of you fellow planetarians and your hard-working professionalism inspires me to constantly re-examine and improve my practices.

I ended up using the spectrometer screen as a demonstration at the end of the lab. The kids observed the gas tubes with the diffraction grating glasses and colored the emission lines like they always had. I used to run a little light show with the built-in buffer time at the end of the period, but now I had something better. I held the spectrometer's fiber-optic cable to each lamp, and we discussed how the spectrometer worked, what it showed, and how that correlated with what they saw through the diffraction grating glasses. The teachers then used my online lab from the virtual days to have the kids match up a few spectrometer graphs with sets of emission lines like they had observed to help reinforce the idea of "chemical fingerprinting." What I hadn't planned on was how much the brightness of the spectrometer display on the dome would catch their attention. We observed with the diffraction grating glasses in the planetarium so the kids could get fully dark adapted. Suddenly, opening the shutter of the bright video projector really served to wake up anybody with PIN (Planetarium Induced Narcolepsy). It turned out to be a good way to catch and re-focus their attention as the lab

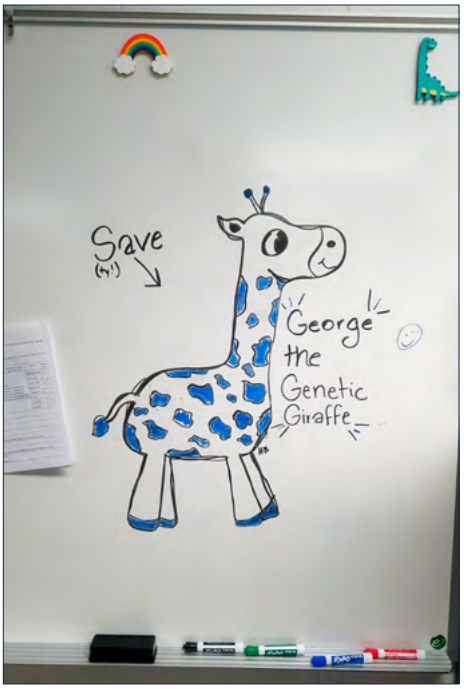


concluded. That got me thinking about various ways we catch the kids' attention.

Meet George the Genetic Giraffe. He caught *my* attention as I passed through my friend's classroom. While he doesn't really convey an educational concept, he did his job by catching my attention...and he got me thinking about genetics. As teachers, we can't get ideas into the kids' heads unless we make a connection. I asked our cadre of ClassDome teachers what sorts of things they use to catch the students' attention. I received some pretty interesting responses!

Neil Pifer - Salisbury, NC, USA

1. The absolute best tactic with our youngest visitors that captures their attention and gets them to listen better is to play music very softly while we are talking. To some speakers and most adult audiences, this is wildly distracting, but to our K-12 groups, this makes them have to actively listen to what YOU are talking about. Play music and talk during most of the star talk and you will start to see a change in engagement. Our youngest visitors have stamina through 10-15 minute star stories!



Top: Screen capture of Vernier spectrometer software by Mark Percy. **Above:** Photo by the author, artwork by Haley Brown

2. Another tactic for engagement and wow factor for middleschool learners is to use a flat screen projector, laser projector, or multi-sensory experience to introduce the lesson instead of you talking. Play an introduction video or loop the instructions for your activity

in lasers. Ask a student what they are doing today in the planetarium and reward the correct answer with a small trinket or a "seat upgrade." THEN, every person will be shooting up their hands or trying to earn that reward the rest of your show.

3. Finally, for your show, put the school or the teacher's name on the TV or marquee in your dome or in your lobby. We give this task to an intern. This small personalization (that takes 30 seconds) automatically connects with the teachers and makes them feel like the program was written "just for them."

Geoff Holt - Madison, WI, USA

In-person or virtual, I try to use interaction to keep audiences engaged as much as possible, for example by asking them to make predictions by pointing or with actions like thumbs up or down, or by using words. The predictions not only keep them engaged but also shows me where they are in understanding the current system we're exploring.

I don't have any specific jokes that I tell, but I do enjoy my attempts at humor. I do also sometimes enjoy getting things wrong. For example, let's say I'm asking them to predict where the Sun is going to be at noon, and they are pointing toward the south. If it seems like they need a little poke to focus their attention, I'll do something like pointing in the east and saying, "so, it looks like most of you predicted that the Sun is going to be in the east at noon." For one thing, it makes them re-evaluate what their prediction was. But it also challenges them to speak up for something that they know to be wrong. It can be powerful. I sometimes do this when summarizing constellations that they've learned. I'll point to Orion, and say, "so remember, this is Canis Major," and usually, before I can finish my sentence someone (or several people) will say, fairly loudly, "noooo."

Peggy Hernandez - Elgin, IL, USA

When exploring the shape of the Earth with kindergarten and rotation with 1st grade, I use a globe that has a Lego guy on it. I tell them that that Lego guy is stuck with clay right on top of Illinois.This really piques the interest of the Lego aficionados, and they crane their necks to try to identify my Lego character. I pause for a few moments. Someone usually blurts out, "Hey, that's where I live!" We talk about how it is gravity that is holding them down instead of a chunk of clay, and how the Lego guy can't see the other side of the Earth. It is a great conversation starter to begin the recognition of the view of space from Earth and the view of Earth from space. Side note: Students of all grade levels ask me about the Lego guy year after year. They just want to see it...and confirm that it's still stuck on the Earth even if I don't use it.

Public domain image via freesvg.org

This is something many probably already do, but I think crickets work. They work a little like whispering in a crowd of loud people. I have a recording of locally native crickets and Katydids and play it as the Sun is setting. This sunset time can be a loud and wiggly moment with younger kids, but the sound gets their attention. These nighttime sounds sometimes get them to settle in and just observe instead of yelling, which inspires the others to also yell, "I SEE A STAR!" or similar refrain. There's nothing quite like the crescendo of 60 first graders all telling (yelling) me that they see "a star" when there are hundreds of stars visible and more every second. I think they try to tell me about each and every one. Sometimes the crickets keep those announcements to a low hum as they notice more and more. So many times, it seems like the mindset the students have as they reach darkness (yelling and frantically pointing vs. quiet, careful observing) dictates the rest of the tour.

There is a first-grade curriculum standard about how "objects can only be seen when illuminated" and we can use the darkness of our planetariums to illustrate this. However, that very darkness is scary to most first graders. I do this during the AVI program, *The Moon,* when there is a graphic showing the light from the Sun reflecting off the Moon to travel to the Earth so we can see it. I pause the program and make sure that all other room lights are down. The only light in the room is from the curved mirror and the monitor running the full dome video. I have a small moon globe I pick up and hold over my head so they can see it. I make sure they are looking at it and can see it. Once they all agree that they can see it, it is the moment. I close the dowser while still holding it over my head. It becomes very dark, and I ask if they can see it now. They can't. Panic sets in in about 0.7 seconds. However, I have a flashlight in my other hand that I aim at the globe, turn it on, and ask, "what about now?" They gleefully tell me, "Yes!" and I repeat the process, on and off, for several cycles. I can then point it up at the dome, now that their eyes are a little adjusted to the dark, and they can see all their friends and me. All is good. They start to understand. We need light to see, and it is not always scary when it is dark.

Anthony Kilgore - Woodbridge, VA, USA

For me, it is my crazy suits. I have about 15 crazy outfits I wear and when the kids show up, regardless of age, they are always star struck by my outfit before they even get into the planetarium.

(Continued on pg. 48)

Image credit Heather Kilgore

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INTERNATIONAL NEWS

Dear fellow planetarians...

The corona pandemic is, while not over yet, fortunately slowly losing its grip on our domes across globe. More and more planetariums are being reopened and some conferences are being held and planned for the physical world. Luckily, we also see planetarium shows and other activities that were postponed now being brought back live. You'll find many good examples of that below.

For this section I'm indebted to contributions from Andreas Schmidt, Aase R. Jaocbsen, Milène Wendling, Loris Ramponi, Alexis Delivorias, Bart Benjamin, Amie Gallagher, John Hare and Ignacio Castro.

Let's start this tour around the World in Germany.

SOCIETY OF GERMAN SPEAKING PLANETARIA

Tilo Hohenschlaeger, international coordinator, sent out important information to the joint international program, Week With the GDP. Due to the ongoing Covid-19 pandemic, the GDP managing board decided to stop the applications for the program in 2022. The two previously selected candidates for 2020/21 are still waiting to visit their hosts in Berlin and Freiburg, which will hopefully go ahead during 2022. If all goes well, the application process will open up again towards the end of 2022. Stay tuned for more information on the GDP website and in the *Planetarian*.

Bavaria

The torch has been passed on in Augsburg. It would have been a nicer good-bye with some last live presentations and a big farewell party for planetarium director Gerhard Cerny without the pandemic situation, but still, the team gathered late December to hand over some special gifts to honor and thank him for his 20 years of passionate work for the S-Planetarium Augsburg. Successor to Mr. Cerny is Markus Steblei, formerly of Sky-Skan Europe for 16 years and also former planetarium director at Forum der Technik in Munich. He started January 1st and will carry on the educational mandate and all administrative and technical duties, joining the existing team of educators, scientists, and presenters. On to the stars!

North Rhine-Westphalia

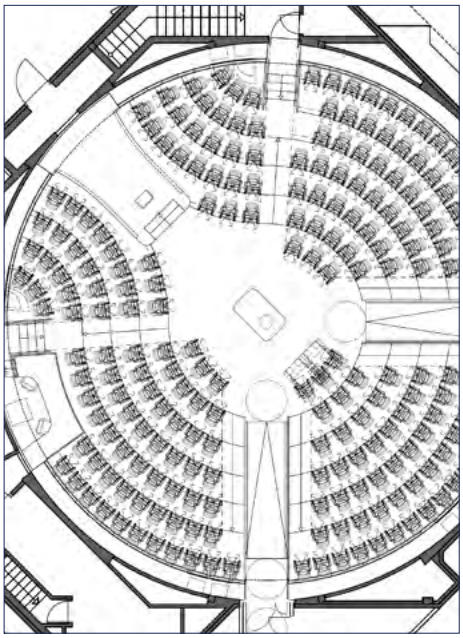
The Planetarium in the city of Münster, one of Germany's large 20m domes, has been closed since the beginning 2021 for major refurbishments. These refurbishments have been planned for many years, since 2017, and by chance, this project coincided with the COVID-19 pandemic during which the planetarium would have been closed anyway. While many planetariums reopened in mid-2021 after the spring waves of the pandemic ebbed away, and mostly remained open (at least in Germany) for the winter season, Planetarium Münster remained closed all year, and will remain closed into 2022.

The planetarium, a part of Münster Natural History Museum, opened in 1981 and still retains some original elements from that time, such as carpet-clad walls in a style that has been dated for a long time (see photo 1). More importantly, the 1981 dome showed a strong paneling structure with dents and warping in many panels, leading to a sub-standard appearance of any moving fulldome image in the theater. Thus, it was decided in 2017 to replace the dome, and along with it, to plan a major facelift and technical renewal of the theater. This includes the installation of new seating, a new star projector, laser projection, and other technical elements.

Most importantly, the floor and seating layout was improved, with the addition of a new stage and partially concentric, partially "stage-hugging" seating (see photo 2). The new seating will be comprised of individually swiveling chairs on raised levels. To the knowledge of the Münster staff, this is a novel combination not found anywhere else in the world (please let them know if you are aware of another theater with these features!). In the first step of the refurbishments, all decorative, technical, and functional elements (or simply: everything!) were removed from the theater: chairs, carpets, wall coverings, projectors, and, of course, the old dome. What remained was a theater reverted to a raw building state (see photo 3). The second step was the installation of the new floor levels (see photo 4), new acoustic elements behind-the-dome, all-new AC and ventilation systems from scratch, all new electric systems, and wall coverings.

The third step, the installation of a

GDP. The impression that planetarium Münster made on its visitors still contained outdated elements of 1980's aesthetics. In this image, the removal of the old seating has already begun. Courtesy of LWL-Planetarium Münster and B. Voss.
The layout of the new theater floor levels and stage, a new addition to this theater. *Courtesy of ht-architektur.*



GDP. The theater after step 1 of the refurbishments: All old systems, floors and wall coverings have been removed; and the dismantling of the old projection dome is in progress. It was striking to see the theater change from "light above the head" to "dark above the head!"

new Spitz Nanoseam dome, was slightly delayed by the pandemic, and is, at the time of this writing, planned to be finished in January. Early 2022 will see the installation of the new technical systems: lighting, projections, star projector, lasers, and more. Stay tuned for the report on the final touches of the new theater, and its reopening, in early summer!

After step 2 of the refurbishments, the new floors were installed. The layout of the raised seating levels becomes apparent, while the carpeting and seating installation will follow in 2022. Both courtesy of LWL-Planetarium Münster and B. Voss.

During the refurbishment of the Planetarium, a mobile planetarium

GDP: The new mobile planetarium, which temporarily replaced some functions of the large theater, and will continue to operate even after reopening.

has been used in and around Münster to continue astronomy education work at local schools and community centers (see photo 5). This project was originally planned to start in early 2021, but because of the pandemic it could not be launched until the summer of 2021. With a 6m interior diameter, it welcomed school classes and public groups in dozens of locations in the region in the second half of 2021 and received a total of 11,467 visitors during this time. This program is planned to continue, mostly to schools, even after the reopening of the "fixed" planetarium.

Berlin

The Stiftung Planetarium Berlin (Berlin Planetarium Foundation) has been hard at work preparing new programs for their young scientists. Two exciting, new programs, a podcast for children and a new family fulldome show, are the headliners for the beginning of 2022. The new children's podcast Abgespaced – Der Weltraum von A bis Z (Spaced Out – The Universe from A to Z) premiered in late autumn of 2021. The program is for children and reported by children with the help of host Kristin Linde. The team will travel, in alphabetical order, from one letter to the next and shed light on interesting and surprising topics relating to outer space.

Tim Florian Horn, president of the Stiftung Planetarium Berlin, explains how the podcast came about: "Every year, over 200,000 children and young people visit us in Berlin's planetariums and observatories. They ask us the craziest and biggest questions, which also make us think. With the children's podcast, we explain the exciting universe letter by letter and show what a special place the Earth is in the process". Every other Tuesday, the Planetarium Berlin Foundation releases a new episode (available in German) wherever podcasts are available as well as on its YouTube channel.

The newest show, slated for premier in March 2022, is Armstrong – Die abenteuerliche Reise einer Maus zum Mond (Armstrong - The Adventurous Journey of a Mouse to the Moon). The program is based on the successful book of the same title for children ages five to eight years old. The show follows the story of a small inquisitive mouse who is fascinated by space, and especially the Moon. In order to set the record straight that the Moon is not made of cheese, Armstrong builds a rocket to become the first mouse to fly to the Moon. Illustrations from the book were used to create the fulldome production, creating the backgrounds that cover the dome. The characters, although also original illustrations from the book, will be lightly animated against the background, creating a unique and fun production for families to enjoy together.

Further information (in German) on these two productions can be found at: Podcast: *www.planetarium.berlin/podcast*. Abgespaced – Der Weltraum von A bis Z on Spotify: spoti.fi/3e5NHlI. Armstrong – Die abenteuerliche Reise einer Maus zum Mond: *www.planetarium.berlin/armstrong*.

GDP. The Podcast icon for Abgespaced – Der Weltraum von A bis Z. Courtesy of Stiftung Planetarium Berlin.

NORDIC PLANETARIUM ASSOCIATION

In November, the association was thrilled to see that many of its members managed to attend the NPA conference in Lübeck, Germany. The host was the **Observatory Lübeck** (*German: Sternwarte Lübeck*) and they, in collaboration with the **Sternkammer**, were happy to welcome the NPA members in the world's first school planetarium. Sternkammer was opened in 1931 at the former *Klosterhofschule* school in Lübeck (now: **Grund- und Gemeinschaftsschule St. Jürgen,** GGS), now modernized with a digital fulldome system. The city of Lübeck is part of the old Hanse collaboration, so Ralph Heinsohn (born and raised in Lübeck) and Aase Roland Jacobsen (past president of NPA) were inspired by this old idea of the Hanse countries and started planning the NPA conference 2021 in Lübeck some years ago. Having the conference in Lübeck provided the opportunity to invite our friends from GDP (Society of German-Speaking Planearium) and to have a wonderful evening in the Hamburg Planetarium.

At the conference, Kai Santavouri stepped down as NPA president and a new president was elected: Karen Torsteinbø from Vitenfabrikken (the Science Factory) in Sandnes, Norway. She has a background in art and culture Science and fell in love with the planetarium when she started working at Vitenfabrikken part time alongside her studies.

NPA: (Top): Group photo of NPA 2021. *Courtesy of Manuela Bräck*. (Above)The new president Karen Torsteinbø. *Courtesy of Ingunn Hovelsrud.*

SOCIETY OF FRENCH SPEAKING PLANETARIA

The 2021 APLF conference took place at the Ludiver Planetarium in northwestern France on November 26th – 28th. All members were delighted to meet again after two years. Discussions, presentations and workshops were very interesting and intensive. The next APLF conference is going to take place in La Coupole, Saint Omer on September 23rd – 25th this year.

A great project that involved some French planetariums: After five years of research conducting regular experiments in microgravity and working with researchers and astronauts (from CNES and ESA), two artists, Jeanne Morel and Paul Marlier, offer an immersive experience under the dome. Overview is the story of a possibility to live in the sky while remaining on the ground. It is a moment of sharing where humans embrace the digital and decide on a new space together, an elsewhere that every explorer, regardless of age, language, social class or ideals, can imbibe because we are all inhabitants of the same vessel.... The project was carried out within the framework of the call for immersive projects launched by AADN – Arts et Cultures numériques de Lyon, the Planetarium of the Cité des sciences et de l'industrie, the Planetarium of Vaulx-en-Velin, the LabLab (Villeurbanne), the Planetarium of Nantes and Stereolux (Nantes).

APLF: Image from the Overview immersive experience. *Courtesy of Jeanne Morel et Paul Marlier.*

ITALIAN ASSOCIATION OF PLANETARIA

The years 2020 and 2021 were very difficult due to the pandemic, leading to many victims in Italy as in other countries and many problems in the world of work, especially in the culture and tourism sectors. Among the structures affected by this situation are planetariums, where the pandemic suspended the activities of many mobile planetariums and some small facilities with too little space to accommodate safety rules, or where the available seating was reduced too much. Thus, many organizations have had to invent alternative programing using the web. The Association of Italian Planetariums has dedicated a new annual award, in memory of Lara Albanese, to the most original dissemination activities scheduled online. The announcement of the new award is added to the long-standing traditional one that invites planetarians to produce a full dome video. All the works that have won the Planit award become the common heritage of the members of the Association and the "library" of these shows continues to grow. The deadline to participate for both awards is the end of March.

The bookstores where books are bought, on the other hand, have become the protagonists of the alternative activities that, in 2021, have been invented by two popularizers engaged in the astronomical field for years. The limits imposed by the pandemic did not prevent the publication of their first editorial works. Thus, Ivan Prandelli (Serafino Zani Observatory) published his first volume Reactions Avverse, a collection of short stories, many of which are of astronomical interest. Each chapter is like an "astronomy pill,"

but there is much more, including the author's numerous travels from extreme latitudes to desert areas. These distant destinations are the backdrop to original stories, such as the astronomical one that we could combine with the misleading title of Sex for Men, or the incredible coincidences, always linked to the science of the sky, of a visit to the Tanami desert.

Likewise, Gianluca Di Luccio (EG Planetarium) had to suspend his activities for two years with the traveling Planetarium, which was his main source of income. He did not give up, and thus, brought the book he had wanted to write out of the drawer of dreams. He started it in June 2021 and at the beginning of December it was already out in bookstores. Thus, he invented a new job, that of an independent publisher, which will keep him engaged in the promotion of his volume for many months, which tells a true story inspired by his own sentimental one. Again, astronomy peeks out from the pages of the book entitled When a Man Loves. In an interview, the two new authors talked about their experiences and their works in the series Voices from the Domes published on the Facebook page for the Italian Association of Planetaria.

The updated list of all the interviews and "News" of the Voices from the Domes series is on the page: *www.facebook.com/bresciaartescienza/photos/a.750841974971574/4532553713467029*

IAP: The noble floor of the library of Palazzo Roberti, the historic building where Napoleon Bonaparte stayed. The bookshop, located in Bassano del Grappa, is one of the most beautiful in Italy. It is one of the places where Gianluca Di Luccio exhibited his book. *Courtesy Gianluca Di Luccio.*

The birth of individual planetariums and the experiences of their operators is promoted by the National Italian Archive of Planetariums with the online publication of articles, photographs, and other related documents as part of the Open the Archives! Project. A coincidence connects the city of Strasbourg to an anniversary that dates back to 1982. That year, the planetarium of Strasbourg was officially inaugurated. Ten years later, precisely on February 7th, 1992, the University Diploma for planetarium animators was signed by Professor Agnes Acker of the Université Louis Pasteur in Strasbourg, where this course was held for two years. The diploma was delivered to the operators who attended the second edition of the university course, one from Italy.

On the 700th anniversary of the death of Dante Alghieri, the two social and cultural promotion associations, Micro Teatro Terra Marique and Star Light, created the A RIVEDER LE STELLE. Dante Alighieri's comedy. Itinerant Event in 8 Stages and 8 Days project, which addressed the main themes of the work, connecting them to the present day and bringing them into everyday life. Activities followed the time frame that Dante himself indicates within the Divine Comedy. The spectators faced a performative journey made up of eight different 80 minute performances, three dedicated to hell, three to purgatory and two to heaven. The shows took place in eight day trekkings over three weekends located in different historical places of the territory with site specific events, i.e. a dialogue about the morphology of the site that hosted them, involving the viewer in a total and interactive experience. Participants were invited to follow a historical/artistic path, listen to the most significant passages of Dante's Comedìa, assist in live performances (theater, music, and dance), deepen their understanding of astronomical aspects described in the poem through experiences, paper models, and moments of reflection on astronomy.

The 2022 calendar of PLANit includes the International Day of Planetariums on Sunday March 2nd, but according to the proposal of Voss Bjorn the

IAP: Penultimate day of events, the Dante's journey to paradise - astronomical laboratory on the celestial sphere (the tenth canto) in front the oldest church in Perugia (V-VI century). *Courtesy of Simonetta Ercoli.*

March date will be postponed to May 7th, 2024, in relation to the date of the first projection planetarium (see the anniversary of the Centennial: *Ips-planetarium.site-ym.com/?page=IDP*).

The other two 2022 dates are the yearly Meeting of Italian Planetariums (37th edition), organized in Florence in collaboration with Fondazione Scienza e Tecnica (29 April – 1 May) and the yearly National Day to Fight Light Pollution (October 2022).

EUROPEAN/MEDITERRANEAN PLANETARIUM ASSOCIATION

Greece

Since last September, the Eugenides Planetarium in Athens has functioned as a "Covid-free" venue, meaning that it only accepts fully vaccinated adults and underage visitors that are either vaccinated or have documentation of a recent negative test.

On November 4th – 6th, the Eugenides Planetarium hosted The New Infinity Athens festival, organized by the Onassis Culture Foundation in partnership with the Athens Biennale, the Berliner Festspiele, and the Eugenides Foundation. Since 2017, Berliner Festspiele's program series, The New Infinity, has invited visual and sound artists, filmmakers, and video game designers to enter the unconventional (for them) architectural space that is the planetarium and create new works to be presented at such venues and fulldome festivals around the globe. The festival was held as part of the 7th Athens Biennale ECLIPSE. More information on the festival and on the works presented can be found at the following link: *www.onassis.org/whats-on/7th-athens-biennale-eclipse/the-new-infinity-athens.*

Under the adverse circumstances created by the pandemic, it is very gratifying to report that on November 15th the Eugenides Planetarium finally premiered its Story of Earth digital fulldome show, a premiere that was originally scheduled for March 2020 but was repeatedly cancelled due to the Covid-19 pandemic. The show narrates the formation and evolution of Earth, highlighting the geological processes that cause earthquakes and volcanic eruptions and explaining why Mars and Venus are so hostile to life today, as opposed to our planet. It is worth mentioning that this is the first time the Eugenides Planetarium has incorporated live action fulldome video of an actor/presenter in its shows. The show is complemented by an illustrated book that expands on the main theme of the show and by a much shortened and easier-to-read booklet aimed at younger children. Both books are freely available to all in pdf for, on the planetarium's website.

Needless to say, that the Eugenides Planetariums' online communication with the public continues through its Facebook page, with numerous articles, quizzes, and short videos etc. on astronomy, astrophysics, and space exploration. It is worth mentioning, for example, that on September 17th, the Eugenides Planetarium premiered The Life and Death of Stars, the third episode of Space Series, a sequence of short videos on various astronomical topics. Also, on October 26th the Eugenides Planetarium premiered the third podcast in the series Space Talks featuring Dennis Simopoulos, titled The Evolution of Giant Stars. Given the uncertainty caused by the pandemic, the Eugenides staff is currently unable to present plans for future events with any certainty. Activities for January 2022 onwards will be highlighted in the next issue of the Planetarian magazine.

Croatia

Since November 2021 the Rijeka Astronomy Centre (RAC) has continued to operate its planetarium and observatory at 50% capacity, requiring at the same ime that all visitors present an EU Digital Covid Certificate. The weekly schedule has continued with programs for all ages, family packages, workshops for kids, and programs for school and kindergarten visits. On December 6th, the RAC premiered the digital planetarium show Beyond the Sun (produced by Render Area and Monigotes Estudio 2.0.). Parallel to the premiere, an exhibition by students of the Academy of Applied Arts of the University of Rijeka opened with posters on light pollution, astronomy, and the RAC itself as part of the RIBIZ project. RIBIZ is a collaboration between the Rijeka Academy of Applied Art and RAC, is implemented as part of the Visual Communications and Graphic Design graduate program and aims to promote astronomy among students. The best three works were awarded with student funds, offered by Rijeka Sport.

On December 16th, the Rijeka Astronomy Center participated in the celebration of the first Italian National Space Dayand facilitated a virtual meeting with Luca Parmitano, an Italian astronaut holding the European Space Agency's record for the longest stay in orbit (366 days). In his talk, Parmitano spoke about his experience living onboard the International Space Station, highlighting the scientific research conducted on ISS for the audience. Parmitano's presentation can be seen at the following link: *https://www.facebook.com/events/273876781385098/?ref=newsfeed.* This event, which was complemented with live planetarium shows *From the Earth to the Universe* and *Beyond the Moon* was possible thanks to the collaboration of the Italian Ministry of Foreign Affairs, the Italian Embassy in Zagreb, and the Italian Consulate General in Rijeka.

EMPA: With Luca Parmitano during the first Italian Space Day. *Courtesy of Rijeka sport Ltd.*

In December 2021 and January 2022, the RAC organized three special programs, the first of which was Christmas in the Planetarium for adults and children and included the live planetarium show The Story About Stars, seeing the night sky through the observatory's telescope, and the workshop Star Detectives. Winter Holidays, the second special program for the holiday season, included the digital planetarium show Beyond the Sun, while the third was dedicated to the James Webb Space Telescope.

GREAT LAKES PLANETARIUM ASSOCIATION

Illinois

At the time writing, the Adler Planetarium is planning its public reopening for March 4th, 2022. The dome roof scaffolding over Adler's historic Sky Theater has been removed and construction crews also worked on the flat portions of the roof that cover the upper-level exhibits and collections storage spaces. Adler recently hosted another television shoot, this one for Shining Girls, an upcoming AppleTV+ series. Portions of several episodes were shot in Adler's Space Theater, Doane Observatory, Solarium, and the main lobby.

This winter, the team at the Dome Planetarium in Peoria worked on content related to the launch of the

GLPA: The new Adler dome roof from the zenith. The street-level view of the new Adler roof. Both courtesy of Adler Planetarium.

James Webb Space Telescope. In December, the staff hosted two events related to the launch: a family-friendly program educating people about the mission and an evening night-out style *Wine and Cheese Under the Stars* program on the night of the launch. The staff is also bringing back their *Yoga Under the Stars* program.

The ISU Planetarium in Normal continues to welcome visitors. Heavily attended special events recently included free public programs during the Sugar Creek Arts Festival and live performances of Ghostly Tales Under the Stars for Halloween by ISU's Improv Mafia. Wrapping up 2021, the planetarium offered Season of Light in December.

The Staerkel Planetarium in Champaign has many more staff members in the office now that they have hired Heather Ann Layman to be the operations assistant for the planetarium and the Parkland Theatre. She also supervises their five new student workers, who are paid through the federal work study program. Not surprisingly, the planetarium has not booked many group visits since they reopened in August, but they did host a wedding! Finally, and for the first time, the planetarium offered Un Cielo, un Mundo: La Aventura de Big Bird and De la Tierra al Universo with a native Spanish-speaking presenter, Ricardo Covarrubias.

GLPA: Scene from the Shining Girls shoot in the Adler's Space Theater. *Courtesy of Adler Planetarium.*

The news from Strickler Planetarium in Bourbonnais is now reported by their new planetarium manager, Jeri LaMont. The Strickler Planetarium has had large turnouts for its bi-monthly planetarium shows. Adding a new program, Beyond the Sun, to the lineup increased community interest. In early October, Strickler partnered with the Bourbonnais library to offer a Starry Storytime to children ages 3 and up. The local librarian read three astronomy-themed books, and they explored the Solar System and studied constellations.

GLPA: Strickler Planetarium partnered with the Bourbonnais library to offer a Starry Storytime to children age 3 and up. *Courtesy of Strickler Planetarium.*

Indiana

The Koch Immersive Theater and Planetarium in Evansville has installed a stainless-steel sculpture at the entrance to their museum and planetarium entitled Stargazer. The attractive new addition was created by New Mexico artist Gino Miles, measures 3 x 2 x 2 meters, and presents a visual contradiction, challenging the fundamentally static nature of most sculpture.

The Carmel Planetarium in Carmel is undergoing renovation. The planetarium has a new LED lighting system, and is going to get new carpet, new chairs, and new paint. These projects started this past summer with new lighting and, at the time of writing, are planned to be completed over winter break.

GLPA: The new sculpture, Stargazer, at the entrance to Koch Immersive Theater and Planetarium with director Mitch Luman posing beside it. *Courtesy of Koch Immersive Theater and Planetarium.*

Michigan

The Delta College Planetarium in Bay City reopened to the public last August with limited showtimes and capacity, but the response has been good. Over 50 virtual field trips were presented to local and regional schools in the past year, with hopes that in-person school visits can resume before spring. The staff has been active in the creation of other online content, including 57 original YouTube productions with over 30,000 views and 10 Facebook Live events on a variety of popular topics. One in particular, See the Northern Lights, brought in 102,000 watching live with over 800,000 subsequent views! Plans are underway to restart the successful music and immersive art programming with a variety of genres and styles, both live and recorded. Finally, Delta College hosted a James Webb Space Telescope Community Event in December.

Ohio

In September, Dr. Patrick Durrell (director, Ward Beecher Planetarium in Youngstown) was named the very

first Warren M. Young Chair in Physics and Astronomy at a small ceremony in the planetarium. Warren was a long-time planetarian and GLPA member and was the director of the Ward Beecher Planetarium for over 35 years. This endowed chair position was a gift from Dr. George Young, Warren's son, in honor of Warren's lifetime commitment to astronomy education and service to Youngstown State University and Youngstown.

Jeanne Bishop and Katy Downing will be presenting programs for Westlake Schools classes in the Schuele Planetarium at the Lake Erie Nature and Science Center in Bay Village. Last summer, Jeanne worked to dismantle the Westlake Schools Planetarium because mold was found in the building that houses the planetarium. Jeanne now has an office at the new Westlake High School.

Finally, Ohio welcomes Diana Yoder at the Boonshoft Museum in Dayton and Mallory Palmer at Coshocton City Schools Planetarium.

Wisconsin / Minnesota

In November and December, the Southwest Minnesota State University Planetarium in Marshall will use OpenSpace to highlight the James Webb Telescope Mission.

Although the Gary E. Sampson Planetarium in Wauwatosa, Wisconsin is open for both field trip groups and the public, attendance is far below normal because of the social distancing requirements of bus trips.

Milwaukee's Soref Planetarium is currently running its own family show, A to Z Astronomy!Its next production is DINO SOARS! Change Over Time, the story about the discovery that birds are living dinosaurs.

At the Horwitz-DeRemer Planetarium in Waukesha, Wisconsin, Professor Dr. Bob Benjamin from UW-Whitewater collaborated with the planetarium on a series of outreach opportunities. In other news, the planetarium recently brought live music to its dome, specifically the Spring City Recorder Consort, who shared holiday and winter cheer at several shows under the stars!

The Bell Museum's Whitney and Elizabeth MacMillan Planetarium in St. Paul, Minnesota has seen its highest attendance since pre-COVID times, with over 1,400 people visiting the planetarium during Minnesota's 5-day school fall break in October.

MIDDLE ATLANTIC PLANETARIUM SOCIETY

Shawn Laatsch, at the Versant Power Astronomy Center at the University of Maine, will be hosting the MAPS Conference on May 18th – 21st. Registration materials are on mapsplanetarium.org. The theme is Dome Visualization and Climate Change. All are welcome to attend. There are some great speakers lined up and a trip to the Maine Mineral and Gem Museum, which has one of the largest meteorite collections in the US (including the largest Mars meteorite), and some other fun events.

SOUTHEASTERN PLANETARIUM ASSOCIATION

SEPA is pleased to announce the 2022 SEPA conference dates: Tuesday August 23rd - Saturday August 27th. Tuesday (day) will most likely be a mini-Lips conference (not confirmed at the time of publication). The opening session will be Tuesday evening and the closing event will be the traditional SEPA farewell breakfast on Saturday morning. SEPA 2022 will be hosted by the U.S. Space & Rocket Center in Huntsville, Alabama, home to the INTUITIVE Planetarium, One Tranquility Base. Hotel booking can be made at the Huntsville Marriott at the Space & Rocket Center through the SEPA Website. The hotel is on-site within a 5-8 minute walk of the museum.

At the close of the conference, there will be an optional 1-day Space Camp experience, which includes a simulated mission, engineering challenges, astronaut training simulators, ropes course, and team building. Huntsville is centrally located in the southeastern region of the US and is easily reached in 1-day from most locations in the region. Huntsville is served by a regional airport with dozens of daily flights to major airline hubs. Book online now at *sepadomes.org*!

The Bays Mountain 2023 SEPA conference will be held in June as a multiregional event. Specific dates and further details will be available later in 2022.

For further information regarding SEPA please visit the website sepadomes.org or contact IPS Advisory Council representative John Hare at *johnhare@earthlink.net*.

ASSOCIATION OF MEXICAN PLANETARIUMS

AMPAC congratulates Milagros Varguez, director of Cozumel and Cancun planetariums, Quinatna Roo, for having been elected IPS Board Member for Latin America for a three-year term. The association is certain it will benefit communication, needs, and projects, to name a few, by being the link between AMPAC and Latin America planetariums and the other IPS continental zones.


ROCKET BUILDER TO MARS
INTERACTIVE EXHIBIT
MISSION:
REACH SPACE
ENGINEER A ROCKET THAT CAN REACH THE EDGE OF SPACE
REACH ORBIT
MAINTAIN A LOW-EARTH ORBIT
REACH MARS
CONDUCT A TRANSFER BURN TO MARS FROM LOW-EARTH ORBIT
CLARK PLANETARIUM PRODUCTIONS
CLARKPLANETARIUMPRODUCTIONS.ORG
INTERACTIVE EXHIBITS | FULLDOME SHOWS | MUSIC SHOWS

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TALES FROM DOME UNDER

3PD OR NOT 3PD

Editor's Note: The editor would like to apologize to Tom Callen and to our readers, as the "continued on page" referenced in Vol. 50, Issue 4, Page 64 was accidentally not printed.

Please enjoy the column in its entirety.

If you are working within the digital domain when creating visuals for fulldome video presentations, there is very little you have to worry about when it comes to ensuring that the background of the objects projected on your dome don't have formatting problems. As long as the background of your individual visual elements are black (or chromakeyed out in compositing) and the projectors in the theater are matched to one another, tweaked for as black of a background as possible, and the transitions between the multiple projectors making up the dome-covering image are blended, then the end result is a very realistic scene.

If, however, you look back to the analogue days when images came from slide-based projection systems—panorama projectors, Kodak Carousel projectors, zoom projectors, special effects projectors with non-traveling images, and special effects projectors using moving first-surface mirrors for traveling images—it was another ball of wax. The very nature of analogue 35mm film means that there will always be a rectangular format surrounding colored images that have to be taken into account.

Coming only from the digital fulldome domain, there is probably a very real chance that you have never seen one of these analogue presentations, which may have unintentionally contained an image, let's say of a NASA spacecraft, traveling at a stately pace across the starfield surrounded by a very marked dark gray-green square. Such a formatting failure completely destroys the impression that what's being seen is "real" and that the audience is actually in space with the astronauts.

When projected slides of varying formats were first used during planetarium "current night sky" talks, there was no effort made to hide the rectangular format of the images as they were projected, but then they really didn't have to. A presenter would throw up an image of the Crab Nebula while talking about Taurus, the Bull, and the projected format surrounding it was inconsequential. But, if they were talking about recent advances in space (think October 1957) and showed an image of the Soviet Union's Sputnik 1 satellite, it would have been nice, in the ideal case, to see just its shiny silver ball and its four long skinny "whip" antennae among the stars overhead. Unfortunately, there were very few options available in the analogue audio-visual domain.

One of the first things that was tried to help hide the rectangular-formatting around an image was the use of double-mounted slides. Returning to our Sputnik 1 example from above, you would start with an image of the Soviet satellite on a black background. To help ensure that the black background was as dark as possible, this piece of board art was lit with polarized light (making sure that, if using multiple photo lamps, that all the filters were oriented in the same direction) and then photographed with a camera utilizing a polarizing filter that was adjusted for the darkest black surrounding the image.

An extra benefit of polarization was that the colors in the final 35mm slides "popped" and looked really saturated. Since you were going to be sandwiching two slides of the same image together in one glass slide mount, each of the two images would be a little overexposed so that they would appear lighter after developing. When combined together in the slide mount, the two lighter images would make a normal appearing one with a dense(er) black background.

One thing that you had to be sure of was that you made up lots of extra copies; the light coming from the bulbs in analogue projectors have a tendency to burn out the slide's image over time, so they had to be regularly replaced. In fact, this is the case with all of these analogue techniques addressed herein, regardless of the technique used.

Another way to hide formatting around an image was borrowed from the printing industry; the use of opaque paint added to a slide to paint away the background. Part of some printing processes used hi-contrast lithographic films to make printing plates, which sometimes had clear spots in them, or even scratches. These could be "removed" by using opaque paint to cover them up so that light no longer went through the film. Such paint, which could be thinned with water, came in two colors, black or a sort of rusty red that had to be applied with a paintbrush. It is fairly safe to say that most planetarians used the red, as it was easier to see when working on a slide, though I have encountered a few who, masochistically, preferred the black.

To say that painting out the background of slides is time-consuming would be an understatement in the extreme. Hand opaquing also required a pretty steady hand and was typically done with the help of a low-power stereo microscope. It was also a great way to get hand cramps if, for example, you were trying to paint away the background from something like a forest of trees on a panorama's horizon. While it was not the most fun way to spend your workday, it was necessary and it probably goes without saying that mentioning slide opaquing could bring back some fond—or not so fond—memories for some analogue-day's members of a theater's staff. For example, how about the way that red opaque smelled...but I digress...

Like everything else, there were certain tips and tricks that helped ensure success. For example, ALWAYS be sure to paint on the base (i.e., shiny) side of the developed slide film and not the emulsion side, because you

can't get the opaque off if you make a mistake. A person also learns how all sorts of simple homemade tools, like the modified end of an old paint brush, a dulled toothpick, etc., can make a safe scraper tool to get extra opaque off from the image part of a slide. Did I mention that you also have to make lots of extra copies of these hand-painted slides too?

As far as I'm concerned, the ultimate method to remove the background from slides was a technique that was invented by the staff photographer, LeRon "Ron" Cobia, at Michigan State University's Abrams Planetarium, which, coincidentally, is also where I was a graduate student.

Ron had his photographic studio down in a back hallway of the basement, which was kept as fastidiously clean as an operating theater in a hospital. It was an OFF LIMITS area where he had the key and it was a rare occasion when one was allowed into his inner sanctum, or at least that's the way it was for us lowly graduate students.

Much to his credit, what he did come up with is what's known throughout the analogue planetarium community as the 3PD method for slide masking. If memory serves, he may have even written an article for "The Planetarian" about how it worked; probably in the late 1970s or early 1980s. He may have even given a talk at an IPS meeting back in the day.

What exactly is 3PD? Simply put, it stands for Project, Paint, Photograph, and Double-mount (i.e., P+P+P+D), and it really worked. Granted, it took a little more time, but the final results were well worth the effort and spoke for themselves. Let's take a look at it step-by-step, while continuing with the previous historic spacecraft motif; remove the background from the 1965 NASA artwork of a Gemini space capsule.

Here's the original color image of NASA artwork from a press kit that we would like to knock the background from. Sure, you could paint it out with red opaque, but it would not be easy because parts of the spacecraft go so close to the edge of the picture. It would be pretty hard to use a brush, though I once had a special one that only had a few bristles in it for very small detail work. It also doesn't help that the Adaptor module at the rear of the spacecraft is white, which is notoriously difficult to try and opaque close to; the darker the slide's colors, the easier it is to paint it. So, we want to 3PD this instead.

After photographing the artwork under polarized light and making a slide of it, the image is Projected onto a piece of heavy white Bristol board, or some other similar artist's heavy paper stock. While I was at the Albert Einstein Planetarium at the Smithsonian's National Air and Space Museum, our technicians built a special tabletop stand that had a single 35mm slide projector that was suspended on aluminum rails at a fixed vertical distance from a small floodlight-lit stage, which is where the Bristol board went. You projected the color slide onto the board and then outlined it with a special opaquing red marking pen used in lithographic photo work, or, alternatively, a black marker.

Once it was outlined, the image was filled in (the Paint step), so that it looked like the silhouette above. I used a red, opaque marking pen in this example. Why this unusual red or black? Because it was going to be photographed with a special high-contrast film, used in the printing trade, known as Kodalith. With the Kodalith, those colors reversed to clear "windows" on the slide, with the white background of the Bristol board becoming a solid black. We used to buy this highly specialized film in long rolls for bulk-loading into reusable 35mm cassettes. That way you could load as many frames as you needed, rather than waste a whole roll of 20- or 36-images for only a few shots.

Besides its sensitivity to color, especially the opaque red, one of its qualities was its film speed, or sensitivity to light. To wit, when was the last time you used a film (let's assume you don't have a digital camera) with an ISO speed of 6; that's right, 6. As you may have guessed, that also led to some l-o-n-g exposure times compared to "normal" photography.

In the next step, Photograph, the projector that was used to shine the original color image down onto the Bristol board for tracing its outline was replaced with a pin-registered 35mm camera, complete with macro-lens and loaded with the aforementioned Kodalith. What is a pin-registered camera? It's like a 35mm analogue camera, but more expensive because it has a special system in its film plane that accurately registers the film in place for each shot, which includes the capability for doing double exposures to build up

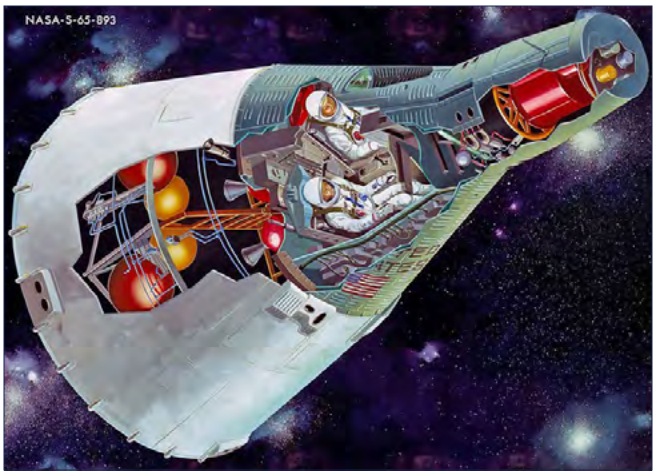

Figure 1: The original NASA artwork showing a cutaway view of the Gemini spacecraft's major components, including the two astronauts they carried. Compared to the one-man Mercury capsule, this was a sports car, and was the intermediary step before the Apollo command and service Module (CSM) flights to the Moon.

Figure 2: the Projected outline of the Gemini spacecraft filled in (the black line is added to make a border for clarity)

an image in layers.

Such devices were used in sophisticated multi-projector slide shows, controlled by early automation software on dedicated PCs (shoutout to the AVL Eagle II running PROCALL software) using an operating system like CP/M in the 1960s through 1980s. Or, at least until far cheaper and easier-to-make videos replaced them. You can take a deeper dive, if you're so inclined, at this URL: *https://en.wikipedia.org/wiki/Multi-image.*

I once took a week-long course in this at Kodak in Rochester, N.Y., and the final project was that teams of two had to turn in a 2½-minute long show from the same set of 40 slides that everyone else was using. The difference was that we had to write our own script for a professional narrator and specify the AVL programming for a show 3 screens by 3 projectors deep with music that came from library needle drops. Ah, memories...

Once the Kodalith film had been exposed, it had to be developed, which, about 100% of the time, meant that you had to do so yourself. Those of you who have only lived in the digital domain will never have the experience, or the fun, of going into a darkroom (lights out, of course), popping open a 35mm film cassette and then winding the film onto the stainless-steel reel from a developing tank, being careful so that you didn't accidentally scratch the Kodalith emulsion. I can recall practicing this loading procedure, when first starting out, using a long piece of scrap 35mm film—first with eyes open and then later with eyes closed—so that it became second nature while in a blacked-out darkroom.

After loading the reel(s) and closing the tank's lid, it was easy. With the lights back on, you went ahead and sequentially applied the A & B developers needed to "soup it," making doubly sure that you banged the developing tank on the darkroom's countertop, as each developer was added separately, to make sure that no air bubbles had adhered to the film. Why bother? Because if you didn't, there could be small pinhole-like spots in the

Figure 3: Here's what the finished Kodalith film image looked like.

dense black areas of the finished slides where there had been air bubbles. You would then have to touch-up each slide by painting them out with opaque.

When you opened up the developing tank after you were finished, you hung up the film on a "clothesline" strung across the darkroom, with a weighted clip on the free-hanging lower end, so that the film wouldn't curl up while drying, and waited. Some darkrooms had the luxury of having a film-drying cabinet, but I never did. Note that, since this is a film that gives a negative, the opaque red areas that were the silhouette of the Gemini spacecraft are now clear, and the white of the Bristol board is a nice dense black that light

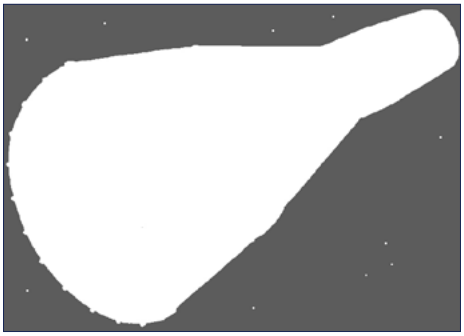

Figure 4: A "thin" slide with pinholes.

won't shine through (provided you didn't screw up the developing and end up with a "thin" negative, which meant you had to re-shoot and re-tank). A careful glance will also reveal that there are no "pinholes" in this image either, so this roll of film got a good banging on the countertop during development.

This is an example of what a poorly developed slide looked like; a gray background that projector lamp light would easily pass through, as well as a number of small holes that would all have to be opaqued out. This would still have been the case if it was a properly developed roll of film that had a dense black background. Since the air bubbles

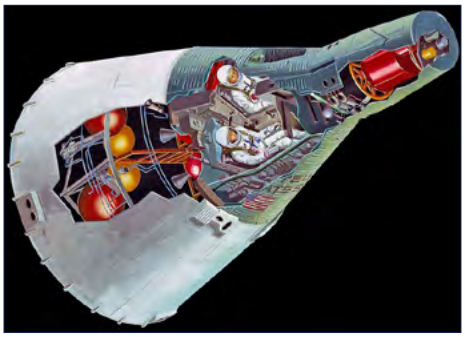

Figure 5: This is the final result; the Gemini spacecraft (let's call it Gemini 8, one of my favorite missions, with Neil Armstrong and Dave Scott onboard) with a nice dense, light-proof, black background.

were not evenly distributed, it could be that not all individual frames had "pinholes," so you had to carefully examine all of them to make sure they were usable.

With the 35mm color image and finished 35mm Kodalith mask in hand, the only thing left to do was to Double-mount the two together in the same pin-registered glass slide mount. Pin-registered slide mount? If you've ever looked at a piece of 35mm film, there are regular perforations down both sides that are called sprocket holes. That's what's used to pull the film horizontally through an analogue 35mm camera, one frame at a time. A pin-registered slide mount has a couple of sprocket-like pins on one of their inside edges that can be used to lock a single frame of 35mm film (a.k.a. a "chip") so that it doesn't move when the slide mount is closed.

After opening the pin-registered slide mount, you put the color film chip inside and locked it in place with the registering pins and then put the Kodalith film chip on top of it, pushing it down over the pins. I would be seriously remiss if I didn't mention that you had to make sure that both the slide mounts interior glass surfaces, as

(Continued on pg. 48)

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MOBILE NEWS NETWORK

OUTREACH WITH A MOBILE DOME

Here is a question I posed on Dome Dialogues: When using a portable planetarium as a outreach from a stationary planetarium, how do you assure that the mobile dome does not take business away from the stationary planetarium? What are some strategies for using the mobile dome as an advertisement for the main planetarium?

Dan Tell (Planetarium Engineering Manager at California Academy of Sciences and Senior Planetarium Systems Support Engineer at California Academy of Sciences) provided an answer that included most folks' responses. Thank you Dan!

He wrote, "When you asked your question about whether having a portable dome creates competition with a stationary dome I immediately thought back to my own elementary school experience, where my class was lucky enough to have both a visit from a portable dome and a trip to our local stationary planetarium during our astronomy unit.

In the decades since, immersed in the other side of that relationship, I've seen that often one of the biggest barriers schools have to accessing a stationary planetarium is the cost of transportation. As many school districts, especially in cities, have moved to contracts with private, for-profit bussing operators the cost and availability of school buses for field trips has become impractical for many schools. And grants and donations that might cover museum or planetarium admission may not cover transportation costs.

With this information, an institution should consider that using a portable dome is not going to create competition against their stationary planetarium. Instead, our experience has been the opposite: it gives you the opportunity to bring the wonders of the universe and the excitement of the planetarium to students who otherwise would not be able to access your stationary dome. You are only growing your audience, not subtracting or redirecting. I've also seen portable dome programs are a great opportunity to obtain grants and donor support, increasing impact across schools, science fairs and other public events across our region. Not only that, but rather than working against you, a portable dome can be the best advertising for your stationary facility, helping audiences feel comfortable in and excited for the planetarium environment and eager to encourage their families and friends to visit the stationary facility to experience more.

Here is a list of points made in this and other responses I received:

Portable Planetariums can…

1. expand an institution's outreach to audiences that aren't able to make it to the stationary planetarium. You can't capture this audience in another way, so it's not a lost potential audience, and definitely should never be revenue negative at the bottom line.
   For instance:
   - It's complicated to take students in upper grades out of school for a partial day, because it interrupts their full schedule. But if you take a mobile dome, it fits into their hourly schedule. You can market directly to those schools.
   - The portable dome may be a good fit for nearby schools with small numbers of students per grade, which makes transportation costs to the main planetarium prohibitive.
   - A mobile dome can go to places hundreds of miles/km away to people that would never go to the fixed dome.
2. better provide highly interactive and memorable activities with small numbers of people
3. be used as a classroom laboratory to conduct observational research and answer questions about such topics as seasons, celestial motions, moon phases, and so on.
4. taken to local stargazing events and used to show people what they should be looking for when they go back to the telescopes.

Advertising Strategies with a mobile planetarium…

1. The biggest advertisement is getting audiences into any dome and encouraging them to come back!
2. With school shows, the end result is kids coming home, telling about their experience, and then the family will visit the stationary dome.
3. Hand out flyers or slap a show trailer on to the end of a show
4. Offer different programs in the portable and encourage audiences to come to the stationary planetarium for other experiences. i.e. Do just a basic night sky show and maybe a couple of short films for schools, or community events outside of town. Often you can get people who go to one of those shows and want to come to the big planetarium for the full experience.
5. Provide a demo to an audience for science nights or larger events where people are coming through for shorter amount of times; it gets people excited to go to the bigger dome.
6. Show a photograph of the big dome as part of your intro, to show that the main dome is a very different thing. The mobile dome is our "little dome!"
7. To expand the fixed dome offerings, set up the portable for camps, open houses, teacher previews, etc. In every case its helps much more than it hurts.
8. Portable dome programs that reach out to underserved populations make your case more attractive for

grant applications and pleas for donor support.

The Indigenous Education Institute (IEI)

This institute is a recently discovered gem that you might be interested in! I discovered it through attending the presentation in January 2022 of their *Sense of Place Speaker* Series "Indigenous Perspectives on Earth, Water, and Sky." featuring Swinomish Elder Larry Campbell. Larry was a fisherman until the age of 40 when he sought a college education and received a BA in Tribal-Federal Govenment Relationships. He currently co-manages the Swinomish Community Enviromental Health Program. This is a resource for learning many good strategies for working with native communities. This and eight other webinar presentations can be found on the website: *http://indigenouseducation.org/*

When you visit the front page of the website you will learn, "The Indigenous Education Institute (IEI) was created for the preservation and contemporary application of traditional Indigenous knowledge.

The mission and goals were developed in order to provide awareness of the importance of cultural and linguistic diversity in the world today. Cultural and linguistic diversity provide strength and richness to individuals and nations. Indigenous ways of knowing contain knowledge that can provide greater sustainability and stewardship of the earth and cosmos, leading to a harmonious, balanced future."

You will also be interested in a publication from the Swinomish Community Enviromental Health Program called 13 Moon - First Foods & Resources Curriculum. "This program is built on the definition of health, including environmental health, as founded on the cooperative relationships between humans, non-humans, and their environment."

This is a beautiful resource; 13 chapters, one on each of the moons of their lunar calendar, include information and activities related to each specific time of year. "Each activity highlights one or more aspects of environmental health, with all activities focused on a theme of environmental sustainability as visualized through an ecosystems and community health approach. This approach recognizes that humans are part of the food web and have a symbiotic relationship with the plants and animals within a given ecosystem."This curriculum can be found at *https://swinomish-nsn.gov/media/116714/13moonsfreshecurric.finalversion.pdf*

PPA Planetarian Zoom Seminars

The Pacific Planetarium Association (PPA) runs a series of very interesting planetarian Zoom seminars. For more information go to: *https://www.ppadomes.org/events/online-seminars/ppsarchive*

The seminars are usually held on the last Friday of the month at 2pm Pacific Time and uploaded to the PPA Youtube channel. *https://www.youtube.com/channel/UC-pfVOHnkvAV_fdnKLdqzwA/videos*

Each seminar is on a different fun and/or informative topic, for an example, on January 28th the topic was "Navigating by the Stars." Tony Smith (Bishop Museum in Honolulu, Hawaii) demonstrated methods used by modern navigators to sail thousands of miles and how we can share this knowledge with our planetarium audiences.

If you would like to do a presentation at a seminar please contact PPA Secretary, Alan Gould at *adgould@comcast.net*, with the following:

1. Possible date(s) for your presentation
2. Presentation Title
3. Brief Description of Presentation
4. Brief bio (who you are, where you work)

Transporting Your Mobile Dome

How do you transport your mobile dome from the van/car to the set-up location and back? I always used what we in the United States call a "hand truck." It would take two or three trips but worked well on ramps or stairs because of the larger wheels.

Sometimes a school/venue would supply a flatbed or platform cart and if I was really lucky the school custodian would help, especially if I gave them a free mini show under the dome!

Many times you can make friends with the custodians and

This hand truck can fold to a closed position then opened to load the STARLAB projector and dome; the other equipment can come on subsequent trips. The advantage of this particular hand truck is the large platform and large wheels make the cart stable and easier to go up stairs if needed. *Credit: Photos by Susan Button*

All the equipment can be loaded in one trip on this flatbed cart if the entrance and set-up space are on the same level but you must use an elevator (lift) to go to a different floor. *Credit: amazon.com*

kitchen staff by showing them some of what the students are going to experience. You might find that they have a passion for astronomy and will ask some great questions. Some may even have their own telescope or have done astrophotography and many can tell some wonderful stories!

Recently an interesting exchange pertaining to the topic of transport occurred in the British Association of Planetaria (BAP) group. They posed some different options than mine.

Rachel Backer (Winchester Science Center and Planetarium in London, England) wrote that their current method of transporting equipment was a heavy and ackward trolly (cart). She was seeking a better solution.

Colin Daley (Aurora Planetarium in Wakefield, England) responded, "I use a trolley and large wheeled plastic storage containers (see pictures), if the room I'm using is close I just wheel the containers, if further away I use the trolley and stack two containers in it strapped down (it's a little too heavy and you need to take care on bends) which half's the transport time of my three containers and one flight box with my mirror in it, it has worked well and I have seen some of the plastic containers which have handles so you can more comfortably drag them in their wheels."

This type of wagon or trolley is good if the entrance and set-up space are on the same level and can carry a heavy load but you must use an elevator (lift) to go to a different floor. *Credit: Photos by Colin Daley.*

Jarvis Brand (The Observatory Science Centre in Herstmonceux, England) shared, "We currently use a wheeled flight case. The top of the flight case is flat so we can stack extra equipment on it in the van or even use I as a trolley itself. It does have a problem that we can end up with a dead lift of 40 kilo of dome out of the trolley (definitely a two person lift!) so I am planning to build a new flight case with a drop side rather than a top opening, that will eliminate the dead lift."

Martin Conroy (Exploration Dome in County Clare, Ireland) offered, "These containers are brilliant for 4m to 6m domes." (See photo) When asked where to find them Colin Daley shared, "There are loads of places just look up 145 or 175 ltr plastic storage containers on line."

This kind of container has better handles for pulling it to the set-up area. *Credit: Photo by Martin Conroy*

I like this idea but still like my hand cart. The big wheels on the back make it easy to go up stairs and it folds up for transporting in in the van! Actually, I got it when all I had was a Pinto to transport everything....very tight, if you know what a Pinto hatch back is you know what I mean! Oh, you can also find these hand carts that open out to a flatbed!

IPS Resources for Mobile Domes

This is just a reminder: There are resources to be found on the IPS Website: *https://www.ips-planetarium.org/page/resources#*

Be sure to check out the Portable Planetarium Webpage *https://www.ips-planetarium.org/page/portableresources*, the Free Media Page *https://www.ips-planetarium.org/page/freemedia*, the Education Page *https://www.ips-planetarium.org/page/edresources*, the Live Interactive Shows page *https://www.ips-planetarium.org/page/lips*, and the Voices From the Dome page *https://www.ips-planetarium.org/page/voicesintro?&hhsearchterms=%22voices+and+dome%22* just to name a few!

It would serve you well to explore the IPS website for the wealth of information and free resources to be found plus the opportunity to collaborate with colleagues through Networking and Social Media. *https://www.ips-planetarium.org/page/domel*

Check out how you can Get Involved *https://www.ips-planetarium.org/page/share* through contests, global projects, committee work or just by posting in the suggestion box!

KITZ THE CAT'S SUPERMOÖN ADVENTURE

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LIP SERVICE
VOICES IN THE DARK

As I write this, it's not long after the American Astronomical Society's 239th meeting should have been held in person, with virtual participation as an option for those not yet ready or able to travel to in-person gatherings. As with so many events over the past two years, AAS was canceled due to continuing concerns about COVID-19.

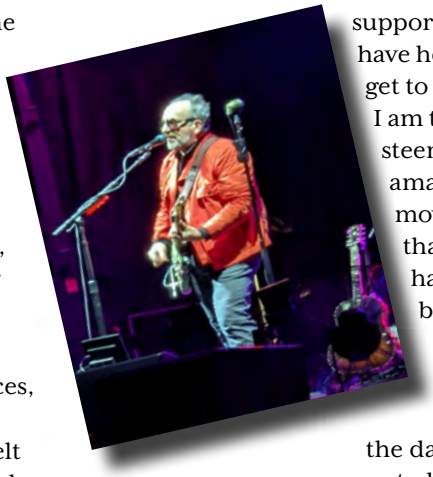
Although I believe AAS made the best decision under the circumstances, it was disappointing for everyone. I suspect I am not the only one who felt like the already short winter days had become just a little bit darker.

Thankfully, there has been some light in the not-too-distant past for me: I was lucky enough to attend the Great Lakes Planetarium Association conference in November in Kalamazoo, Michigan. I was honored to have been selected to give the Spitz lecture during the banquet because of my work on LIPS over the years. As the theme for my talk, I chose "A Voice in the Dark," and I'd like to share some of the ideas from that talk and expound on them in this column.

Unlike a voice in the dark in a horror film, which is unexpected and typically downright terrifying, I think of the phrase as encouragement and guidance out of a frightening or sad situation. I also chose the title for its literal interpretation, as LIPS-style presentations frequently involve teaching in the dark. Lastly, it is the title of one of my favorite songs by Elvis Costello, who has been a voice in the dark for me since 1985. Here's a snippet from that song:

"When bores and bullies conspire
To stamp out your spark,
Listen for a voice in the dark"

My goals for the Sptiz lecture were primarily to share how some people have helped me through the dark days of the pandemic and to reflect on their connections to LIPS. I looked farther back as well to some inspirations and supports that have helped me get to where I am today, steering the amazing movement that LIPS has become.



Elvis-Costello: Long time voice in the dark Elvis Costello in action in Omaha, Nebraska in August 2021. *Image credit: Karrie Berglund*

So, who are my voices in the dark? As noted above, Elvis Costello is a long-term voice in the dark for me. I had a friend growing up who was the youngest of nine children and one of her older brothers introduced her to Elvis's music. She then shared it with me and our other friends, and the rest is history.

What makes EC (fan shorthand for Elvis Costello) such a powerful voice in the dark for me? More things than I can get into here, but primarily these aspects:

1. He never stops exploring. This is reflected in the breadth of his music. He's done rock and roll, jazz, country and western, ballet, opera, and more. I too enjoy variety, which is one of the main reasons I prefer attending and giving interactive planetarium programs: No two programs will ever be exactly the same.
2. He's comfortable showing vulnerability. One of the first EC songs I ever heard was "Brilliant Mistake" on the album King of America. It contains the lines "Now I try hard not to become hysterical, but I'm not sure if I am laughing or crying." I was 14 years old when I first heard those lines, and I can't explain how reassuring it was to hear someone so successful admit to the same type of confusion I felt.
3. He can express complicated ideas in beautiful ways. Lest you think there is no astronomy connection here, I share these lines: "Last rays of sunlight die, full moon begins to rise." Accurate, concise, and memorable.
4. He never stopped working during the pandemic—the man has a serious work ethic—and he still kept learning new things. In a recent interview he commented about the pandemic, "You have a choice between hunkering down and doing mopey, whey-faced ballads about isolation or you can kick a hole in the box you're in."

That EC quote makes me remember that I am only as powerless as I allow myself to be. In a way, LIPS exists because I refused to consider myself powerless; I saw needed change and took action to make it happen. I kicked a hole in the box I was in, and we ended up with LIPS.

One of the fun parts of the past couple of years has been becoming part of an online community called The Immobile Tour Backstage (ITB), now in its second incarnation (ITB2). This was started by keyboardist and longtime EC collaborator, Steve Nieve, along with his partner Muriel Teodori and Muriel's son, AJUQ Kessada, who sings and plays the drums. The concerts often feature guest performers, and in fact Elvis Costello has performed during several ITB concerts. The concerts are streamed live from chez Steve and Muriel in France.

Immobile-Tour: Left to right, Steve Nieve, Muriel Teodori, and AJUQ/Kessada, creators of the Immobile Tour Backstage and ITB2. *Image from ITB2 Facebook page.*

From the ITB2 Facebook page:

> We created The Immobile Tour when countries around the world began to lock down their populations in an attempt to stop the spread of coronavirus. Something along the lines of alternative healthcare prompted us to give 60+ free concerts on Facebook and Instagram, and in the process build a community of friends with perhaps one interest in common - the work of Elvis Costello.
>
> Day after day we were gathering more friends around us. The messages we were receiving were making it impossible to stop, we have to admit that for ourselves, they were, and still are magical moments and a help, especially when we musicians can't do live concerts in public.

I will never forget celebrating the arrival of 2021 with EC crooning "What Are You Doing New Year's Eve?" on Zoom, and I am glad that the ITB2 shows are continuing for at least a few more months. ITB2 and LIPS both remind me of the importance of community, of the innately human need to connect with others. Merci beaucoup à Steve, Muriel, et AJUQ!

Dennis Schatz: Dennis Schatz is one of my voices in the dark and has had a major impact on my career. *Image from DennisSchatz.org*

A more career-centered voice in the dark for me was Dennis Schatz. Dennis spent many years at Pacific Science Center (PSC) and he was the Associate Director of Education during my nearly 15 years there. Many of you know that I had several jobs at PSC, from ticket sales to ushering laser shows to exhibit installations to outreach to Willard Smith Planetarium supervisor, and more.

Many of you may not realize that LIPS is closely modeled on the education division monthly meetings I experienced at PSC, and the direction of those meetings was, in part, set by Dennis. I have fond memories of Dennis reading a storybook aloud to the ~50 educators during our June meeting each year, which was always a big celebration for the end of the school year.

Dennis is passionate about science education and, in particular, about the power of interaction. He has authored many books (including some about the 2017 solar eclipse), and he even has an asteroid named after him. He is a former president of the National Science Teaching Association and the Astronomical Society of the Pacific. You can learn more about Dennis at: *https://www.dennisschatz.org/bio.html*

And I'm not the only one who can tell you about Dennis and his supportive presence. Dennis worked at the Lawrence Hall of Science in Berkeley, California before moving to Seattle in 1977. When I asked LIPS community members to share their voices in the dark, Alan Gould told me that Dennis Schatz was a voice in the dark for him, too. Alan also said,

> Alan Friedman was my voice in the dark. In fact, when I was hired at Lawrence Hall of Science in 1974, Alan Friedman was Director of that planetarium, which was only a little over a year old, and Dennis was the Associate Director. Alan was the kindest and best boss I ever had. I recall at one staff meeting, he provided this incredibly valuable tidbit of advice that I never forgot: Don't try to cram too much into your planetarium shows…it's way better to leave the audience wanting more than to try to stuff a few more facts in.

I only met Alan Friedman a couple of times before he died (in 2014). However, I feel his influence throughout LIPS. According to an obituary on the Lawrence Hall of Science website, Dr. Friedman "…pioneered the Participatory Oriented Planetarium (POP) workshops and the Planetarium Educator's Workshop Guide, which evolved into Planetarium Activities for Student Success, and now, Planetarium Activities for Successful Shows. These resources help planetariums across the globe include live audience participation in their repertoire of shows." (Full obituary: *https://www.lawrencehallofscience.org/news/remembering-dr-alan-j-friedman/*)

I am sure I speak for many when I say that Alan Gould himself is a voice in the dark. His ideas percolate throughout LIPS, and he was one of the key people I really wanted to be at the inaugural LIPS in 2011. He continues to offer excellent insight and thought-provoking discussion, as well as friendship and support.

Jon Elvert also wrote in about a voice a dark:

There are actually several "influencers" for me who impacted my career in the dark, and one of those voices was Fran Biddy, former show producer at the Strasenburgh Planetarium in Rochester, New York. I was fortunate enough to intern there in the eighties, during the heyday of Strasenburgh's Internship program.

Back then, shows were recorded and synced to cues on reel-to-reel tape, and most shows included characters asking questions of the audience (the presenter would stop the show tape and wait for answers from the audience before resuming the show). Fran died a number of years ago, but those of us who interned under his guidance were introduced to innovative ways for connecting to K-12 and public audiences, including theatrics, costumes, and props, through humor and spontaneity. Fran taught us to treat our audiences with respect, and never dumb down the presentation. As a planetarium show producer (and scriptwriter), Fran showed how to make astronomy accessible with simple imagery and language while using tech innovations (probably one of the first planetariums to use VHS video on monitors in shows).

He even placed emphasis on arrow pointing etiquette by actually pointing to an object rather than having the arrow wiggle around the object. The Internship program focused on all aspects of show production (recording, special effects, scriptwriting, editing,

(Continued on pg. 49)

A DIFFERENT POINT OF VIEW

A Little Bit of Everything

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Pet peeves - we all have them, and as I get older, I tend to get more cantankerous. They are small things, for sure, but they bother me and while many might say "keep your opinions to yourself" or "don't say anything as you might upset someone", I get my aggression out by stating opinions. You should be in a car with me as I drive along shouting opinions about other drivers' abilities behind the wheel. I certainly won't dump them all on you at once but dish them out slowly so you can savor them. Perhaps you won't find them troublesome at all, but indulge me, if you will.

VERTICAL MOVIES. Perhaps this comes from a lifetime of making movies, but why do people insist on taking videos with their cell phones in a vertical orientation? The only time this ever worked was a show given in Las Vegas at Circus-Circus about a high wire act. Other than that, every film I've watched has been wider than taller. For you scientists out there, look at your visual receptors. Your eyes are on a horizontal plane and see a wider horizontal, rather than a taller vertical, view of the world. Without this ability, Cinerama would have been a bust.

COMPUTERS: While I have never generated a like for these beasts, I have learned to tolerate them. They have become a kind of necessary evil. I think everyone has had a hard drive go out for apparently no reason and one just accepts these things. I just make three backups of everything and that is normally enough protection to allow me to sleep at night. If I really want an extra backup, I will burn a CD/DVD, which has never failed me…yet.

A couple of months ago, I made the decision to start giving shows once more. I really doubt that we will ever be free of Covid 19 or a variation of it, so life must and will go on. When I went to access my email list of some 700+ visitors, I found the cloud where all of this stuff is stored had dissipated somewhat and only 400 or so remained. How, where or why this happened is anyone's guess, but I can't find them. I just feel beat down. Perhaps that's why I love my old mechanical/optical projector so much. Gears and motors and flashlights may not be state of the art, but I never got a blue screen of death from them.

While I won't be reviewing the December 2021 issue of the Planetarian for ten years (if I'm around in ten years), I did notice that some of Keith's Captured Quips that I posted were, again, posted by April Whitt in Last Light. A good quip is worth repeating.

While I am not much of a book reviewer, I would recommend Emily Levesque's book "The Last Stargazers." It came as a Christmas gift, and I wasn't sure what to expect. The experience was more like a family member remembering the trials and tribulations of life over a glass of wine. Well worth the read.

Keith's Captured Quips ~ Chapter Eighteen

(Two boys came slowly into the dome while I was working; one pointed at the dome, illuminated in sky blue). "What's that?" "That's God!"

(Overheard from a girl on her way out) "I can't wait to go to college!"

"I got dizzy when the walls moved."

"When you rorotated the sun I got dizzy." (And I didn't move anything all that fast")

"Did you know we are so small you will be scared? I do not really like that. Do you?"

10 years ago (2012):

Chuck Bueter tells us about the transit of Venus. This was before I had my planetarium operational but was able to view a projection of the sun with the black dot of Venus. I'm glad I had a chance to see it, as the next viewing will be in 2117. Not many of us will be around to see that one. Thankfully, we can fake it under the dome.

Kristie Mazzoni and Kyra Elliott tell us about "Tackling digital production with a small staff" in producing "One planet, two planets, red planet, blue planet." It is fun to see production happening at a small planetarium, but one wonders; with the speed of computer and software advancement, are the shows even playable today? Their original Spitz STP lasted nearly forty years; a feat I doubt the new digital equipment will match.

As I review the various issues of this great magazine, there are questions and statements that are repeated over and over again. Perhaps the question visited most often is, "How can I be a better planetarian and what tools are required to do it?" I find the "Guest Editorial" by Philip Groce one of the best answers to this century old question. While the entire article is worth the read (as well as a review every year or so), he sums up the secret to our universe in his closing paragraphs reproduced below.

"Be a planetarium"

So, my friends, here it is, the secret of the universe, planetariums, and everything:

Be earnest and true to yourselves—be a planetarium, and, most important of all, be unafraid to be human by sharing your love of the sun, moon and stars.

You don't need a million-dollar budget or even a thousand-dollar budget to do that. It doesn't matter what technology you use or what size dome you project upon. If you can approach your presentations with the same awe and wonder you had when you saw your first star-filled sky, you will succeed. For what our audiences want the most is a learned and passionate guide to the heavens. They want someone with a cosmic perspective who will inspire them to go find their own starry night, explore it and, yes, celebrate it. Nothing could be more human and, for planetariums, more important."

25 years ago (1997):

Gary Tomlinson generates not one, but two, different articles, the first on

(Continued on pg. 55)

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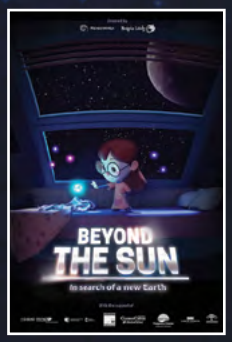

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Tales from Dome Under (con't.)

well as front and back of the two film chips, were free of dust and lint. This was accomplished by using a static-free photographic brush, which contained a small and weak source of radiation to provide the ions that made it antistatic.

If you've done everything right, the clear "window" on the Kodalith slide, as defined by the painted silhouette that was photographed, lines up exactly with the color image underneath. You're done!

Now all you have to do is repeat this process 3, 4, 5, 6 times for this one particular visual, and continue to do so for all the slides—30, 53, 78?—required for the presentation, but I think you get the picture. Labor intensive while under production, but a sense of real relief and satisfaction when the planetarium technicians come knocking on your office door first thing in the morning for a replacement slide to one that was burned out and they needed another.

That, in a nutshell, is how the 3PD process works, and it worked really well for those decades that it was in practice. There may even be some analogue theaters out there that are still using it today, though I doubt that 35mm Kodalith (the printing industry is digital today), let alone 35mm color slide film (refer to your smartphone's capabilities as camera) is as readily available as it used to be. I know that here in Stockholm my "go to" photo service that duplicated, masked, processed, and mounted all my slides (we didn't have the capability inhouse at Cosmonova) stopped doing so right when I was producing a major school production in 2002-2003. Fortunately, I was able to get a much-welcome assist from Loch Ness Productions (thanks, again, Mark, and Caroline!), since they were well aware of what was required in planetarium slide work.

After having all this "flash from the past" in mind, I think I'll have to take a look through some of my old planetarium-related boxes of stuff downstairs. I just might have an open bottle of red opaque in one of them that I can take a whiff of; just for old time's sake...

Surface vs. Volume (con't.)

tilt 45 degrees or more, and depending on the dust content of the galaxy, dust absorption may hide much of the emission along the line of sight such that we mostly see only the near side of the galactic plane and whatever is "above" the dust.

Some galaxies are, of course, seen so close to edge-on that the spiral structure is completely invisible. Then, only dust-penetrating radio observations can help. Spatially resolved velocity observations of neutral hydrogen at 21cm wavelength may provide hints towards the spiral structure and the type of spiral. Even then, there is considerable ambiguity in the interpretation of such data.

So, what do we do?

The overall structure is known from general knowledge about the classification of spiral galaxies, unless we are seeing the galaxy very nearly or exactly edge-on. It is also known that the dust and gas is distributed in a thinner layer than the stars. We assume that the emission line regions have a similar extent perpendicular to the galactic plane as perpendicular to the spiral arm, but with a different small-scale structure. First, we lay out the distribution of stars and emission line regions and then add the dust filaments to match the observations as well as possible. The positions of individual stars and small-scale structures are generated with random noise functions that are chosen to approximately match the observed statistical distribution.

For galaxies with intermediate inclinations (angles of tilt), we not only match the structure as seen from Earth, but also check that the face-on and edge-on views match the expectations for the type of spiral that it belongs to in the Hubble-classification scheme. While the distribution of matter and light emission at a local level is uncertain in the direction perpendicular to the plane of the galaxy, the scientifically known, general properties are incorporated. We also match the overall and regional visual aspect to that of the available photographic imaging in the optical and other wavelengths.

At *ilumbra.com*, this methodology, together with our proprietary 3D astrophysical modelling software, allows us to produce volumetric 3D models of spiral galaxies with high visual fidelity.

Under the Classdome (con't.)

Summary

There are as many techniques to catch students' attention as there are teachers. That is why our planetarium organizations are so valuable. I just learned some new techniques myself as we assembled this column. I was ready to share some of *my* ways to catch the kids' attention, but now you'll have to wait for part 2 because I got so many great ideas from the rest of the ClassDome cadre. I would love to have to wait a second time because some of you readers decided to contact me with YOUR ideas about how YOU engage your students. I'm just a quick e-mail away at mpercy@williamsvillek12.org.

design, programming), but, for me, it was Fran's presentation style that I most remember, and it was this presentation talent that I used to mentor dozens of presenters I've hired and worked with over the years.

Jon has been a positive presence in my life for several years now, as I started working closely with him on the Vision 2020 initiative. I always appreciate his support, sense of humor, and generosity of spirit. I did not ever meet Fran Biddy, but I certainly wish I had based on these comments.

I want to end with a look to the future. There are several LIPS-style events planned for 2022. In chronological order, they are:

1. Mini LIPS at Middle Atlantic Planetarium Society (MAPS) conference in Maine on Wednesday, May 18. This will be the first-ever Mini LIPS at a MAPS, and I thank conference host Shawn Laatsch for his past, present, and future help with the planning.
2. Mini LIPS in Bournemouth, England in mid-June. I will be seeing my longtime voice in the dark Elvis Costello at three concerts in England, and it made sense to organize a Mini LIPS while I was on that side of the pond. This will be the first in-person, LIPS-style event outside the USA!
3. We will have a storytelling workshop by Cassandra Wye, plus sessions by attendees in a classroom space and in a portable dome. I extend my thanks to Neil Carrington of Science Dome for his help finding an appropriate facility, collecting registrations, organizing break/lunch food and beverages, and much more. I couldn't do this without Neil's help. If registration hasn't already opened by the time this column is published, it will be open very, very soon!
4. Possible half day LIPS at IPS 2022—thanks to Ian McLennan for acting as communications liaison and to Mark Webb for volunteering to run the actual day (assuming IPS 2022 does happen in person). I personally will not be attending IPS 2022, but I will provide as much "behind the scenes" support as desired.
5. Mini LIPS at the Southeastern Planetarium Association conference in July in Huntsville, Alabama. Thanks in advance to host David Wiegel for helping with the second-ever Mini LIPS at a SEPA.
6. The main LIPS in early August—more details on this below.
7. GLIPSA during the Great Lakes Planetarium Association (GLPA) conference in Buffalo, New York in October. GLPA was the first US regional to ask about holding a LIPS-style event. By my count, this will be the tenth GLIPSA—time flies! Thank you in advance to host Mark Percy for assisting with GLIPSA 2022.

Storyteller Cassandra Wye will do a workshop during the June Mini LIPS in Bournemouth, England. *Image credit: Cassandra Wye.*

There are simply not enough words to describe how excited I am for LIPS 2022! You may recall that the Fiske Planetarium at the University of Colorado Boulder was planning to host LIPS 2020. Plans were coming together well, and it was going to be a phenomenal LIPS. But for obvious reasons, LIPS 2020 ended up being a virtual conference.

As I write this, we are planning to hold LIPS 2022 in person at the Fiske Planetarium. The main LIPS days will be Wednesday through Friday, August 3 through 5, with an optional half day workshop on kinesthetic astronomy led by Cherilynn Morrow on Tuesday, August 2. During the main LIPS days, we will have a three-part presentation skills workshop with Eddie Goldstein, opportunities for LIPS attendees to present public shows, and much more.

We hope to open registration and session proposals in late February or early March, so by the time you read this (or shortly thereafter), you should be able to register as a regular or sponsor attendee. I want to give a huge thank you to LIPS 2022 hosts John Keller, Briana Ingermann, and Nick Conant for all of their past, present, and future work!

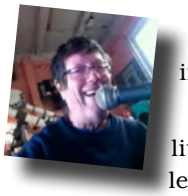
I'll be keeping the LIPS website as up to date as I can with new information: *https://sites.google.com/view/lipsymposium/home*

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.

WANING GIBBOUS

Odds & Ends

This quarter's "Odds & Ends" is from Gary Likert. Gary is founder of the Home Planetarium Association, the world's first organized group of home planetarians. Below is what he describes as an "offbeat overview" of his podcast.



Thinking of putting a home planetarium in your own backyard?

My podcast hopes so, but admittedly it's a little like Frodo asking ' Mordor, Gandalf, is it left or right?'. Left leads to the accursed land, while right presumably leads to the blessed. Either road can lead to a planetarium at home, for such an endeavor can often be both a blessing AND a curse for many reasons. So much to explore!

Such then are the fertile complexities of the 'Home Planetarium in Your Own Backyard' podcast, which has been running now for 18 months and umm A LOT of short episodes. It represents an ongoing blessing for our inner geeks, analogs, P.T. Barnums and even Carl Sagans, who all can run wild but under our control. We can hear that roar of the crowd, if a couple visitors over as many months can be said to roar. Experience the joy of construction, if drilling 2000 pinholes is your idea of fun, like mine is. Know the wonder of infinity grasped as you count the number of times you fell off your step ladder whilst trying to build that dome. Such blessings!

But a home planetarium can be a curse too, there's no limit to our stars, so no one tells us STOP already. Funds may be limited, so suddenly no junk is bad junk. That's no toaster, it's an aurora projector! No black boxes for us, it's just as much fun LOOKING at the stacked exotics all over our makeshift star chamber than worrying whether they actually WORK or not. Never mind that snarl of wires wrapping around your leg, pulling you deeper into the darkness. Some future 'gasp' will make it all worthwhile maybe. And my little podcast will be there to document it!

Mordor then, Gandalf, left or right? But if mortal challenges lurk one way, and to be sure they are legion, surely heaven waits down the other path!

First we create our own stars, but then we pile expectations upon them! We anthropomorphize them into human-like beings, treat them like some pre-Copernican 2D band of shiny, happy people who listen, may be wished upon, urge us to follow them, want us to catch them if they fall. Like some cosmic therapists, they listen patiently, they deliver us to our distant lover's arms. We step on them, we chide them to pay attention. Is it any wonder eventually they have every right to go blue? Stars are over romanticized, overreached for - who could blame them if they begin dodging our questions, resenting our stalking them, moving just OUT of the reach of our out-stretched hands! My podcast looks at these cultural practices - songs and poetry perhaps are the worst culprits here. As narrator, I must admit at times I grow lonely and talk to AI voices, and even imagine I see Urania herself standing before me. And she's a bit bossy. Perhaps all who spring from myth and legend share that feature, who can say. Not I.

Questions outnumber answers surely when it comes to putting a planetarium in your own backyard, but a podcast can live in many worlds at the same time, and mine surely attempts that feat. But all are invited to this dance, science, romance, literature, poetry, music - in other words, all the Muses get their hand in the game. And the stars, if we sing to them, surely then might just sing back to us. They may even call me, maybe You never know..

So if its mechanics you want, the podcast has those - projectors, domes, footprints, infrastructure, music, effects, shows, poetry, ghosts even. In its more fanciful moments it even talks to Muses and they talk back. Act like they are in charge. Perhaps they are. I know I'm not. Mordor Gandalf? Blessing or Curse? There's only one answer.

All of the above. Like the stars.

The following is a photo of my latest home planetarium, which seats about 8 on couches in a converted 12 by 12 carpark. A Homestar and Spitz Junior are being utilized, and I've even got Steve Smith's old copper star cylinder, but am giving it a rest. The angel in the corner is left over from Christmas, but I've started calling her Urania.

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BOOK REVIEWS

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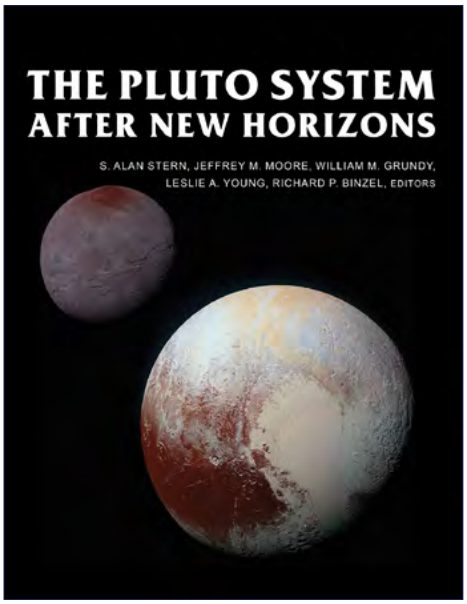


The Pluto System After New Horizons

S. Alan Stern, edited by Jeffrey Moore, William M. Grundy, Leslie A. Young, and Richard Binzel, University of Arizona Press, 2021, ISBN 978-0-8165-4094-5, US$65.00 hardbound, electronic edition available.

Review by April Whitt, Atlanta, Georgia USA

Many of us probably remember that exciting week in mid-July 2015, when the New Horizons spacecraft skimmed past Pluto, sending back images of a surprising and complex surface and a system of moons.

Or that New Year's Day in 2019, when the target was distant Arrokoth.

This nearly 700-page volume summarizes what we've learned about Pluto itself, about Charon and Pluto's small satellites, and discusses the origins, interiors, and "big picture" of the whole system.

Binzel and Schindler's broad context of the discoveries of Pluto and the Kuiper Belt opens the story and is followed by a detailed table of transneptunian objects. Pluto's volatile-related landforms and their Earth analogs, impact craters and age estimates, the photochemistry of haze layers in the atmosphere, Charon's geology and geochemistry, and Nix and Hydra's shapes and compositions are all reported.

There is a good review of hypotheses for the system's origin, and an excellent presentation of the planetary nature of dwarf planets. The small, but fierce, spacecraft returned so much data and so many images. The authors in this volume set it forth well and in great detail.

Many chapters end with summaries and questions to be answered with the next mission to the far reaches of our solar system. Appendices include "An Abbreviated Photographic Journal" by Michael Soluri, which highlights the New Horizons Team and their amazing accomplishments, and H. A. Weaver's descriptions and list of the craft's instrument suite.

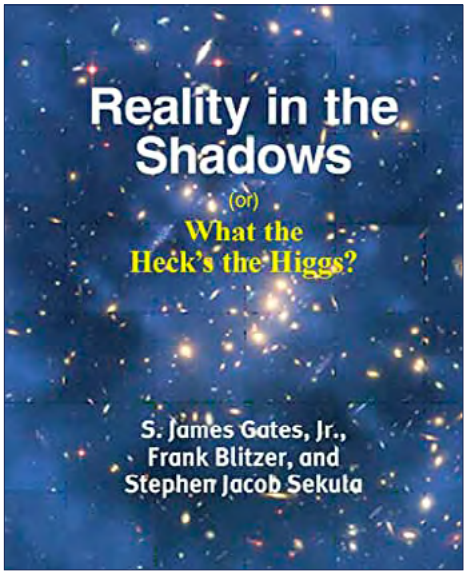
In their foreword, David Grinspoon and Dava Sobel point out that astronomers redefined the word "planet" to exclude Pluto shortly after the launch of New Horizons in 2006.

"The mission's primary destination," they say, "shifted in the eyes of many – from the ninth planet to the first world of the outer solar system's vast, unexplored expanse."

They mention the loss of New Horizons' radio signal less than two weeks before encounter, and the team at Johns Hopkins Applied Physics Laboratory that reacquired it, only to face the next glitch; the reboot had also erased "all of the commands needed to execute the encounter."

The heroic work of restoring the software allowed "the rare and brief opportunity for the people and activities of the planetary science community to become highly visible." Twenty-first century social media turned the mission into a new type of global event.

This book is a rich resource for educators and researchers. While the electronic version may be an easier mass to handle while reading, I've thoroughly enjoyed exploring this volume. The many, many contributors to this book are from all over the world – researchers, technicians, developers – truly an international mission.



Reality in the Shadows, or What the Heck's the Higgs?

S. James Gates, Jr., Frank Blitzer, and Stephen Jacob Seluka, New York: YBK Publishers, 2017, ISBN 978-1-936411-39-9, softbound, $26.95 US, Kindle, $9.99.

Reviewed by Francine Jackson, Ladd Observatory, Providence, RI.

Several decades ago, Filmmakers Charles and Ray Eames created a short film called Powers of Ten. In it, the viewer's vision is changed by a factor of ten every ten seconds. Beginning with a couple on a picnic and the first set of changes increases by a power of ten. Finally, when it seems there is nowhere else to go, the scene changes to powers of negative 10. Were this made today, using the information we now know about the macrocosm, and the incredible number of subatomic particles introduced within this book, the movie would be several times its short, several-minute run.

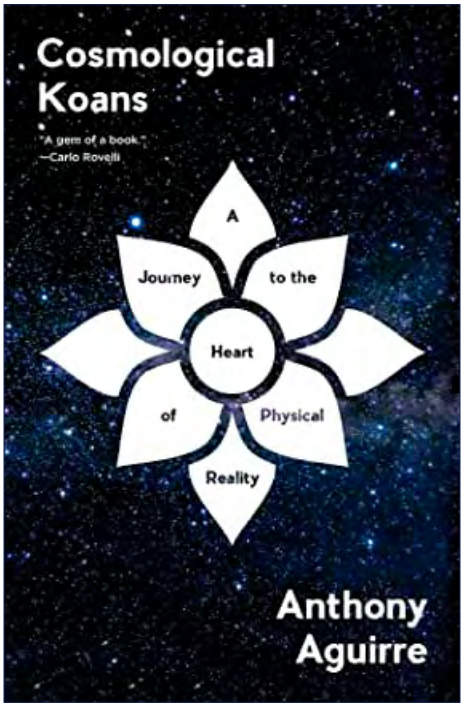
Reality in the Shadows is much more than just a history of both astronomy and physics: it is a travelogue of the incredible world of science. Granted, some of the best-known discoveries are documented here, but there are many more, some unknown to most of us, that have brought the universe literally to incredible heights.

The authors begin with the eye-opening realization not so long ago that the Earth is not the center of the universe, then, in meticulous fashion, introduce us to the minute particles which make it up. For some readers who were brought up on just the three major parts of the atom, there is much to learn here. This book shows the reality of the number of discoveries that have been made plus the many scientists, some not everyday names, and their dedication to doing whatever they could to increase our knowledge of everything around us. We look both upwards to the concept of a black hole (not a new idea, by any means) and its relationship to super strings, and downwards to particles even the most dedicated person might be unaware of.

Each of these discoveries are all a part of what keeps the universe whole.

And of course, as mentioned in the title, the Higgs. What made the discovery of this particle worthy of such fanfare? How was it even discovered? And how does it relate to everything we think we know about our world today?

This book was written for the layperson, although a rudimentary idea of general physics might be worthwhile as the discoveries, and the scientists who made them, come fast and furious. For those for whom science isn't a first love, you might want to peruse this book slowly, but you will truly enjoy it, and definitely come away with a more wonderful and beautiful concept of what is all around you.



Cosmological Koans

Anthony Aguirre, W.W. Norton & Co., 500 Fifth Ave., New York City, New York, 2019, ISBN 978 -0-393-35831-5, US$18.95.

Reviewed by Lauren Albin, Fernbank Science Center, Atlanta, Georgia, USA.

Anthony Aguirre's *Cosmological Koans* uses the format of Zen Buddhist koans to bring his readers a new and deeper understanding of concepts in physics and cosmology.

The koan is a device, usually a brief anecdote, dialogue, story, or riddle, used for Zen spiritual practice. Confronted with a koan, a student must first find comfortability in the face of what's apparently baffling. Then, they must sit with their "not-knowing" until old thought patterns and past experiences are left behind and a new way of seeing the issue emerges. Removing the koan from its traditional spiritual landscape, Aguirre repurposes it as a tool of science.

Each chapter in the book opens with an original koan, which places the reader in a historical setting in the 17th century, like in a cave in the Arabian Desert or in the hull of a ship leaving Venice. Brief as they are, each anecdote is packed with descriptive imagery, fully allowing the reader to imagine they are conversing with a Djinn or about to be struck in the heart by an arrow shot from a Sensei's bow.

Beneath the koan is a wandering discussion of what concepts of physics are at play in the innocuous example above. For instance, jumping off a cliff while throwing a book becomes a new way of envisioning Einstein's equivalence principle, and pilgrims entering through two separate gates at the Samye Monastery in Tibet is a new way of approaching the double-slit experiment, detailing the dual properties of light.

It is my recommendation that this book is most useful for those readers who already have a moderate understanding of concepts in physics and cosmology, or perhaps for new students of the subject that want to practice their grasp. To quote Aguirre, each koan is meant to engage the reader in a "fully *participatory* and *personal* experience." In doing so, he asks us to leave behind the comfort of oft relied-on textbook examples, such as the Twins Paradox or apple pie made from scratch, to journey into frontiers unknown.

The text is laid out in such a way that each chapter builds on the one before. Starting at the beginning of the text, you could slowly work your way through a history of cosmological thought. Or alternatively, you might choose to select a chapter at random and dedicate your afternoon to chewing on the intricacies of a single thought experiment related to that difficult concept you want to unpack. If you are a teacher, you might let your students do the chewing for you.

Overall, Aguirre gifts his readers with a totally unexpected way of examining some of the most puzzling revelations in physics, bringing science and philosophy back into close relationship with one another.

A Different Point of View (con't.)

"Grade Appropriate Concepts" and the second, "Listening vs. Reading Levels." The first is rather straightforward, but certainly worth a review. The second is more fun. How high of a presentation level can one provide and still keep the interest of the viewer? Gary asked the question, "Is it appropriate to write a planetarium show with a reading level one or two grades higher than the intended audience?" Do things go over your audience's head, and do they care at all? Do people understand slower in the dark as Don Hall suggests?

Cary Sneider reminds us that, in order to get any concept across, one should follow five simple rules:

1. Keep sentences short and simple.
2. If you're trying to express two separate ideas, use two separate sentences.
3. Use common words.
4. Construct short paragraphs with clear topic sentences.
5. Don't pack too much information into a program. Less is better.

While I have no idea if the general population understands slower in the dark, I assume they would not listen as well if presented with a spectacular star-filled sky. I imagine their minds would be in another place.

Such fun...if you missed this article from twenty-five years ago, I would suggest reviewing it.

Richard McColman, in *Planetechnica*, talks about simple old cam and micro switch technology. This is my neck of the woods. Once built, this technology would last a literal lifetime, available over and over again at the touch of a button. An easy fix with just a glance if it did malfunction. Not a circuit board with IC's that just mock one with invisible burned out circuitry. The least they could do is smoke a little and turn black. Give us slow learners and old folks a fighting chance. No, they gave us Windows 11 when they promised us Windows 10 would be the end. Bah Humbug, no wonder we can't enjoy Christmas.

45 years ago (1977):

Editor's Message: "Long overdue, but here it is. Because of a combination of problems, not the least of which is poor postal service, your journal is late." (Where have I heard this before? I won't touch this with the proverbial ten-foot pole.

Way back when the average salary of a planetarium director was $15,025 a year, (who says there is no inflation?), the average annual budget was $46,216, just about what it is today. Most planetariums did 15 public shows a week, so says a survey conducted by Herbert Schwartz (just don't call him "Herby"). You will need to review this entire issue to make some sense of that. Back in those days, optical/mechanical projectors were king, and Spitz made 75% of them. As long as you're reviewing the issue, I would select "diagram 3" as the answer to the "example test question." (If you made it this far through my column, you certainly need a challenge. Perhaps you might have surmised that March 21st is very close to April 1st.)

SEEKING WHAT WORKS

THE ROLE OF VIRTUAL PLANETARIUM SHOWS: MOVING PAST THE PANDEMIC

Peggy Hernandez
Science Communication | Planetaria
peggyhernandez@u-46.org

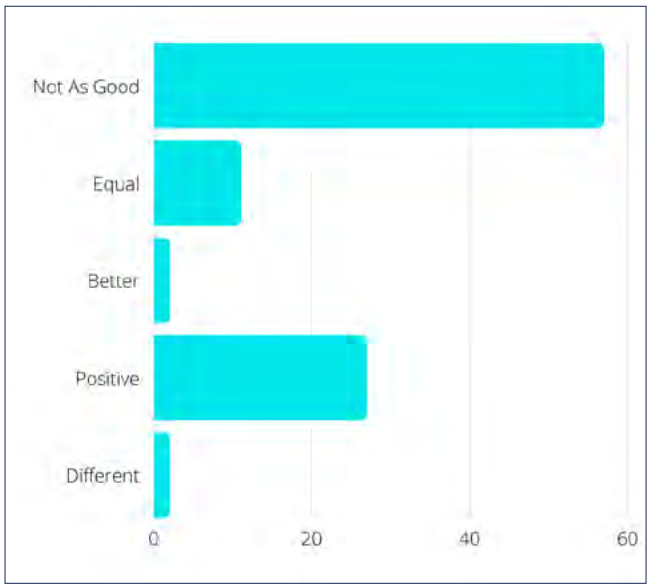
This column has focused a lot of COVID-19 related content in the past year or so. Members of the education committee have looked at the response from Italian Planetariums (Simonetta Ercoli), the lessons learned on doing virtual programming with school children on zoom (Ken Brandt), and the silver linings we can take from a very difficult time (Peggy Hernandez). We have all been looking for ways to cope, adapt, and make the best of a bad situation. As we move toward either getting past the pandemic or learning to live with it, I want to see what we can take with us moving forward using data from audiences.

I am a member of the Big Astronomy Project that has created a planetarium show, hands-on activity kits, and a web-portal with additional content, and that hosts live virtual events on facebook live focused on observatories in Chile. My role on this project has been as the research lead. Our original intent was to study how we best engage audiences in continuing their learning beyond the planetarium theater. We had planned a global premiere in May 2020 and the research team was going to travel around the United States to collect surveys, interviews, and field notes with audiences. However, the pandemic changed our plans completely. Instead of premiering the show in domes, we instead premiered it as a 360-degree stream on YouTube. In time, domes reopened, and the show has been shown to in-person audiences as well. The research team has responded to this by instead focusing on comparison studies between this online 360-degree stream of the show to in-person.

One aspect we asked audiences about was how the 360-degree stream of the show compares to an actual visit to the planetarium. We asked this in an online survey shared with audiences at the end of a YouTube stream as well as in virtual interviews. These were offered in both English and Spanish. We are currently working on a full analysis of all the data and plan to have the results published in a peer reviewed journal sometime this year. However, I wanted to share some initial results here, as I think what we are seeing could be beneficial to planetarians moving forward. I will focus only on the survey data results from those who saw the show as a 360-degree YouTube stream from either the Big Astronomy YouTube channel or another planetarium's YouTube channel, for which we have had 177 responses. Of those responses, 100 people answered the write in question about how the 360 YouTube stream compared to a visit to the planetarium. Below are some emerging themes from those responses.

How does it compare?

The majority of respondents to this question. 57%, stated that the 360-degree YouTube stream was not as good as a visit to the planetarium. Another 11% saw the experience as equal or similar to visiting a planetarium, 2% said it was better. Some responses were not so much a comparison as just a statement of the experience itself with 27% just responding that it was a positive experience while 2% just thought it was different.



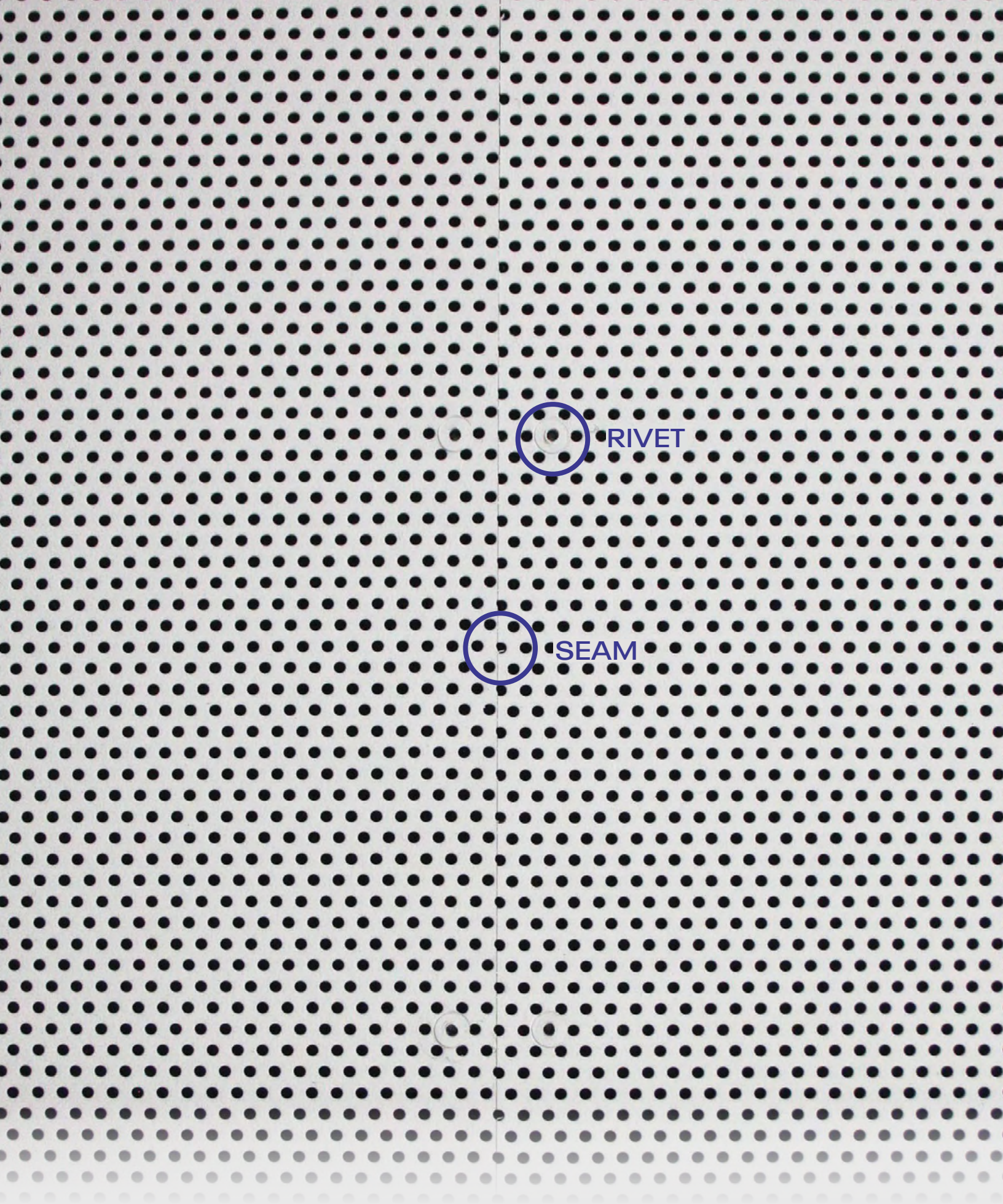
Immersion and Internet Issues

Most people who saw the 360-degree stream did so during the height of pandemic closures when they could not make it to a planetarium at all to see it in person. As a result, of those 57% who did not say that the 360-degree stream was as good as a visit to the planetarium, 42 of those respondents shared a common refrain that it was good enough for now, considering planetariums were closed (9 responses), or that the stream itself was good, just not as good as visiting a planetarium (33 responses).

Not everyone offered reasons for why they thought it was not as good of an experience, but, from those who did, the most common was that the 360 YouTube stream was not as immersive as a planetarium show in-person (11 responses). Another 3 of those who did not think it was as good as an in-person visit mentioned issues with the stream and another 7 mentioned that the show was at a lower resolution. Even those who offered just generally positive responses also mentioned stream issues (3 responses) and the fact the show was at a lower resolution (2 responses).

Convenience, Accessibility, and Interactivity

Similarly, for the more positive responses, not everyone offered a reason why but there were some themes as to why the experience was positive. This includes responses from people who suggested the experience was generally positive, equal, or better, as well as those who felt the experience was not as good as a visit but still thought it was good overall. There were 5 responses that noted that it was convenient to watch the show from



home and not have to leave their house.

Another 2 responses brought up that this was more accessible for people who could not reach a planetarium as they did not have one nearby. This is in addition to those who felt the experience was good enough for now because their local planetariums were inaccessible in that moment due to the pandemic.

Finally, another 3 responses mentioned that the 360 YouTube stream was interactive. Of those responses, 2 mentioned that they were able to move the screen around. One person mentioned the chat function on YouTube that allowed them to talk to other audience members. While this was just one response, it is an interesting contrast and value added to the virtual version as social expectations do not allow for chatting during an in-person show.

Take Aways

Some things we might be able to take away from this is that people appreciated the unique opportunity of the 360-streams and that it was a good enough substitute, but, for many, there is nothing that can quite replace the immersive experience of being in our domes due to the small screens and glitches that can happen. Any fears planetarians have had around whether or not people would come back after the pandemic can be alleviated by this result.

However, offering online content and virtual versions of planetarium shows is a way to capture audiences who may not be able to or want to visit for one reason or another. And while the accessibility issue represented in this data set is not having a planetarium close enough, there is also something to be said that this could be a way of making planetarium content more accessible to those who may have trouble navigating a planetarium due to physical limitations. Additionally, the interactive and social experience of an online experience will make virtual shows a different experience with their own affordances.

Ultimately, I think we can be assured that audiences will come back to our domes and continue to enjoy the unique experience a planetarium offers. But there is likely room for virtual programming well past the pandemic to reach more audiences and support more folks in learning about astronomy.

If you'd like to keep up to date with the Big Astronomy Project, learn more, and see our current research results visit *bigastronomy.org*

ELECTIONS

IPS ELECTIONS 2022: OFFICERS AND BOARD

IPS will conduct two separate elections in 2022 – one for Officers and one for Board Members. Follow those links for details of the nomination and voting procedures. Everyone can have a say!

IPS Officer Elections 2022

IPS members are asked to put forward their nominations for the Officer positions of President-Elect, Secretary, and Treasurer for 2023-24. These elections are held every two years and give you your chance to have your say! Current Secretary Patty Seaton and Treasurer Michael Smail are both eligible for re-nomination. On January 1st, 2023, Michael McConville will take the chair as IPS President and Kaoru Kimura will become Past President as we welcome a newly elected President-Elect, who will hold that office for two years and become President on January 1st, 2025.

Multiple nominations for all positions (especially President-Elect) are highly desirable, so we encourage nominations from the worldwide IPS membership.

Please first discuss your nomination with your nominee, then send nominations to Martin George, Chair of the IPS Elections Committee, at *martingeorge3@hotmail.com*. Nominations close at the time of the IPS General Meeting at the upcoming IPS Conference in St Petersburg, Russia, in June.

Please contact Martin George if you have any queries about these positions, or the election process.

IPS Board Member Elections 2022

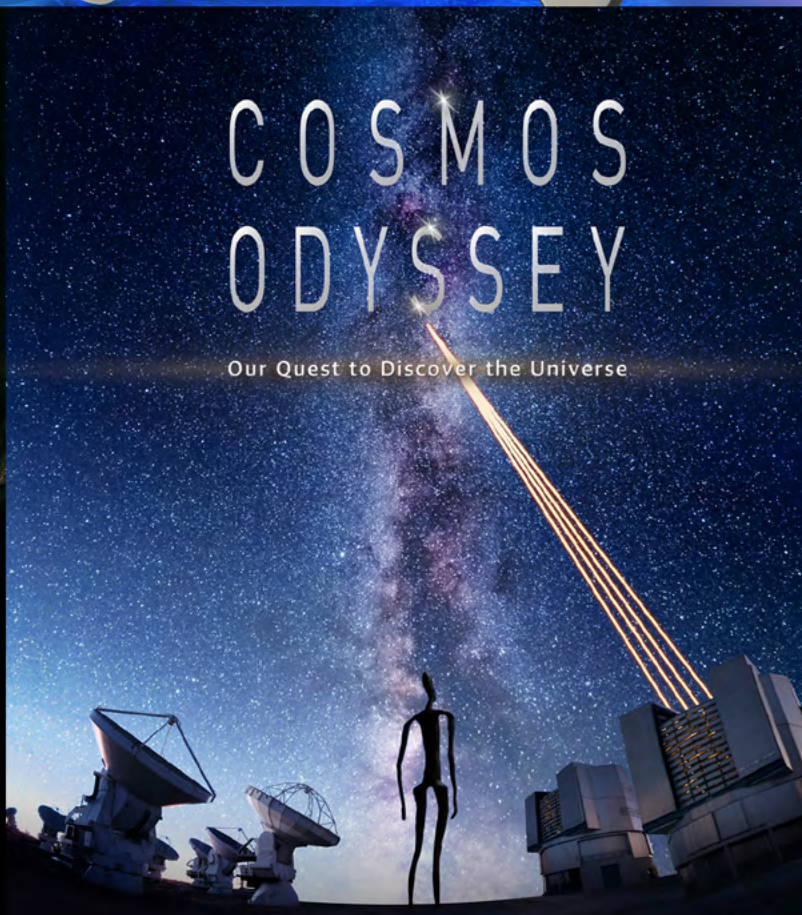
In addition to nominations for Officer positions, IPS members are asked to put forward their nominations for Board Member positions in five of the six continental zones: Africa, Asia, Europe, North America, and Oceania. The first terms of office of Board Members Susan Murabana, Sumito Hirota, Bjorn Voss, Dayna Thompson, and Martin George, respectively, will finish at the end of 2022. All five of these members are eligible for re-election for one more three-year term, to end on December 31st, 2025. IPS encourages nominations for each of the five positions.

In regions covered by an IPS Affiliate, please forward your nomination to the Affiliate, who will make the nomination on your behalf. In regions not covered by an affiliate, IPS members may nominate Board Members directly.

Currently, IPS is governed by the five Officers and nine Board Members (two in each of Asia, Europe and North America, and one in each of Africa, Australia and Latin America).

Board Member nominations close on August 1st, 2022, at 0h UT, and are to be sent to Martin George, Chair of the IPS Elections Committee, at *martingeorge3@hotmail.com*.

Martin George
Chair, IPS Elections Committee



Website : fulldome.kr
Contact : sales@metaspace.co.kr

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INTERNATIONAL PLANETARIUM'S CALENDAR

COMPILED BY: LORIS RAMPONI

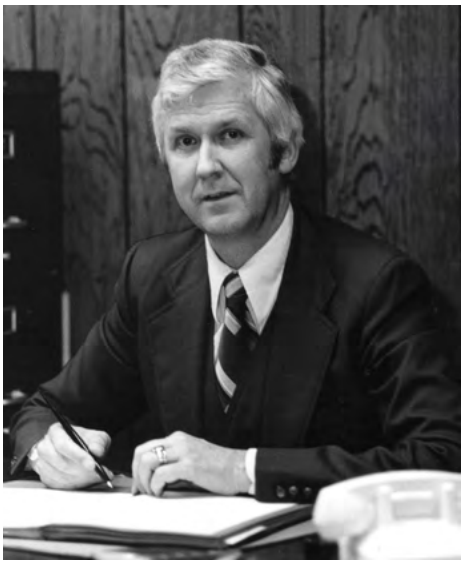
2022

- **11 March.** Deadline of the Stipends Application for IPS 2022 conference registration. The stipends cover full conference registration for IPS members whose circumstances make it otherwise difficult or impossible to attend. Applications will be initially reviewed by the International Development Committee, and this will be followed by a final decision from the IPS Officers.
  Registration fee at page *www.ips2022.com*
  Stipend information at page *https://www.ips-planetarium.org/page/stipends*
  https://www.ips-planetarium.org/page/StipendApplication
  Contact: *martingeorge3@hotmail.com.*
- **11 March.** IMERSA Day. This IMERSA Day will explore the potential of bringing live performances to the dome. The program will showcase examples that have evolved from experiment to success. *Imersa.org*
- **13 March.** International Day of Planetariums, public initiatives between 12 and 13 March. *Ips-planetarium.site-ym.com/?page=IDP*
- **22 March.** Submission deadline for SIGGRAPH 2022 that invites you to elevate your voice and contribute your greatest innovations in research, art, production, technology, and more to the premier conference for computer graphics and interactive techniques. SmithBucklin Corporation. *https://s2022.siggraph.org* ; Contact: *confadmin@siggraph.org*
- **31 March.** Deadline of 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. *www.planetari.org*; Contact: *segreteria@planetari.org*
- **23-25 April.** Gesellschaft Deutschsprachiger Planetarien e.V., (GDP), Annual Conference of the Society of German-Speaking Planetaria, Heilbronn. *www.gdp-planetarium.org*; Contact:*bjoern.voss@lwl.org*
- **29 April – 1st May.** Italian Association of Planetaria (PLANit), National Conference of Associazione dei Planetari Italiani, in collaboration with Fondazione Scienza e Tecnica, Florence, Italy. *www.planetari.org*; Contact: *segreteria@planetari.org*
- **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*
- **18-21 May 2022.** Middle Atlantic Planetarium Society (MAPS), Versant Power Astronomy Center & Jordan Planetarium, University of Maine, USA. This year's theme of "Dome Visualization and Climate Change!" will explore a variety of new tools we use to create content for our domes and look at one of the most pressing issues planet Earth faces – Climate Change. We will feature a variety of speakers from the Climate Change Institute at the University of Maine - a global leader in the field, plus member presentations, vendor demonstrations and more. See *https://mapsplanetarium.org/maps-2022-conference-save-the-date/*
- **2-4 June.** European Network Science Centres & Museums (ECSITE), Annual Conference, Heilbronn, Germany. *https://www.ecsite.eu/conference*
- **8-10 June.** Fulldome festival Brno. Brno Observatory and Planetarium, Brno, Czech Republic. *fulldomefestivalbrno.com*
- **22-23 June.** Fulldome festival, Saint Petersburg, Russia.
- **26-29 June.** International Planetarium Society Conference, Saint Petersburg, Russia; *https://en.planetarium.one/ips, https://www.ips2022.com/*; Contact: Evgeny Goodov, *ceo@planetarium.one*
- **30 June.** Asteroid Day. *https://asteroidday.org/*
- **3-5 August 2022.** LIPS Conference (Live Interactive Planetarium Symposium), with optional pre-conference workshop on August 2nd. Fiske Planetarium at the University of Colorado Boulder, USA. *LIPSymposium.org*; Contact: Karrie Berglund, *karrie@digitaliseducation.com*
- **22-27 August.** Southeastern Planetarium Association (SEPA). Vendor set-up: August 22-23, 2022. Farewell breakfast and Space Camp Experience: August 27. U.S. Space & Rocket Center, Huntsville, Alabama, USA. *https://www.sepadomes.org/2022-sepa-conference-huntsville-al/*
- **12-15 September.** Association of Science-Technology Centers (ASTC) Annual Conference, Carnegie Science Center and the Children's Museum, Pittsburg, Pennsylvania, USA. *www.astc.org*
- **23-25 September.** Association of French Speaking Planetariums (APLF), Annual Conference, La Coupole, Saint Omer. *www.aplf-planetariums.org*; Contact: Milène Wendling, *milene.wendling@unistra.fr;*
- **14-18 October.** IMERSA Montréal. IMERSA Summit 2022, Montréal, Espace pur la vie, Planétarium Rio Tinto Alcan, Montréal, Canada. *Imersa.org*
- **16-18 December 2022.** Workshop of small digital planetariums, Marseille, France. Contact: *lionel.ruiz@live.fr*
- **31 December.** Deadline for the contest "A week in United States" For information and application requirements go to: *www.ips-planetarium.org/?page=WeekinUS*
- **31 December.** Deadline of the prize "Page of stars" organized by IPS Portable Planetarium Committee in collaboration with Serafino Zani Astronomical Observatory. *http://www.ips-planetarium.org/?page=pagesofstars*; Contact: Susan Reynolds Button, *sbuttonq2c@gmail.com*

(Continued on pg. 67)

IN MEMORIAM:

Hans-Heinrich (Henry) von Tiesenhausen



September 23, 1931 to December 30, 2021

The planetarium community has lost one of its most enthusiastic supporters – a participant in the growth of the medium through the technical side rather than the astronomical or educational aspects. Henry von Tiesenhausen's story began on the family estate of Odenwald, Estonia, where he was one of six children born into an old, noble Baltic-German family with roots tracing back to 1198. As a consequence of World War II, the family was uprooted, first to Poland, then as refugees to East Germany, and later to the Allied Zone in West Germany. It was there that Henry began learning electronics through library books, obtaining scrap parts from local radio shops, building radios, and creating other electronic devices.

In 1951 his father was able to organize emigration to Canada, and in 1952 the family began the move to Vancouver. There, Henry persisted in his studies and, while working odd jobs, eventually started his own modest company, Commercial Electronics, Ltd, which he owned and operated until 2010. It began with renting a meter square counter space, servicing record players, TVs, and radios. The organization grew and diversified into eight successful lines of business and five corporations in Vancouver, Edmonton, and Bellingham, Washington. The business gained a reputation for high-end retail Hi-Fi and video systems sales and service, custom home automation, professional A/V sales and rentals, and custom systems for planetariums and world expositions. Major achievements included audio/visual and control systems for twenty-one planetariums in North America and Europe, and numerous systems for EXPO 86 Vancouver, World Expo 88 Brisbane, and other location-based attractions. Henry was always appreciative of the loyal staff, and industry friends and colleagues who worked together for the success of this legacy.

Some of the planetariums that benefitted from Henry's personal attention through his Omni-Q and Omniphonic control and sound systems are located in Vancouver, Cupertino, Los Altos Hills, Tucson, Herkimer NY, Reno, Oklahoma City, Jackson, Salt Lake City, Richmond, Chicago, Bowling Green, Edmonton, Madrid, Montréal, Calgary, Pamplona, and Jena, with two major upgrades in Vancouver and Salt Lake City.

Everyone looked up to Henry – literally. He was always the tallest person in the room, which, combined with his quaint, European style patrician manners, made him an unforgettable character. He attended many planetarium conferences and loved to dance.

Henry von Tiesenhausen is lovingly remembered by his wife of sixty-four years, Freda, his sons Peter and Alexander, daughter-in-law Eva, grandsons Andreas and Johann, his brother Engelbrecht and family, his many personal friends and professional colleagues from his long and productive working life.

Contributed by Ian C. McLennan

Robert Andrew (Bob) Nelson

April 28, 1932, to December 19, 2021

Robert A. (Bob) Nelson joined the staff of the City of Calgary's Centennial Planetarium project in 1966 as Assistant Chief Technician. He played a key role in planning and equipping the new facility, which opened on July 1, 1967. With Chief Technician Jim Wright, he travelled to Jena, then in East Germany, for training on the Zeiss Planetarium projector. After Jim left to head the technical staff at Vancouver's H. R. MacMillan Planetarium, Bob took over as Chief Technician in Calgary and continued in that role until he retired in 1991.

In his youth, Bob was an enthusiastic amateur astronomer, telescope maker, and member of the Royal Astronomical Society of Canada (RASC) Calgary Centre. He trained as an aviation technician at the Southern Alberta Institute of Technology and worked for Western Geophysical, Field Aviation, and the City of Calgary before joining the Planetarium. Bob had a lifelong love of aircraft that equaled his love of astronomy. He became Planetarium Director, Sig Wieser's, enthusiastic partner in establishing an aviation collection that now forms the basis of the Hanger Aerospace Museum.

After retiring from the Planetarium - then part of the emerging Alberta Science Centre, which evolved into TELUS Spark - Bob continued pursuing

(Continued on pg. 67)


ATLAS
of a Changing Earth:
Mapping Our Climate Future
OFFICIAL SELECTION
DOME FEST WEST
LOS ANGELES 2021
OFFICIAL SELECTION
INTERNATIONAL FULLDOME FESTIVAL
MINSK 2021
OFFICIAL SELECTION
IEEE VIS SATELLITE EVENT
VIRTUAL 2021
Cosm STUDIOS
TLP
ILLINOIS NCSA
Please contact Jenn Davis at jdavis@es.com for licensing.

PAGES OF STARS

COMPILED BY: LORIS RAMPONI & SUSAN REYNOLDS BUTTON

We are very pleased to announce that, for 2021, we have two first prize winners! We are sure you will find their submissions equally interesting and unique. Perhaps you can incorporate their scripts or recordings in a planetarium show at your facility! For downloadable text and audio files go to: *https://www.ips-planetarium.org/page/pagesofstars?&hhsearchterms=%22pages+and+stars%22* The authors have released these materials under the Creative Commons Attribution 4.0 International License.

WINNERS

First Place:

1. "Venus the King in Mesoamerica" by Alejandro Casales Navarrete
   This story relates how Mayas linked the birth of their kings with the first appearance of Venus as the evening Star, transforming them into divine beings. [Read the script below.]
2. "World Beneath Worlds" by Tami Pudina
   This original poem is about dreams and how we project ourselves out into the universe as well as the universe projected within us and references Eridanus, "The River," as an allegory for the human story. [Read the script below.]

Alejandro Casales Navarrete

(G-15-41. A.P.R, Coyoacán, CDMX, Mexico; email: alejandrocasalesnavarrete@gmail.com; Website: https://www.alejandrocasales.com/)

Alejandro Casales Navarrete is the Mexican artist and director of "Fulldome Mexico," equally cultivating the arts for teaching in a dome and for research. He received his Bachelor of Fine Arts degree from the National Institute of Fine Arts. Likewise, he obtained postgraduate degrees in Cultural Policy and Management, a Master's in Educational Planning, and he is currently pursuing a doctorate in Sciences and Arts at the Autonomous Metropolitan University in Mexico City.

Venus the King in Mesoamerica

by Alejandro Casales Navarrete

Many centuries ago, in Mesoamerica, the mechanisms to predict the astronomical movements were based on the observations and views by ancient Aztecs and their stargazers.

In those times, Venus was a special astronomical object for the ancient settlers; they perceived it as a manifestation of their king Quetzalcoatl. The well-known relationship of Venus with Quetzalcoatl dates back to several centuries before the first civilization in Mesoamerica, to the Tolteca civilization.

The first signs of Venus with Quetzalcoatl were found in Palenque, an ancient city in the state of Chiapas in Mexico, where several objects express the birth of the Mayan king Pakal and the first appearance of Venus as the evening Star.

Their astronomical illustrations from the 7th century show that Mayas linked the birth of their kings with the first appearance of Venus as the evening Star, transforming them into divine beings in the same way the Toltec and Aztec civilizations made the king Quetzalcoatl.

Perhaps the best-known image of Quetzalcoatl is as a feathered snake. In the Mesoamerican tradition, the snake has a relation with the reproductive powers of the land. Likewise, the bird is associated with the sky and the creative forces.

Finally, when the ancient civilizations combined the attributes of the snake and the bird into a single entity, they metaphorically referred to the germinative powers of the earth. Therefore, the feathered snake became synonymous with beauty and its manifestation in Venus was the greatest expression of its perfection in the space.

Tami Pudina

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Tami Pudina is a student of Space Studies at the American Public University System (APUS) and is also a poet and blogger at Hyperdrive Anthropology under the pen name Anjelika Keisuke.

World Beneath Worlds

by Tami Pudina

"World Beneath Worlds" is an original poem, appearing in my 2021 self-published chapbook, Unraveling, under the pen name Anjelika Keisuke. It is about dreams and how we project ourselves out into the universe as well as the universe projected within us. I was influenced by Joseph Campbell's "Inner Reaches of Outer Space" and wrote this piece while reflecting upon its themes of myth and space exploration. The poem is partly inspired by Frank Herbert's science fiction classic, Dune, which follows the Hero's Journey of Campbell's studies. The references to water represent the fluid nature of circumstance and how ideas take on a life of their own. Much like the chaos of the universe, the results are dependent upon the context or container of circumstance into which the ideas, or "unspoken dances," are thrown. The "City" whose "connections entwine at nightfall" is the Milky Way, and the "severed streams" are Eridanus. There are many reasons why Eridanus, "The River," is an allegory for the human story. The constellation itself is located at the foot of Orion, who just as well may be a representation of the ill-fated Phaeton (Phaethon). The myth of Phaeton refers to Eridanus. Phaeton's opportunity to run his father Helios' chariot turns tragic when he loses control of the reigns and is struck down by Zeus' thunderbolt. Phaeton fell into the river Eridanus and perished, which causes his father to cease riding his solar chariot and plunge the world into darkness for days. The name Eridanus may be based on the Babylonian for the Star of Eridu. Eridu was a city held sacred to their god Enki-Ea, ruler of the cosmic Abyss. Here, Eridanus is both a mythical river and the sixth largest constellation. Notable stars in Eridanus include: Achernar, from Arabic for 'end of the river,' and one of the brightest stars in the night sky, Cursa, a white giant that marks the footrest of Orion, Acamar, a binary star that marked the end of Eridanus during the time of Ptolemy, and Epsilon Eridani, one of the nearest stars visible to the naked eye that also hosts a confirmed exoplanet. Eridanus is the home of the CMB Cold Spot, also known as the Eridanus Supervoid or the "Endless land" in the poem, and is the largest void ever discovered,the Eridanus Group of galaxies, and the Witch Head Nebula, a reflection nebula lit up by the lucent glow of Rigel in the adjacent constellation of Orion.

Poem:

"World Beneath Worlds"

Meet me in the world beneath worlds
Where the unspoken dances
Of the living and unliving
Mingle into the place of dreams
And write verses of their own.
Into the Endless land of wind and fury,
Where connections entwine at nightfall
as the City grows and stretches,
And yet, the twines cannot ever be broken.
Let us meet there,
Between the severed streams,
The unsunned beams of delight,
An allegory, yet powerful,
Ever inscribed within each Being.
And when we do meet,
Hand in hand,
Desert skin cracked and thirsting;
May our waters join together
And finally release, each form upon form,
To grow this garden
With eyes closed to the world.

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REFERENCES:

Eridanus https://www.constellation-guide.com/constellation-list/eridanus-constellation/

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The Astronomical Observatory Serafino Zani and the Mobile Planetarium Committee are seeking submissions for the competition, "Pages of Stars."

The goal of this competition is a to build a collection of short audio clips (maximum 3-5 minutes each) that can easily be shared among planetarians using mp3 files.

For all winners, past and present, and their downloadable files go to: *https://www.ips-planetarium.org/page/pagesofstars?&hsearchterms=%22pages+and+stars%22*

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Information about how to enter this contest can also be found on this page; the deadline for submissions is December 31 each year but you do not have to wait, entries are welcome anytime during the year!

In Memoriam (con't.)

his love of aviation, assisting a group restoring classic aircraft. Bob, an enthusiast for all things technical, was also a licensed amateur radio operator with call sign VE6RN.

Bob loved total solar eclipses and first experienced one as part of the RASC's expedition to witness the July 10th, 1963, eclipse in Fort Providence, Northwest Territories, Canada. In 1970, he organized an expedition to acquire high-quality photographs and movies of the March 7th, 1970, eclipse for planetarium use. With astronomer Walter Stillwell, photographer Ron Hopf, and astronomy student Bill Peters, he drove to a location near Oaxaca, Mexico and observed under perfect skies.

Bob was a wonderful mentor to young staff members, and a thoughtful and generous manager. His good humor resonated in the workplace and made it a delightful and happy place to be employed. There was a streak of mischievousness in Bob that is captured in this reminiscence from Fred Boehli, then a laserist at the planetarium:

Planetarium Director Sig Wieser acquired a new Steinway grand piano for the Pleiades Theatre, a live drama theatre in the planetarium facility. Sig didn't want just anyone touching the new instrument. As Bob's office was next to the theatre wing entrance, he would occasionally check to see if the door to Sig's office was open. If it was, Bob would sneak into the Pleiades and play the only song he knew on a keyboard...Chopsticks. Sig would come bolting out of his office and charge down the hall to catch the perpetrator. Bob would, of course, have snuck out the main theatre doors and deked back into his own office. Sig, having not seen the offender, would walk back and, in passing Bob's office, would enquire if Bob had seen anyone. Bob would respond with complete authenticity that he'd seen no one go into the theatre. Sig never got to the bottom of it.

That was Bob, always a consummate professional, but never afraid to have a little mischievous fun along the way.

During the 1960s, Bob started convening occasional Friday noon-hour lunches where technical staff and a few others would gather at the Lord Nelson Inn, just around the corner from the planetarium. A maximum of ale flowed at those lunches and often a minimum of work was done during the rest of the afternoon! No one wanted these convivial affairs to end as people retired, so, with the help of Andrew Findlay, Bob's Assistant Chief Technician during the 1970s, these continue today and have become monthly Alumni Lunches where former staff gather, and sometimes other planetarians from around North America join via Zoom.

Bob is survived by his nephews Derek, Michael, and Randall Stoll.

Contributed by Bill Peters (former IPS President)

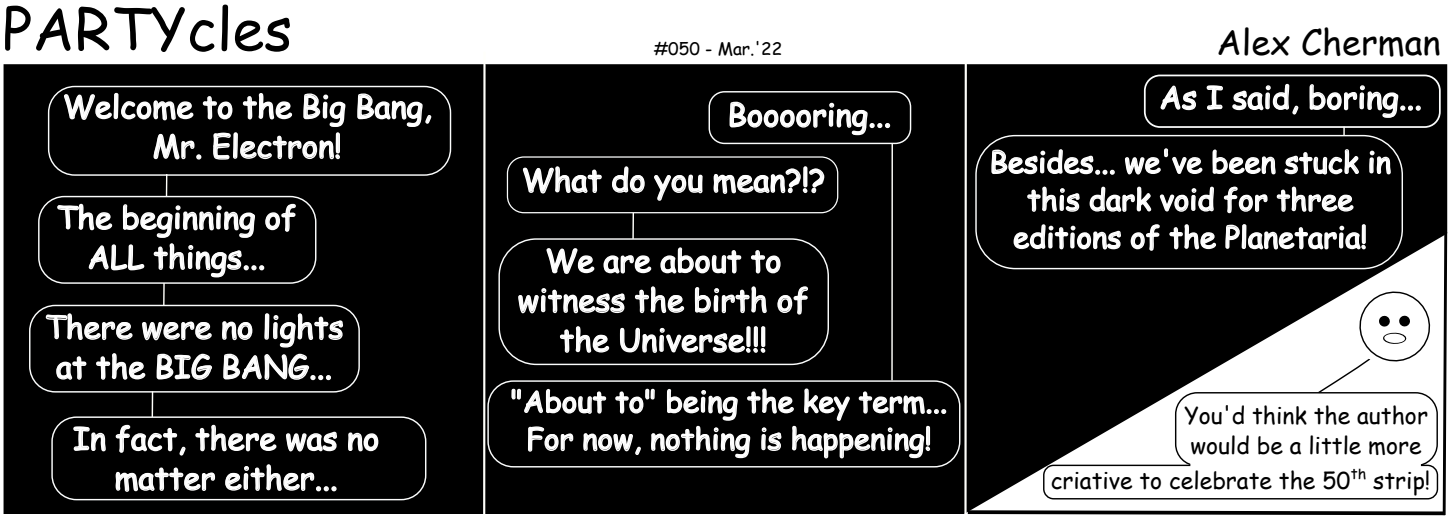
Calendar (con't.)

2023

- **20-24 June.** "Stars for All 2023", US Planetarium Conference, Bays Mountain Park & Planetarium in Kingsport, Tennessee, USA. The event is an official gathering of all seven US planetarium regionals, but is open to any planetarian worldwide. Contact: *AdamThanz@kingsporttn.gov*

2024

- 8 April. Total Solar Eclipse (Mexico, USA and Canada).
- International Planetarium Society Conference, Berlin-Jena, Germany.
- 12-16 June. Pre-Conference Activities (Fulldome Festival, IMERSA Day, and LIPS Day).
- 16-20 June. IPS Conference.
- 21-22 June. Post-Conference Tours.; *https://www.ips-planetarium.org/page/conferences*; Contact: *ips2024@planetarium.berlin*

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LAST LIGHT

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We're all heartily exhausted by the current (ongoing?) pandemic. We have to meet in some electronic space rather than face-to-face. Teaching remotely is less than satisfying for both instructor or student. Local public-health requirements either shutter our domes or mean smaller audiences and decreased revenue. Higher stress levels can add to our already over-loaded nervous systems.

Alan Gould invited everyone to a hospitality zoom in October of last year.

Hi fellow planetarians,

In place of our normal monthly seminar this Friday, we'll be having a zoom hospitality room. I guess that would be a hospitality zoom. This will be pretty much like a hospitality room for an in-person planetarium conference except that

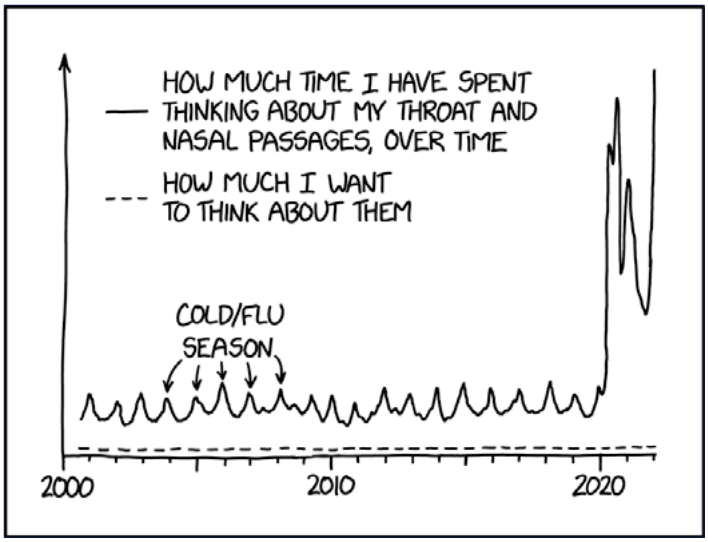
1. You bring your own mood-altering drinks (or whatever)
2. Bring your own snacks
3. It won't be following a grueling day of conference sessions. More like a "thank god it's Friday" occasion.

And it was a treat.

Many of us are familiar with the xkcd cartoon site: *https://xkcd.com*

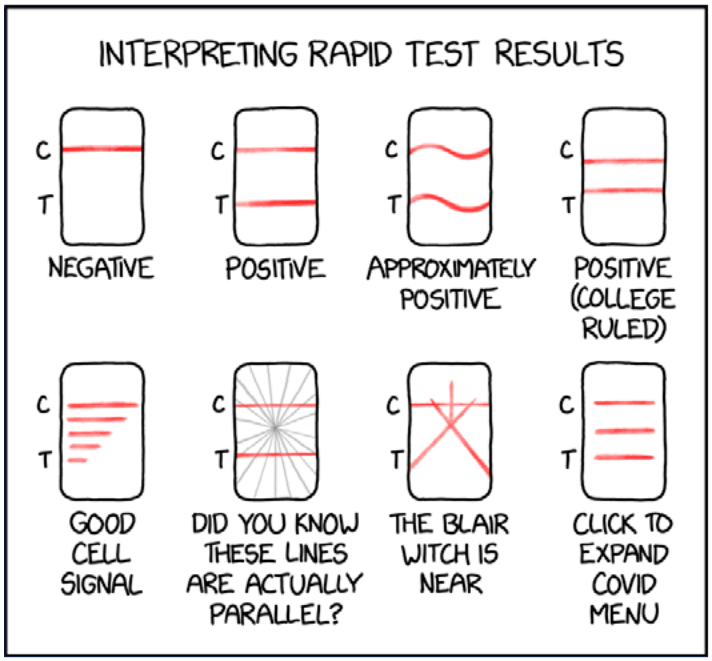
These images and comments brought me a few smiles.

"I've always felt like what the 'You are now aware of your tongue' thing needed in order to be truly enjoyable was an element of mortal peril." (xkcd 2563):



One of my favorites, xkcd/2558:

"A solid red area with two white lines means that you have been infected with anti-coronavirus COVID+19 which will cure anyone you have been in contact with."

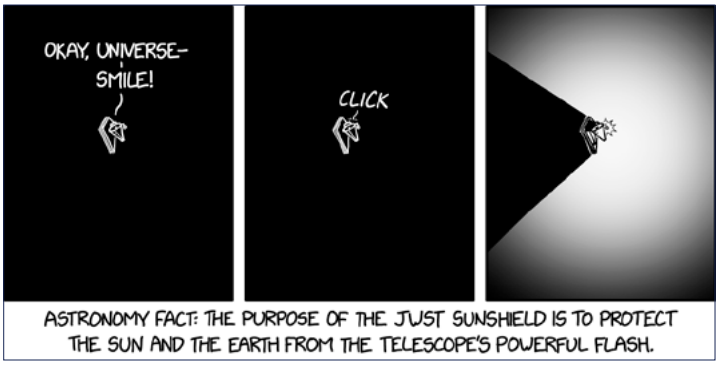


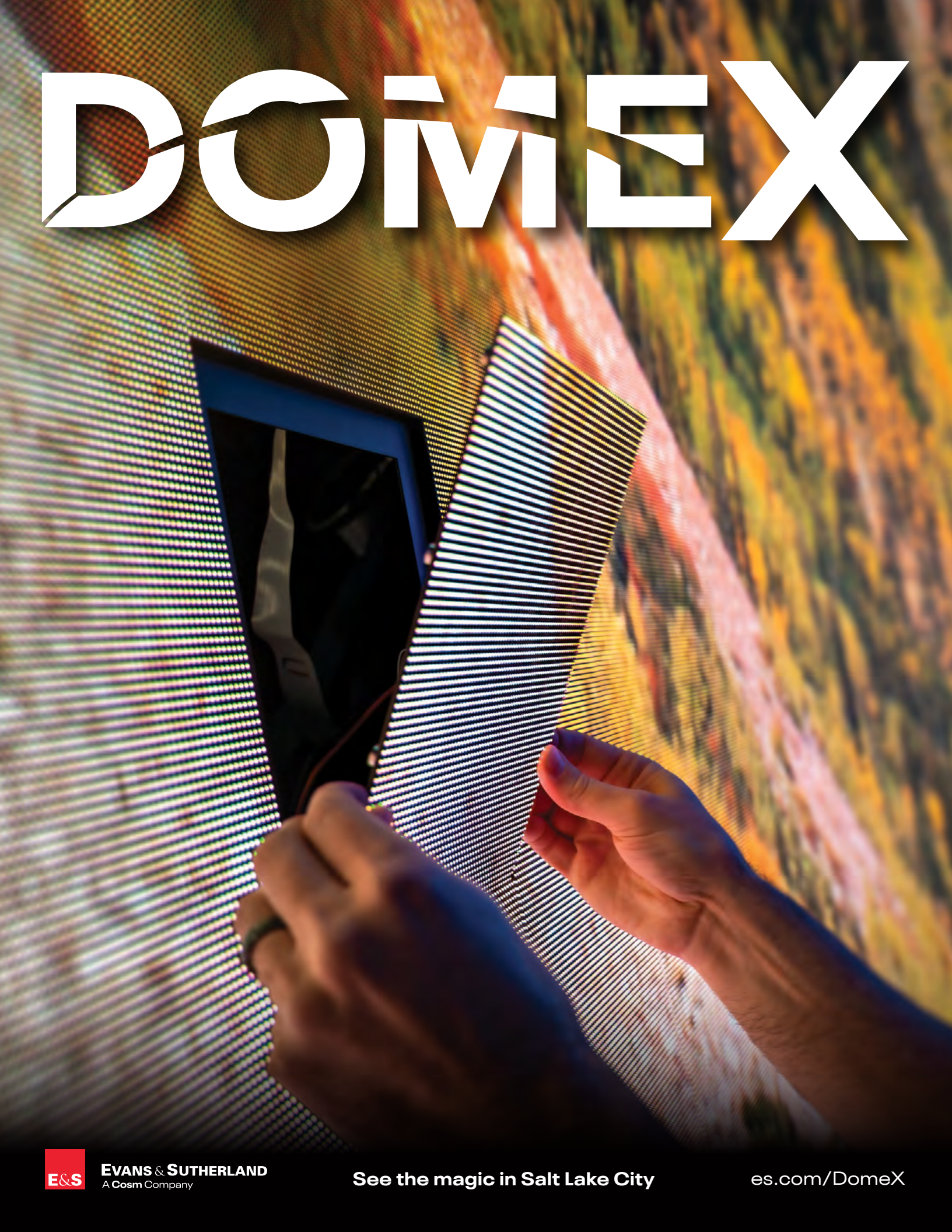
The launch of the James Webb Space Telescope has been a long-awaited breath-of-relief-at-success event. I've gotten more questions about this telescope – almost more than about Hubble. But a launch on December 25? Xkcd 2559:

"Update: Santa has been destroyed by the range safety officer."

Still, it will be great to have new images to share with our audiences!

Xkcd 2564: "RIP the surface of Mars."

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