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ON THE COVER

The Lagoon Nebula  
Guevremont/Snyder/NOIRLab/AURA/NSF  
Kitt Peak, Tucson, AZ  
Takahashi FSQ 106mm f/5  
Canon EOS 60Da, ISO 3200, 120 sec  
This image was taken as part of the Kitt Peak Visitor Center’s Overnight Telescope Observing Program on June 21, 2017. This program allows visitors from around the world regardless of experience to come to a research-grade site and work with a trained staff member to obtain high-quality images. My visitor that night was from Quebec, Canada.  
The Lagoon Nebula is a stellar nursery over 100 light-years wide and about 4000 light-years away in the constellation Sagittarius.  
–Lucas Synder
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IPS President Dave Weinrich
Welcome to the 2012 IPS Conference
Baton Rouge, Louisiana

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A DAZZLING NEW SHOW FROM THE HAYDEN PLANETARIUM

WORLDS BEYOND EARTH

Narrated by
LUPITA NYONG’O

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LOOKING TO THE NEW YEAR
IN FRONT OF THE CONSOLE

To be completely honest, I am never sure what to write when it comes to this column. I have looked at past columns from previous authors and marveled at the eloquence with which they were written. Unfortunately, as of late, I have struggled to find the time to just sit and write; it has been a struggle to balance my workload and graduate schooling with life’s other demands. I do not often get to attend all the e-conferences that I would like to, but I try to keep up on what is going on via various outlets, including Dome-L and Dome Dialogues - and of course, reading all the columns and articles that come through.

All that said, I have spent a lot of time lately thoroughly exploring the offerings various planetarium hardware and software companies have to offer. Let me tell you – it is a bit overwhelming, but it is so amazing to see how far things have come in the last seven years. Yes, I know in technology terms, seven years is a long time when it comes to hardware, but the leaps that have been made in the software world are just as jaw-dropping.

Perhaps that is where I was a bit naïve, assuming that the software system we have at my Planetarium would last us a long, long time. For what it’s worth, I have no doubt that it will (to a point), but I look at the hardware that the software runs on, upgraded as far as it will go and still struggling, and I realize that our initial outlay was only the first step.

I have been amazed at the things I have seen so far – the ability to plug, play, and warp the video output from a professor’s laptop, an instant music show with the use of visualization software, and the new data sets that are being imported into various software suites. It is a lot to take in, and I find myself asking questions about what is next often– if we purchase this, what happens to it in five years? Ten years? Twenty?

Then I think about Hector– Hector Vector the Star Projector, a Minolta Viewlex S-IV starball that gave me the first simulated sky I had ever seen, decades before I was ever an employed planetarian. I find myself still comparing the digital skies I see now to the sky that Hector projected (and I will be honest, I am one of those “but can the black be blacker?” planetarians). I think about the awe I felt when I was a tiny second grader, and I think about how I can recreate that feeling for the next child who visits for the first time.

It is an exciting and uncertain time. Visitors have flocked back for “Tucson Sky & Beyond”, as well as Pink Floyd’s Dark Side of the Moon laser show. The school group requests are no longer a trickle, but a flood. Unfortunately, we have variants rearing their ugly heads, and this further complicates our goal of trying to create the safest place we can for our visitors.

But then I bring up that night sky, and get excited and the promises of what the future holds next.

Thank you all for allowing me to continue to grow into this position, and I hope that all of you have a safe and wonderful holiday season.
Homage to APOLLO & ARTEMIS Mission!
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ABSTRACT

Indigenous people have nurtured critical relationships with the stars, from keen observation and sustainable engineering to place-based ceremony, navigation, and celestial architecture for tens of thousands of years. The Indigenous relationship and knowledge of the sky is exceptional in that it encompasses mind, body, heart, and spirit. This moment is an opportunity to recognize that science is embedded with culture and history, and it is past time to widen the lens. All people from all over the world and throughout human history have had a keen relationship with nature and have therefore been practicing science/scientific thinking for millennia. This article presents an overview of the revitalization efforts of Indigenous star knowledge in hopes that the Planetarium community will nurture relationships with Indigenous efforts and leadership.

This panel is organized by the IPS’s newly formed Indigenous Astronomy Working Group. It brings together Planetarium Professionals, Indigenous Star Knowledge Keepers, Indigenous Astronomy experts, Cultural Astronomers, and allies of Indigenous STEM communities from Canada, the U.S., and internationally to discuss best practices for dissemination of Indigenous astronomy specifically for science communicators and the planetarium community.

I. Introduction

Astronomy, as presented in planetarium shows, can be beautiful but ultimately distant, with no way for audiences to link what they are viewing to their everyday lives. In contrast, Indigenous astronomy has people at its center. It is about people, relationships, and the sky, not just about the sky as a distant physical construct. As described by two well-known Diné scholars:

*The Diné word, ‘Sitsooi Yoo’ (Star or original light that evolves) acknowledges the ancient relationship to the original light that came from the original star. It acknowledges all life, including human life, proceeded by the original energy of light, similar to astrophysicists’ explanation that we are stardust. Ancient teachings tell us that when humans look at the Milky Way galaxy at night, they are actually looking at themselves, from which energies they actually evolved. Maryboy and Begay 2020)*

Clearly, there is an enormous amount of wisdom in our Indigenous Knowledges Systems (IKS) and, in particular, our Indigenous relationship with the night sky. Indigenous peoples around the world, from time immemorial, have looked skyward, obtaining valuable insights that have helped them define areas of each culture whether from a religious, biological, spiritual, or even temporal point of view. And yet, the enormity of post-colonization can and should not be understated. Five-hundred years (c. 1492) after the Portuguese and Spanish armadas first sailed west and bumped into the North and South American continents, the impact from the loss of cultural knowledge and language is a present, harsh, and enduring reality.

Fortunately, not all has been lost. Elders like Nancy Maryboy and David Begay began working on revitalization of Diné Indigenous Astronomy over three decades ago. Other Indigenous voices from North America (such as Wilfred Buck-Ininew and Annette S. Lee-Ojibwe and D/Lakota), from the Hawaiian Islands (Ka’iu Kimura and Kalepa Baybayan), and from Mexico (Milagros Varguez), have been working together with African American/African Indigenous Astronomy scholars (such as Jarita Holbrook), Maori Knowledge Keepers (such as Te Kahuratai Painting), Aboriginal Australian & Torres Strait Island communities (through Duane Hamacher), and more recently, Chilean-Argentine Indigenous Mapuche people (via Yasmin Catricheo). We are at a critical moment. People have an excitement and curiosity about the night sky, a kind of craving for more, but at the same time we are in danger of dark skies going extinct (Bogard
of the process of inculturation, the newborn begins to learn not only the language and customs but also the basic assumptions, premises, and concepts of his parents, family, and community. At the moment of removing a person from their culture (deinculturation), they lose their identity and, with it, the chain of transmission of the knowledge of their ancestors, generation after generation, is broken. By acknowledging one and only one culture’s natural philosophy, we are losing valuable perspectives related to the physical/natural world, acculturation/inculturation, and environmental wisdom as well as methods of transmission of knowledge. Whether we use the more formal term ‘Indigenous Knowledge Systems’ (IKS), or the more general term ‘worldview,’ we can recognize that Indigenous people had, and still have, a keen awareness of the natural world. Relationships and participation with the natural world were, and still are, key elements in Indigenous science.

The term “Indigenous Knowledge Systems (IKS)” is rooted in the voice of post-apartheid South Africa, and similar movements followed in Australia, New Zealand, and more recently Canada. The South African government began to recognize IKS as a critical and valuable perspective worth protecting and promoting at the federal level. Comparisons of some differences between Indigenous Knowledge Systems and Western Sciences have been published by African scholars like Munyaradzi Gawere, Lesley LeGrange, and Meshach Oguminyi (Le Grange 2007; Gawere 2015; Oguminyi 2005). See Table 1.

<table>
<thead>
<tr>
<th>INDIGENOUS KNOWLEDGE SYSTEMS</th>
<th>WESTERN SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>nature is real and partly-observable</td>
<td>nature is real and observable</td>
</tr>
<tr>
<td>events have both natural and unnatural causes</td>
<td>all events have natural causes</td>
</tr>
<tr>
<td>the universe is partly predictable and partly unpredictable</td>
<td>the universe is predictable</td>
</tr>
<tr>
<td>language is important as a creative force in both the natural and unnatural worlds</td>
<td>language is not important to the workings of the natural world</td>
</tr>
<tr>
<td>knowledge is a critical part of culture</td>
<td>science is culture free</td>
</tr>
<tr>
<td>humans are capable of understanding only part of nature</td>
<td>humans are capable of understanding nature</td>
</tr>
</tbody>
</table>

Table 1: Comparison of Indigenous Knowledge Systems with Western Science, Le Grange 2007, 585
model is that humans are separate from nature and meant to dominate it. This is in direct opposition to Native American/Indigenous worldview that humans are part of nature, close to it like family. Medin and Bang state that the answers to science questions depend precisely on who is asking and what cultural value systems they are part of. As Carter et al. write, “The emphasis of Western science is on mastering, controlling, and transforming nature and promotes individual success and competition” (2003, 6). The damage of colonization is still being dispensed when we put on our blinders and teach science (or astronomy) as ‘the objective truth’. As Ininew elder, Wilfred Buck (2012, 73) explains:

We as individuals tend to view our civilization as “the best” and when our teachings, knowledge, and belief systems are ridiculed, marginalized, and then utterly dismissed as “quaint,” we begin to question our world view. This has happened and is still happening to First Nations people as well as all colonized peoples. Until other worldviews are proposed and considered, there will be a distinct “difference” and “quaintness” about all that is not mainstream. In addition, our children will see these differences and attempt to discard them in order to become more mainstream. These teachings reflect the differences and propose another perspective, broadening and giving voice to them...The implications for the educational systems (public schools and federally funded Band operated schools) in which our children are indoctrinated, is that it recognizes the “otherness,” and becomes a part of our multicultural nation.

Simply put, if astronomy is defined as ‘a natural science that studies celestial objects and phenomena’ (Unsold and Basche 2001), then we can define Indigenous Astronomy as a living relationship with nature focused on the sky and celestial phenomena that is deeply embedded in keen observation and participation, anchored to heritage that goes back tens of thousands of years, and includes recognition that all living things are embedded with spirit and, therefore, related.

IV. Indigenous Astronomy in a Planetarium Setting

It is important to acknowledge that narratives, language, knowledge, and culture are essential in astronomy communication in planetariums. Currently, there is growing hunger from communities to learn more of Indigenous Astronomies (Harris and Matamua 2012) with Indigenous narratives being fundamental to understanding this codified Indigenous knowledge (Hikuroa 2017). However, by uncritically centering on Greek and Arabic constellations, star names, and narratives, we are locating the night sky in Greek and Arabic narratives, language, knowledge, and culture. This intellectually positions the planetarium in Greek and Arabic lands, rarely the lands of the planetarium. At other latitudes, constellations appear rotated or even upside down. In this way, planetariums can further disconnect the audience from their night sky.

When located in other lands, such as Aotearoa, New Zealand, the irrelevance of the Western-Eurocentric narratives in astronomy becomes even more apparent. As an example, there are no scorpions in the Pacific Islands, therefore Scorpius, the scorpion, has no relevance to the lives of Indigenous peoples of the Pacific. Contrarily, this constellation is seen as Te Mataunia-Maui, Maui’s fishhook. A fishhook is a familiar shape to the seafaring peoples of the islands in the Pacific, and recognizable as such in their night skies. Further, the heliacal rising of Rehua (Antares), the brightest star in this constellation (Scorpio/Mataunia-Maui), occurs in mid-December in Aotearoa, New Zealand. Rehua rising signals the height of summer and ripens the berries in the trees within Māori narratives. Again, the Indigenous astronomy is culturally embedded as well as situated within the local context. A wealth of relevant star knowledge can be observed, connected to the environment, and reinforce our relationship with the stars in the night sky.

Many astronomers and astrophysicists recall a visit to a planetarium being the start of a lifelong relationship with the night sky, sparking curiosity, excitement, and careers. This speaks to the main purpose of planetariums – sparking a relationship with the night sky by representing the sky, first and foremost, where you are. This is especially important in towns and cities where light pollution renders a star-filled sky invisible. The planetarium projects what is out there in the sky onto the dome, unseen and disconnected, communicating excitement and connection. If the intention of planetariums is to build relationships with the night sky, closing the palpable distance between us and the stars, then locating astronomy in place through Indigenous astronomy strengthens the relationship between the audience and the night sky, and closes that sense of distance.

The seasonality embedded in Western-Eurocentric narratives are out of sync with most local environments. As mentioned above in Aotearoa, New Zealand, Rehua (Antares) returns to the night sky in December near midsummer, signaling the driest, hottest time of year. This time is dominated by the Western association with the constellation Aquarius reigning from mid-January to mid-February. Both months are in the height of summer when there is rarely rain. In contrast, the Western narrative of Aquarius ‘The Water Bearer’ is seasonally distant and requires the audience to mentally locate themselves away from the local night sky and planetarium.

Although this section focuses on the obvious cognitive dissonance between Northern and Southern Hemisphere astronomies, with a particular focus on Aotearoa, New Zealand, similar examples could be used from across the globe, including the Northern Hemisphere. In some locations the differences can be subtle. The differences can also be as diametrically opposed as rain and drought.

One important aspect of Indigenous astronomy is how knowledge connected to the sky, or about the sky, is culturally encoded for sharing as well as remembering. Stories about the sky
often provide a mapping of the sky (Holbrook 2014). For the Ewe people of Togo, Orion is the hunter, same as in the Greek myth, but he is hunting chickens (Spieth 1911). Their constellation Dzeretsia fits the description of Orion, with a tattoo on his belly representing three people, seems to be describing the belt of Orion, and his genitals seem to be the sword of Orion. Kolkovino (the chickens) is described as a cluster of stars, assumed to be the Pleiades but, from the description, could be the Hyades. Nevertheless, they are what Dzeretsia is hunting. Dzeretsia is connected with yam planting. He leaves the night sky at the time the yams are seeding, when he appears near the zenith at sunset yams are planted, and when he appears in the west after sunset planting is stopped. There isn’t a causal link between Dzeretsia and yams given that he is a hunter, but instead, he only serves as an agricultural calendar marker. However, Dzeretsia seems to be given some agency over rainy and dry weather: When it is rainy, they say that Dzeretsia has dipped his foot in the water; and when it is dry, they say Dzeretsia is keeping his foot in the fire (Spieth 1911). This example encodes important agricultural information about when to plant yams, thus the location of constellations in the night sky is entwined with the livelihood and food security of the Ewe.

Another example of place-based astronomical knowledge tied to seasonal and cultural agricultural practices is found in the Dine teachings of when to plant corn seeds. This occurs in the spring in Navajoland when the Pleiades are visible and then disappear into the western horizon. They are spoken of as little boys who disappear behind some hills. That is a signal to begin planting. When the Pleiades become visible in the east, and the little boys reappear in the night sky, it is a sign to stop planting. Elders say, “Never let Dilyehe (the Pleiades) see you plant your seeds!” (Maryboy and Begay 2005, 2010, 42-3).

Constellations, or Wanjen in Mapuche culture, were used as important calendar events and for deep spiritual connection. To the Mapuche in Chile, Weluwitraw (also known as Orion) represents a traditional Mapuche sport consisting of two men who have a rope in common tied to their necks and pull in opposite directions until one of them manages to win, dragging the opponent. Orion’s belt represents one of the men and the Orion Nebula represents the other, with the sword representing the rope between the two. In some sectors, it is used as a temporal and spiritual variable. In other words, the time of year it is observed, and personal spiritual connection can change the meaning.

Indigenous astronomy highlights the process of using long term (generational) observations of the sky to build knowledge within a cultural context and locational context. The cultural context is important because the observations of the sky and the implications were, and still are, part of Indigenous life and livelihoods. Including Indigenous astronomy in planetarium presentations, for Indigenous and non-Indigenous peoples, achieves the objectives of planetariums in a unique way specific to place. Indigenous astronomy can strengthen the relationship of the audience with the night sky, with the local environment and, most profoundly, with the local Indigenous peoples.

V. Bringing Indigenous Astronomy into Planetarium Programs

Planetarium programs such as Stellarium now feature a large number of culturally specific packages under “Starlore.” These default plug-ins feature star names, constellation art, and cultural traditions for dozens of Indigenous communities and ancient cultures. Examples include Maor, Lokono, Maya, Tongan, Navajo, Mongolian, Tupil, Ojibwe, D/Lakota, Boorong, Aztec, Egyptian, Norse, and Chinese (among many more). Additional plug-ins can be developed through Stellarium, enabling the inclusion of Indigenous content from anywhere in the world.

Planetaria should include Indigenous content, or develop Indigenous-specific programs, whenever possible. Credits and acknowledgements should be given generously and often. Accomplishing this means adhering to established guidelines rather than the development of ad-hoc programs without relevant community consultation. Those guidelines are as follows:

1. Ensure all planetarium staff are properly trained in cultural competence (ACECQA, 2014);
2. Identify local communities/tribes with astronomical knowledge that could be included in planetarium programs or displays;
3. Engage in due diligence to see what knowledge is available, understand restrictions, and identify the key elders or representative organizations;
4. Follow established protocols for approaching and working with those communities/tribes;
5. Ensure constant consultation with the relevant community/tribe who must give final approval for all content and delivery options;
6. Ensure mutual benefits are in place for that community/tribe. This may include payments to elders, profit sharing, education and outreach programs for the local community/tribe, employment opportunities, educational materials, etc.;
7. Ensure Indigenous voices are centered and provide programs for local Indigenous people to deliver content whenever possible;
8. Produce a signed MoU that sets out rules and guidelines for permissions, program content and delivery, and future alterations.

Some of these guidelines need to be unpacked for further clarification and illustrative examples from various parts of the world are used to show these protocols in action, and their benefits. Educators need to be knowledgeable about local communities and be culturally competent so as not to promote stereotypes or false information, regardless of intent. These are among the most problematic and common issues that face educators and can have long lasting repercussions. Many regions have established protocols for working with Indigenous people (ATSIEB 2015). In Australia, this is set out by organizations such as AIATSIS - the Australian Institute.
for Aboriginal and Torres Strait Islander Studies (AIATSIS 2015).

Educators should work with local communities where the planetarium sits. While it is useful to discuss Indigenous astronomy across a specific country or region, it is critically important to include local knowledge and voices. Indigenous astronomy knowledge has to be collaboratively developed with tribes (or nations) so that accurate information can be shared. This collaboration must ensure that final approval for the delivery of all content is approved by the representative Indigenous body. Some communities have suffered greatly from colonization and much of their knowledge may be fragmented or lost. This careful process is in response to this. Mapuche star knowledge, for example, was passed from generation to generation through oral tradition. There are no reliable records of Mapuche writing that reveal pre-colonization knowledge. In most cases, Indigenous Astronomy is held as a sacred narrative that acknowledges a natural cosmic order that in turn determines a unique way of life, unique to the people involved. In some cases, this information may be sensitive or cannot be shared with non-tribal members. Tribal protocol contains appropriate tribal and cultural integrity, and restrictions should be acknowledged and followed parallel to the CARE principles for Indigenous data governance (Carrol et al. 2019). A clear MoU (Memorandum of Understanding) should be developed between the planetarium and the collaborating community/tribal organization. This should lay out the protocols for knowledge sharing, use of language and terminology, consideration of restrictions, protocols of future amendment, recognition of knowledge holders, plans for centering Indigenous voices, and the mutual benefits for the community.

The protocols and practices for working with Indigenous people are regionally specific. Many Aboriginal communities restrict certain knowledge to men, women, and/or senior initiated elders. These rules vary from culture to culture. For example, the celestial emu is a motif featured in the traditions of a majority of the 350+ language groups spread across the Australian continent (Fuller et al. 2014a). Knowledge about the celestial emu may be public with some communities but deeply secret with others. Some elements may be restricted to men, while others are restricted to women (Michaels 1985). Some elements may be restricted to senior initiated elders. In summary, certain Indigenous knowledge may be freely shared or not dependent upon the ethnic group and their rules governing such knowledge. There may also be restrictions on showing images and names of people who have passed away (NSLHD, 2015). In general, showing images and speaking names of people who have passed away is considered taboo in many Aboriginal communities across Australia, so this must be considered when working with communities/tribes on programs and content delivery. This also means protocols need to be established to accommodate potential alterations in the content delivery in the future.

As opposed to the practice of archeoastronomy, which tends to focus on cultures in the ancient past (which may no longer exist, or currently exists in a much different form), Indigenous Astronomy focuses on contemporary, living people and cultures (Medupe 2015). Therefore, it is important to acknowledge and understand the importance of focusing on Indigenous Knowledge as a living entity, to focus on the importance of Indigenous language, and to center Indigenous voices whenever possible. It is also critical that any program be developed and delivered in such a way as to not be derogatory towards Indigenous astronomy through comparison of Western astronomy (Ruggles 2010). When comparison is presented, the equivalence of Indigenous astronomy to non-instrument Western astronomy should be emphasized. Indeed, when all the instruments are put aside, what shines bright is simply relationship to sky. For the Sir Thomas Brisbane Planetarium in Brisbane, Australia, a large, permanent wall-display was developed to feature Aboriginal and Torres Strait Islander astronomy, with a focus on the scientific elements of this knowledge. Entitled STARLORE, it features examples from three different communities, showing diversity in terms of geography and representation: Wardaman (Aboriginal, Northern Territory), Euahlayi (Aboriginal, New South Wales), and Meriam (eastern Torres Strait, Queensland). It was decided not to show photographs of each elder, but elders gave permission for their names to be shown, even after death. Each section features a small map of Australia that shows the location of each community. The elders spoke at the launch and were centered in the media regarding the display. A similar display was developed at Perth Observatory (2018) in Western Australia entitled Worl Wangkiny, led by Aboriginal elder Dr Noel Nannup. In the case of STARLORE, these three communities were selected because senior elders in those communities had published a significant amount of their astronomical knowledge (e.g., Cairns and Harney 2003; Fuller et al. 2014a,b,c; Guedes et al., 2018; Hamacher et al. 2018, 2019) and Senior Elders or Boards of Elders in those communities were able to give permission for that Knowledge to be shared and displayed. Given the relatively small size of those communities, such a thing was possible. With very large communities, a single central body that can give blanket permission for knowledge to be shared may not exist. In select cases, any shared knowledge may need to focus on smaller, sub-groups within the larger community, such as clan, family, or dialect groups.

Protocols vary from tribe to tribe. These protocols include and identify specific times when it is appropriate to tell stories of the sky. For the Diné, this is closely tied to the natural order of lunar, stellar, and seasonal cycles, usually spanning the winter months from late September to mid-March. There are also restrictions on viewing celestial events, such as lunar and solar eclipses, that vary among and within tribes. When Planetarium educators show programs that are time specific,
they should acknowledge and follow the Indigenous Astronomer guidelines. Restrictions will become clear as one works with different tribes. These are very important to the sharing of Indigenous astronomical information. In addition, it is always important to acknowledge the source of information (whether it is song or story) as coming from credible knowledge holders. For example, there is protocol around when star knowledge stories should be told. In Ojibwe, one restriction is that certain stories should be told only when there is snow on the ground. As explained by Ojibwe elder William Wilson, “Biboonkeonini – Wintemaker is a spirit that makes winter. Each season has certain spirits that make the season happen. Winter-only stories are told in wintertime because a person knows the Winter Spirit is there. No winter stories are told after the frogs wake up” (Lee et al. 2014, 27).

Other tribes, such as the Diné in Arizona, Utah, and New Mexico, also have strict protocols involving when stories of the sky can be told (Maryboy and Begay 2017). For example, Winter Stories are closely linked to cosmic cycles of the Sun and Moon. Generally speaking, one only tells these stories from late September to mid-March. When the First Thunder of spring is heard, it is announced all over Navajoland by radio or newspaper or word of mouth. That is the time plants awaken and animals come out of hibernation, having been stirred by the energies of the Thunder and other signs. It is the time at which Winter Stories can no longer be told (Maryboy and Begay 2005). This protocol is extremely important to be followed if a Planetarium plans to show Navajo stories. There is one time around the summer solstice when some of these stories may be shared, but for educational purposes only. If the protocol is not followed, a planetarium can be severely criticized by local Navajos. Information may also be restricted by gender, phenomena (e.g., taboos around viewing eclipses), time of day, location, or other factors that must be taken into consideration through the MoU.

Finally, it is critical that Indigenous people are able to speak for and about Indigenous Knowledge (Carnes 2011). The collaborating community must give clear permission about how their knowledge is presented, especially if the planetarium educators are non-Indigenous or not from the community sharing that knowledge. Examples of centering Indigenous voices may include naming specific elders who shared knowledge, recording their voices or videos so they can deliver it remotely, or nominating an appropriate person to deliver content if an Indigenous staff member is unavailable or non-existent. If the planetarium has no Indigenous presenters or educators, significant efforts should be made to correct this. Programs have been developed at astronomy-related education and outreach facilities around the world that provide pathways for Indigenous people to be hired and trained as astronomers, educators, and science communicators. Sydney Observatory developed a program that brought in Aboriginal guides to deliver Indigenous programs (Wyatt et al. 2014). The guides delivered programs that were not only culturally and ethically appropriate, but they were also able to draw from their lived experiences, which non-Indigenous educators cannot do in this context. If possible, the planetarium should provide programs that can be delivered in the relevant Indigenous language, enabling Indigenous educators to deliver programs to their communities in their language(s).

VI. Conclusion

In 1999, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), in conjunction with the International Council for Science (ICSU), held a World Conference on Science. The resulting report advocated global governments to support and promote understanding of traditional knowledge systems. First outlined in the Preamble, “All cultures can contribute with valuable scientific knowledge” (UNESCO 2003, 9). In greater detail, the report states: ...traditional and local knowledge systems, as dynamic expressions of perceiving and understanding the world, can make, and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research, and promote this cultural heritage and empirical knowledge. (UNESCO 2003, 14)

The report goes on to urge the scientific community to support, create dialogue, and build relationships with “traditional societies and philosophers from all countries” (UNESCO 2003). Specifically:

Modern science does not constitute the only form of knowledge, and closer links need to be established between this and other forms, systems, and approaches to knowledge for their mutual enrichment and benefit. A constructive, intercultural debate is in order to help find ways of better linking modern science to the broader knowledge heritage of humankind (UNESCO 2003, 40).

The recommendation is for scientists to respect, sustain, and enhance traditional knowledge systems and that traditional knowledge should be integrated into interdisciplinary projects. Clearly the world’s leading voice in science, education, and culture, UNESCO, understands the importance of widening the lens of science.

An important concept guides this work in Indigenous Astronomy and museum collaboration, ‘Etuaptmumk,’ or, Two-eyed seeing. Here are the words of two Mi’kmaw elders:

Two-Eyed Seeing is learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing, and to use both these eyes for the benefit of all (Bartlett, Marshall, and Marshall 2012, 336).

In conclusion, it is important to remember that planetariums can provide immersive experiences where visitors can understand and connect to different cultures through the stars. Further, these experiences can be used to promote awareness that these stories are not just myths, as they are often portrayed. These stories are a rich source of information about how ancient cultures lived and what was relevant and important to them. The stories are a rich source of scientific
data that have been preserved in the stars and passed down from generation to generation orally. And in some cases, the connection to the stars is a kind of a ‘spiritual lifeline’ or guidebook, for the people to know where they came from, what they are doing here, and where they are going. In Lakota, the stars were, and are, called “woniya of Wakaŋ Taŋka, the holy breath of the Great Spirit... when Lakota observed the movement of the Sun through their constellation, they were receiving spiritual instruction” (Goodman 1992, 1). In either case, the teaching that the stars are ‘our oldest living relatives’ cannot be understated. As illustrated in this quote from a tribal member after first learning about the Ojibwe constellations:

I used to look up and see the Greek constellations, like the Big Dipper or Leo the lion... but now I know that there are stars up there that are ours. It does something to me inside, to have that relationship with the stars. It’s like finding a long-lost relative (Tibbetts 2010).

This document serves to support collaborative efforts by museums and planetariums that desire to integrate Indigenous astronomy and science content “in a good way” into their programming, content, and institution. The roadmap starts with tangible efforts to build authentic relationships with Indigenous knowledge keepers and Indigenous scholars. More than a side-note, the Indigenous voice should be allowed to work collaboratively with museum and planetarium staff to lead the Indigenous content. This applies to Planetariums that have a small or large staff. The resource-rich institutions have to re-imagine what it means to listen and give the driver’s seat to an Indigenous voice. The Indigenous knowledge keepers and the museum and planetarium staff to lead are allowed to work collaboratively with Indigenous peoples (Peticolas et al. 2013). Ultimately, the aim of this work is increasing science learning opportunities for Indigenous youth, adults, and communities, but also has the foundational goals of increased cultural pride, engagement in science, and community wellness. For the non-Native audience, there is great value in learning and practicing cultural agility. As stated previously by the Mi’kmaq elders (Marshall and Marshall) in the Two-Eyed Seeing model, we use both eyes for the benefit of all, or “the gift of multiple perspectives” (2012, 336). Standing together, we have enormous reach and capacity.

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ABSTRACT

Identifying the public’s interests in astronomy topics helps planetariums create entertaining and impactful shows for their audience. During the creation process for a new show for SUNY Oneonta’s planetarium, a survey was conducted to gauge the public’s interests. A total of 109 participants filled out a digital survey that asked if they had previously attended a planetarium show, what topics interested them the most, and what they would want to learn about and see in a planetarium show. The survey showed that constellations and the Solar System remain popular choices and that beyond that, respondents’ choices may be strongly influenced by their previous exposure to astronomy topics.

Introduction

For planetariums to continue attracting new and repeat audiences, it is important to understand what audiences want to see when they attend a show. Content needs to be both entertaining and educational in order to engage the public and keep visitors coming back (Daut 2019). Live shows allow audiences to connect with the night sky and create immersive experiences unique to planetariums (Littman 2009). Research has shown that live programming creates a more educational and entertaining experience for planetarium audiences (Peavy 2019). Planetarium professionals, too, value live shows and interactive opportunities more than pre-recorded content (Small and Plummer 2010). However, live shows are time and resource intensive for production teams at planetariums and require trained presenters. It is, therefore, all the more important to support this work with evidence-based audience research.

Falk and Dierking break down the aspects of a visitor’s experience and highlight the success of narrative-based content in museums (Falk and Dierking 2012). Humans have always used stories to pass on information and connect with one another (Rodney 2016). Story-based planetarium shows can elicit emotional responses from audiences and help them to connect with space (Small and Plummer 2010). Humor is also viewed as a way to introduce entertainment into educational content. In regard to popular science articles, readers enjoy articles with humor and are more likely to read more articles than readers of non-humorous articles (Pinto and Riesch 2017). However, humor should be used carefully to avoid treating serious issues too lightly or undermining the scientific background. A study by Martin Fisher (1997) showed that subjects who attended a planetarium show interjected with humor scored lower on a post-show content-based quiz than audience members of a show without humor. These case studies show that, while useful and entertaining, show designers and presenters must use humor carefully as an element within their shows.

But beyond issues of style (narrative, humor), attention needs to be devoted to meeting the audiences’ needs regarding content, too. To create a meaningful show that inspires interest, engages, and educates its audience, planetarium professionals need to understand what topics and types of stories the public wants to see. This study explored the public’s areas of interest, and the types of stories visitors may like to see when attending a planetarium show.

Methods

A five-question survey was constructed to assess adults’ interest in planetarium show content. The first question asked participants whether they had attended a planetarium show recently (within the last few years), at some earlier point in their life, or never. The following three questions were about planetarium show content. Participants were asked to pick three of the astronomy topics they find most interesting from the following list:

- Constellations
- The Solar System
- Exoplanets (planets outside of the Solar System)
- Galaxies
- Black holes
- Stars and their life cycle
- Other (please specify)

Participants were then asked to choose three subjects they want to learn more about from the following list:

- Techniques astronomers use to make new discoveries
- The change of the universe over time
- The formation of stars, planets, galaxies, or black holes
- Making observations in different wavelength bands (i.e. infrared, UV, gamma ray)
- History of astronomical observations
- Interactions between objects in space (i.e. galaxies merging, orbits, black holes’ impact)
- Stories about actual astronomers, their life, and work
- Other (please specify)

The survey asked participants to share anything specific they would like to see in a planetarium show in the future through a short, open-ended answer.

Finally, the last question in the survey asked participants to specify their age.
bracket. The age ranges given were 20-35, 35-50, 50-65, 65+. This question provides the only demographic information from the survey.

The survey was distributed digitally using google forms. The survey was shared via the social media platforms Facebook, Twitter, Instagram and LinkedIn. Thirteen Facebook users shared the initial survey, posting to their timeline, which increased the audience. Participants opted-in to the survey by following the survey link. The survey was completed by 109 participants over the course of five days. All survey-takers filled out the form at their own pace on their personal devices.

When comparing percentages, these are provided with confidence intervals based on a 95% degree of confidence. Percentages alone do not contain information about the sample size. In order to take the sample size into account when assessing the significance of differences between percentages, the range of values is given within which the true population percentage will fall with 95% confidence. A larger sample size will give smaller confidence intervals making detected differences less likely to have happened by chance (Veal 1992).

Results

Figure 1 shows the breakdown of responses to the first question asking if participants had seen a planetarium show. Only 10 out of the total 109 indicated that they have never seen a planetarium show. Of the remaining participants, the majority identified that they have seen a planetarium show but not recently. (See Figure 1)

The survey allowed participants to select multiple answers as their top interests in Astronomy. The responses are shown in Figure 2. The chart breaks down responses by answer and age. The most common choices of astronomy interests are constellations (n=74) and the Solar System (n=62). For all age brackets above 35, the distribution of choices follows the same overall pattern. However, the topic of exoplanets was the third most chosen topic by participants in the 20-35-years old bracket while it was consistently the least popular choice among all other age groups. (See Figure 2)

When asked to choose what they would most like to learn about, participants favored the evolution of the universe (worded as “change in our universe over time”, n=73), interactions between astronomical objects (n=62), and the formation of these objects (n=62). Figure 3 provides a breakdown of learning interests by age bracket. The distribution of selected learning interests remained consistent across the different age ranges overall, with just a few small differences. (See Figure 3)

Thirty-four of the 109 survey respondents provided a response to the open-ended question on anything specific they would like to see in a planetarium show. Answers are grouped based on common responses. Table 1 shows the number of given responses relating to each subject, with only one response not included in the table. Six participants identified that they would like to see a show about constellations, their mythology, or their use. (See Table 1)

We have broken down the respondents’ interests in terms of their previous experience at a planetarium. (See Figure 4)

Specifically, comparing the interests of participants who had recently been to a planetarium show (N=19) and those that had not (N=90), for most topics and the percentage of respondents, no difference can be established given the large confidence intervals (Table 2). However, there are two topics with somewhat larger differences (albeit still with overlap in their confidence intervals). Among those who had visited a planetarium show recently, 21.4% (±7.9) identified black holes as a top interest, making it the most chosen topic. Participants that had not recently attended a planetarium show had less interest in black holes, with only 14.60% (±6.8) of respondents choosing it as a top interest. Only 8.9% (± 5.9) of participants who had recently seen a planetarium show noted galaxies as a top interest, while 17.9% ±7.6) of those that have not recently seen a show choose this topic. (See Table 2)
The top astronomy topics chosen by participants are constellations and the Solar System. These are often already the focus of most common introductory planetarium shows. How, then, do planetariums continue to innovate and develop new shows if the audience interests are already being met? Using these basic topics as jumping off points, shows can look at more specific or complex topics. Further research would be useful to identify such topics. For instance, a show can focus closely on one or two constellations and look at the stories behind them, how they were formed, or how they will look in the distant future, thus introducing the audiences to less well-known topics such as the evolution of the universe, which was the top choice for what respondents of this survey would like to learn about.

Regarding what participants would like to learn more about, discussions about space itself are more popular than learning about astronomers, the history of astronomy, or how observations are done. The same pattern is reproduced in the open-ended question about specific topics the respondents would like to see in a planetarium show. Of the 34 participants that specified something they would like to see in a show, only nine (26%) indicated subjects involving human connections (grouping together Astrology, the history/use of astronomy, and women astronomers from Table 1).

The survey data imply that the public is not highly interested in human stories in the context of Astronomy. This seems counter-intuitive from an education and science communication standpoint. Audiences are generally more attracted to human stories than to factual information (Gotshall 2012, Olson 2015). People learn more from narratives than they do from impersonal science facts. Indeed, narratives are believed to help people process phenomena beyond the human scale (Dahlstrom and Ritland, 2012). The discrepancy could be attributed to the audience’s preconceived idea of what planetariums are for. When seeing a show in a planetarium, most audiences may expect to see representations of space and be in a mindset to learn about astronomy or physics. This may explain that respondents chose the options about space itself instead of learning about the human side of astronomy. Alternatively, this may be showing that human stories and history should be considered a tool, a means to the end of learning about space, and not the subject matter of planetarium shows.

It looks like further research needs to be done on audience conceptions of planetariums and their shows. It is noted that all three participants who specified that they would like to see a planetarium show about exoplanets in the open-ended question were aged 20-35. This topic was a very close third-most-popular choice for astronomical interests in this age bracket, while in all the other age brackets exoplanets was the least popular topic (Figure

(Continued on pg. 22)
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SURFACE VS. VOLUME
THE LINE OF SIGHT PROBLEM

By Nico Koning & Wolfgang Steffen

In the third part of our series on surface and volumetric 3D models of astronomical objects for live-presentations in planetariums, we look at how we obtain the necessary additional information and constraints that are not contained in photographs of the sky. The questions we will attempt to answer are: how do astrophysicists learn about the structure of an object along the line of sight and how do they incorporate this information to generate models?

The line-of-sight problem

Most known astronomical objects are known from photographs. In these images, the emission along a particular line of sight is collected all jumbled up into a single “bucket”, i.e., an image pixel. Modern, digital photographs are made up of millions of such pixels. How do we, at ilumbra, disentangle that information and put the emission back into its correct place in space to obtain a 3D model?

Kinematics

For expanding nebulae such as supernova remnants, planetary nebulae, and their relatives, high resolution spectroscopy is the key to resolving this problem. In this type of observation, the light is separated into its component wavelengths to produce a spectrum that has sufficient detail to measure the change in wavelength that an atomic spectral line suffers due to its speed along the line of sight -- the famous Doppler Effect.

The expansion velocity of supernovae and planetary nebulae is sufficiently large for a high-resolution spectrograph to measure. While amateur astronomers with modern equipment are producing incredible photographs, even of very faint nebulae, these spectrographs are quite rare even in professional observatories. We therefore rely on data from professional databases or journal publications. Fortunately, for most famous nebulae this kind of data is available, at least with partial coverage of the nebula area.

When the spectral line shape is recorded over much of the area of a nebula, the velocity measurement contains key information about the distribution of the gas along the line of sight. In Figure 1, we show an image of the planetary nebula NGC 2392 (formerly known as the Eskimo Nebula), in which lines represent the coverage of spectrograph measurements in the KinCatSPM catalog (López et al., 2012). In Figure 2, we have an example of a spectral line from nitrogen with some of the salient features marked, both in the position-velocity image derived from the spectrum (right) and the direct image (left).

The interpretation and mapping of the velocity information is not straightforward and has to take the known general theory of their formation into account. If that is done properly, the problem of the nebular structure along the line of sight can often be solved quite accurately. At ilumbra we are specialists in the interpretation of this kind of “kinematic” spectra. Whenever available, we use up-to-date data from professional astrophysical literature and data catalogs to build our volumetric 3-D models of expanding nebulae.

The velocity that we obtain from the measurement of a spectral line is the component of the velocity only along the line of sight, which is good since that is the part that interests us the most. If we can find a unique relationship between this velocity and the position along the line of sight with respect to the center or some other point within the nebula, then we are nearly home free.

In a powerful ballistic explosion, or something similar, the dense shrapnel sorts itself by velocity over time. The faster regions travel further away and eventually the distance from the center is proportional to the speed, leading to the relation . So, if we can figure out the constant , then we have a direct mapping between the measured velocity and the position along the line of sight. This factor can usually be estimated either based on an
approximate symmetry of some part of the nebula, or because the size scale along the line of sight must be similar. Alternatively, another geometric constraint that is evident from the images may help, as well as the theory of this type of object.

While expanding nebulae, such as planetary nebulae, usually do not follow a single such law of homologous expansion, within individual shells the homologous expansion law is often approximately true. This means that one must determine a different value of $v$ for each shell. For instance, in Figure 2 the outer shell of the planetary nebula expands more slowly than the inner, brighter shell. This can be seen in the spectral line as marked. Along the velocity axis of the spectrum (horizontal), the inner shell actually straddles the outer shell. Along the spatial axis (vertical), the order is the same as in the image.

This situation prevents an automatic reconstruction of such a nebula from only the velocity information. Similar mappings between the kinematics and the spatial location of emission can come from other dynamical laws, such as Keplerian rotation in a protoplanetary disk, the rotation curve of a galaxy, or other dynamic phenomena in gaseous objects.

Therefore, at ilumbra, we use software specially developed to allow manual reconstruction by parts. We can simultaneously take the spatial imaging and the spectral velocity information into account, which may actually deviate from a homologous expansion. Rather than a single reconstruction algorithm, the essential ingredients for the best possible result are the human being and its knowledge of the astrophysics of the object in question. Rendered images of the reconstructed nebula are shown in Figure 3, and the resulting volumetric 3D model of NGC 2392 can be found under visualizations on ilumbra.com.

Illumination and shadow patterns

For star forming regions, the main constraints come from illumination patterns from their brightest stars. Dense dust regions may cast shadows onto the landscape, thereby revealing their location with respect to the surroundings. Furthermore, dust features can partially occlude bright regions behind them or bright regions may float in front of darker dust.

Structural connectivity of features is also quite a powerful tool, even across wavelengths. A long, curvy filament may become invisible at some point, whereas it may continue in infrared images and connect to another region that is visible in the optical. In such a case both regions seem independent in the optical, but with the additional information from the infrared, an ambiguity in relative location may be resolved.

Again, additional help comes from the overall astrophysical knowledge that star forming regions tend to be hollow cavities in a dusty environment with the source of excitation for the emission being stars inside the cavities.

Careful analysis based on these constraints may reveal the order of

Velocity measurements can therefore rarely be used directly in order to map the velocity to position along the line of sight, as is the case in supernovae and planetary nebulae. At best, the kinematics can sometimes help to distinguish regions that overlap along the line of sight in a photograph. So, we have to look for other kinds of constraints.

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A Survey on Audience Interests (continued)

2. The first exoplanet was officially confirmed in 1992 (Wolszczan and Frail, 1992), making the study of exoplanets relatively new in the centuries old field of astronomy. Unlike older participants, those 20-35-years old may have learned about exoplanets in school growing up. If that were the case, we would expect to see the trend continue for people below the age of 20. This survey did not target participants under 20. Further study on the interests of younger people could help to understand the differences in astronomy interests.

Looking specifically at the responses of participants that have recently seen a planetarium show can help to understand what repeat planetarium visitors may be interested in. While constellations and the Solar System are among the top three regardless of previous planetarium show attendance, the topic of black holes is the top choice by participants who had recently seen a planetarium show. This may be reflecting that repeat audiences may feel more confident to be exposed to what is known to be a complex topic. If further research reproduces and confirms this type of result, it may be an indication that planetarium show producers need to be aware of the need to scaffold their contents when thinking of repeat audiences, who may gradually feel up to the challenge of tackling increasingly complex topics.

Limitations

The survey was shared through personal social media accounts, limiting the distribution and not providing an accurate representation of the general public. The pool of participants may have a larger population of highly educated individuals, from the northeastern US and parts of southern Canada. The participant pool may not have contained a socio-economically diverse population. The limited distribution and lack of a diverse participant pool may show a bias in the results of the survey. Complementary research is necessary to address this limitation.

Conclusions

Understanding the public’s interests in astronomy and what they would like to learn can help planetariums develop impactful shows that the audience enjoys. This survey showed that constellations and the Solar System remain topics found most interesting by planetarium audiences. It also shows that planetarium audiences attend shows with a mindset favoring learning about space. Therefore, while human stories and history are proven resources to make content appealing, they should not take its place as topics of the shows themselves.

Planetarium show creators can also benefit from understanding what audiences have been previously exposed to about astronomy in their education or at a previous planetarium show. A show about exoplanets tends to have a higher appeal to visitors aged 20-35 than to older visitors, perhaps because it is a topic they have heard about in school, and having attended a planetarium show recently makes audiences feel up to being challenged with more complex topics, such as black holes.

Surface vs Volume (continued)

features along the line of sight. The accuracy of this method is, however, not as good as that achieved by using the spectroscopic velocity measurements and symmetries in an expanding nebula as described above. Hence, for star forming regions, and until new observations reveal additional constraints, there is always an element of necessary scientific plausibility and “intelligent guessing” that introduces uncertainty.

Whenever possible at ilumbra, we add physical modeling of the radiation processes to mitigate the limitations of the observational constraints. The overall structure will probably be alright, and hence the didactic value of the volumetric model illustrating the complex structure of a cradle of stars is on scientific footing.

In Take 4, we will take a look at the volumetric modeling of galaxies, from the relatively simple ellipticals to the complex recycling machines called spiral galaxies.

References:


Olson, R. (2015). Houston, We Have a Narrative. Why Science Needs Story (University of Chicago Press, Chicago, IL)


References:


In this Holiday Season 2021 we have a lot to be thankful for. We are especially thankful that we get to work in such an exciting field with amazing professionals, and we are deeply grateful to our loyal and supportive customers worldwide for decades of rewarding collaboration. For new customers or those looking to upgrade, we offer complete solid-state laser or LED projection systems, as well as our legacy theater automation, complete digitally-networked audio systems, and experienced project design services. With our DigitalSky software packages we are bringing new ways to do more in your presentations. Get in touch to find out more.

Let us help you launch your planetarium into the future!
See you soon in 2022
THE STRASBOURG DATA CENTER’S
SCIENTIFIC DATA AT THE HEART OF THE
UNIVERSITY’S NEW PLANETARIUM

By Benjamin Rota and Milène Wendling

Abstract

With an eye on the opening of the new planetarium at the University of Strasbourg at the end of 2022, the Jardin des sciences (department that manages the planetarium), in close collaboration with the Strasbourg Data Centre of the Astronomical Observatory, worked on a new project of research data visualization. The aim is to offer the community new visualization tools dedicated to the outreach of current research topics.

In 1982, the Astronomical Observatory of Strasbourg, with the city’s contribution, acquired a planetarium room (8 meters wide) thanks to astrophysicist Agnès Acker’s strong commitment to public understanding of science. It was the fifth planetarium established in France. At that time, and still today, it had the important specification of being located at the heart of an innovative laboratory doing active scientific research, but also of being managed by a university – the only one in France. This situation allowed it to enrich the local and territorial scientific culture of the citizens in the field of astronomy and space, reaching more than 1 million inhabitants from children to senior since its opening.

After 40 years of faithful service, the 8-meter planetarium will close its doors in 2022 to be replaced by a large, 15-meter planetarium in a new building located 500 meters from the Observatory. This geographical relocation will not break the links with the Observatory. On the contrary, the planetarium team is already preparing for this transition and the public opening of the new place in 2022. Thus, at the initiative of the department Jardin des sciences, a new collaboration was set up in 2019 between the planetarium, the Strasbourg Data Centre (CDS) hosted at the Observatory, and the company Evans & Sutherland – which will provide a simulator of the new planetarium in order to be able to integrate data from scientific catalogs into it.

The CDS, internationally recognized for archiving and sharing scientific reference data on the Universe, is also one of the major actors in the Virtual Observatory and a pioneer in the processing of massive amounts of data produced by modern instrumentation. In addition to the Simbad database and VizieR catalog services, the CDS also hosts the Aladin sky atlas, dedicated to the visualization and analysis of astronomical images and surveys. These data are distributed in the HiPS (Hierarchical Progressive Surveys) format, standardized by the IVOA (International Virtual Observatory Alliance), as well as other well-known formats such as FITS or VOTable. Currently, more than a thousand surveys totaling about 1Pb of data are available across the entire electromagnetic spectrum and provide variable coverage up to the full sky.

The capacity of distributing big data produced for astronomical research is at the heart of the tools developed by the Virtual Observatory, and the HiPS format is an illustration of this. In order to allow access to surveys via the Internet, sometimes weighing several TB, the data are split into individual tiles, stored as simple file hierarchies, and exposed through a standard web server. Thanks to the collaboration, initiated by the planetarium, between the CDS and Evans & Sutherland, a HiPS client software such as Aladin, Stellarium, and now the new Digistar 7 simulator, is able to reconstruct the survey to produce a progressive visualization. The more you zoom in on a particular portion of the image, the more new details appear down the maximum depth level.

CDS offers well-known surveys such as Chandra, GALEX (Galaxy Evolution Explorer), SDSS (Sloan Digital Sky Survey), Gaia, PanSTARRS, and Spitzer. Thanks to their standardization, data in HiPS format will also be produced by Euclid, LOFAR,
LSST, and SKA. Finally, the production tools, freely distributed by the CDS, allow the conversion of any type of astronomical or photographic data into progressive hierarchical surveys, opening the possibility for amateur astronomers to visualize and compare their shots with professional images. Using this method, one of the Coronelli Globes, made in 1697 and kept at the Strasbourg Astronomical Observatory, has been digitized and is now viewable in HiPS in the same way as the usual surveys.

The adaptation of this format to the dome of the new planetarium, through its integration with the Digistar 7 simulator, allows us to develop innovative mediation sequences that will be shared with the community, with the support of the University of Strasbourg (IDEX - future-oriented investment project). Our main objectives are to transmit notions about the Universe by mixing and comparing simulated data and research data, and to explain the scientific process and the techniques and infrastructures that support the development of contemporary knowledge in astronomy. This approach appears to us to be of paramount importance, especially in the current context of mistrust towards science and misunderstanding of the way scientific knowledge is produced.

**Features of the new Planetarium - 2022**

- AstroTec dome-screen 15 meters wide / Tilted at 18° / 138 seats
- Multi video projection SONY - 7K/ Astronomical simulator Digistar 7/
- Skysonus and Skylux


Operating principle of the HiPS standard. Image © S. Derrière / CDS

New planetarium image © Frenak + Jullien Architecves
Despite all the difficulties, the sixth Fulldome Festival Brno was held at the Brno Observatory and Planetarium between July 27th and July 30th, 2021. It was not online, but rather in the form we were used to until recently. We saw fifty fulldome films, of which four won the festival awards.

It is obvious that travelling between countries is far from easy at the moment. Not only due to the dreaded virus storm, but also because of the media’s paranoia, the desire to control the free movement of people, and apparently also because of business, it is a journey across the borders of bureaucratic hell.

Despite it all, at the beginning of July 2021, we decided to go for broke with the world line of destiny. We could not do so last year, but if we had not organized a festival of new fulldome films for digital planetariums this year, we would probably never restart it again. Over the next few weeks, we nervously followed the regulations of the Czech government, as well as similarly changing and confusing policies of other countries of the world, and worked with the international, European, and Czech guidelines to avoid a ‘director’s only’ versions of the festival (me sitting alone in the planetarium dome watching the fulldome films and the rest of the word following me through the webcam).

Finally, everything turned out well and we could welcome our colleagues from most of Europe: Estonia, Finland, France, Hungary, Germany, Poland, Austria, Romania, Slovakia, Spain, Sweden and even… which was really surprising for us, from Japan and the United States.

“It was great to be in Brno again! After a long time in which no meetings and no festivals could take place, this was the first opportunity not only to marvel at all the latest fulldome shows, but also to meet planetarium colleagues and friends from all over the world once again. This time, the festival was a special experience for me, as I had the honor of being a member of the jury. It was, indeed, an effort to watch all 50 shows and to discuss all of their qualities within the jury. But this interesting duty gave me an even better insight into the great work that Jiří Dusek and his team put into the realisation of this festival every year! I am grateful to them for this great event, and I am already looking forward to the Brno 2022 fulldome festival!” Björn Voss, LWL im Überblick

“My favorite festival in this spiral arm of our galaxy! “Team FFB Brno” excels in hospitality and organisation in a marvellous city full of history and culture for which you immediately fall in love! It is remarkable how relaxed one feels while still digesting dozens of productions from around the world (even in 3D), many of them presented for the

(Continued on pg. 35)
Congratulations to the winners of the Fulldome Festival Brno 2021!

AUDIENCE AWARD
Signs of Life

DIRECTOR’S AWARD
Magic Globe

BEST 2D AWARD
Hayabusa 2
Reborn

BEST 3D AWARD
Making Magic
A Visual Effects Story

See you all next year!
8 – 10 June, 2022
www.fulldomefestivalbrno.com
THE BEST OF EARTH
A CONVERGENCE OF FESTIVALS

By Ed Lantz, with contributions from Warik Lawrance, Kate McCallum, Ryan Moore, Micky Remann & Ben Stern

Planetariums proudly serve communities with informal science education, a particularly important service in these times. Many planetarians also seek to expand their community services by offering a wide range of cultural programming, now possible with digital dome technologies.

I founded Vortex Immersion Media in 2007 and, with the help of Kate McCallum and our small team, built The Vortex Dome on the Los Angeles Center Studios film lot to explore these possibilities (see article “From Space to the Stars: Ten Years of Arts and Entertainment at The Vortex Dome-Los Angeles,” Planetarian June 2018 issue, Vol. 47, No. 2).

In 2019, filmmaker and VR producer, Ryan Moore approached Vortex about adapting a live action 360 film that he had produced in VR into a dome film titled Indirect Actions. The film documented their crew’s experience at the protest of the Dakota Access Pipeline that took place in 2016 at the Missouri River crossing just north of the Standing Rock Sioux Reservation in North Dakota, which had become the focal point of the issue. Ryan, who became passionate about the fulldome format as a medium more suitable than VR for long-form content, approached the Downtown Los Angeles Film Festival about starting a category for fulldome films. Vortex came on as a sponsoring partner, and The Vortex Dome served as a showcase for immersive films and talks along with the Wisdome Art Park theater located in Los Angeles’ Arts District.

We have long envisioned a dedicated dome film festival in Los Angeles, so with the pandemic starting to lift in late 2020 we discussed the possibility of an annual LA-based film festival with Ryan, centered at The Vortex Dome with possible additional screenings at the Griffith Observatory, Glendale Community College Planetarium and more. Without knowing how COVID would affect our planning, we all agreed and bravely set a date for the fall of 2021—whether virtually or as a live, in-person event. Plans began to launch for Dome Fest West and we reached out to IMERSA, who partnered with our team on the conference portion of DFW. However, after nine months of financial challenges due to COVID, we packed up The Vortex Dome and put her in storage. Now we needed a venue!

Fortunately, Scott Mitchell with the Orange Coast College Planetarium—a new Digistar 6, 8k installation with a 15m Spitz NanoSeam™ dome that closed due to the pandemic one short year after it opened—stepped up and Dome Fest West was born. We set the festival for October 8-10th thinking that, surely, the pandemic would be over by then.

In planning for the festival, we noticed that the long-standing FullDome Festival in Jena, Germany was planning an in-person festival for October as well. We discussed with festival director and professor of Immersive Media at Bauhaus-Universität Weimar, Micky Remann, the possibility of doing something concurrent with Dome Fest West and the FullDome Festival. COVID-19 had taken a toll on all the dome festivals due to travel and attendance restrictions. Micky suggested we expand the conversation to include additional festivals who might work together to assist one another in recovering from the pandemic.

These discussions led to four fulldome festivals on three continents joining together to present the world’s best 360° fulldome and immersive media showcase:

- Dome Fest West, Los Angeles, USA
- FullDome Festival, Jena, Germany
- Fulldome UK, Plymouth, UK
- Dome Under Festival, Melbourne, Australia

In addition to each festival honoring the best fulldome programming with their usual awards, these independent festivals created a co-op of international
fulldome festivals to bestow Best of Earth Awards to a select group of films. This co-op was conceived to benefit fulldome immersive media in general, fulldome artists in particular, plus companies, educational institutions, planetariums and audiences interested in science, art, storytelling or immersive media. The festival partners recognized that combining their efforts would maximize the outreach to audiences worldwide and promote the fulldome medium in a way that could not be achieved by a single festival on its own.

Numerous emails and Zoom calls were required to settle on detailed submission guidelines, award categories, immersive streaming plans and all the logistics. Under Micky’s guidance, Jena commissioned the design and fabrication of a beautiful Best of Earth award from artist Cosima Goepfert. The festival representatives collaborated admirably, and negotiations were cordial and very professional.

The festivals collectively issued a call for Best of Earth award submissions on March 4, 2021. Fulldome producers around the world applied to have their shows (created after January 2020) included in the Best of Earth program in the categories of full-length feature show (over 20 min.), short film (20 min. maximum), and student films (5 min. maximum). The call for submissions resulted in 108 films for consideration from all four festivals. Each festival rated their top films for consideration, and after several painstaking rounds of collaborative vetting, we narrowed the field down to 19 nominees.

The Best of Earth Awards honor excellence, creativity, and innovation in fulldome media. Six award winners were selected by an independent jury of immersive media professionals chosen by the participating film festivals.

Best Of Earth Jury members included:
- Kelley Francis, Fulldome Creative, US
- Michaela French, Leeds Arts University, UK
- Volkmar Schorcht, ZEISS, Germany
- Gordon Kurowski, CalArts, Los Angeles, California, US
- Alicia Sometimes, Melbourne, Australia

The Best of Earth collaboration was a great success. Three of the four film festivals ran concurrently between October 8th -10th, 2021 (Dome Under Fest was delayed due to another lockdown). Each festival screened all 19 Best of Earth nominated films as an integral part of their overall program. The film screenings were also available worldwide via a ticketed live-stream in 360-format for global audiences. A free Best of Earth Award Ceremony was also streamed live globally from the Zeiss-Großplanetarium in Berlin and was presented by Berlin-based science communicator Anna Green to live audiences in each participating theater and to producers all around the Earth eager to learn if they’d won an award.

The Best of Earth team is honored to showcase leading immersive filmmakers and planetariums - with their powerful digital dome format - to the world. This work expands the public’s perception of planetariums to include narrative storytelling and cultural arts programming in addition to informal science education. To our knowledge, this is the first international collaboration of film festivals to collectively issue juried awards. Kudos to all who participated in and supported this groundbreaking effort, which stands as an example of global cooperation across multiple institutions. We look forward to future opportunities to collaborate!

2020 BEST OF EARTH AWARD WINNERS:

- **Best Full Feature Film**: Legend of the Enchanted Reef by Peter Popp
- **Best Short Film**: In the Land of the Flabby Schnook by Francis Gélinas
- **Best Art & Experiment Film**: Suprematism. The Day Before by Sergey Prokofyev
- **Best Science & Education Film**: Living Worlds by Ryan Wyatt / Cheryl Vanderbilt
- **Best Student Film**: A Toothless Grin by Kristin Jakubek
- **Special Jury Selection**: Ayahuasca - Kosmik Journey Dome Experience by Jan Kounen
IMMERSIVE MATTERS
EXPANDING OUR IMMERSIVE REACH

by Carolyn Collins Petersen, Julieta Aguilera, Michael Daut, and Dan Neafus

More than two decades have passed since the first fulldome video presentations began to make their way into our theaters. From the technology demonstrations at IPS 1998 to the latest festivals celebrating fulldome content, planetarium folk have been treated to, and oftentimes been the creators, of imaginative and informative content that takes advantage of our abilities to transform the dome into whatever environment we wish. Of course, even before fulldome video was a “thing,” planetarians were taking people out to the farthest reaches of the universe and back again using stars and slide projectors. Fulldome video is the latest in a long history of exploration. Today, that exploratory medium benefits from CGI and animation in addition to real-time generated stars and galaxies.

Our August IMERSA Day event, titled “The Science of Extended Seeing: Immersive Connections to Hyperlocal Data”, featured an expert panel of speakers with decades of experience advancing scientific visualization in planetariums, developing immersive tools to enhance cross-disciplinary collaboration, introducing data collection and analysis to the public in their own communities, and utilizing citizen science to better understand how living beings connect to their environments. It was hosted by IMERSA Board member Julieta Aguilera.

Today, planetarium facilities interact with techniques and media, such as virtual reality, in novel ways, “primed” with having some degree of ownership of the immersive space. Virtual reality practitioners are familiar with the word “agency” as in the sense of being an agent, an active presence, as opposed to being a spectator. Even mobile devices give unprecedented perspective to locality. Each of the presenters came to this convergence of immersion, agency, and data from different, but important, directions.

Climate Change and Collective Knowledge
Ka Chun Yu (Denver Museum of Nature and Science) spoke to the context that has made IMERSA central to the projects and ideas that are presented by mentioning the recent IPCC report, stating that efforts to help communicate the climate crisis have been lacking. Yet it was the need for a collective environmental literacy necessary for making the right decisions that was the inspiration for the Worldviews Network ten years ago. The Worldviews Network (https://worldviews.webflow.io/) used the “See Know Do” framework (visualization, complexity, and dialog). Current examples taking place today include active learning and citizen science, showing that empowering agents of change requires understanding of what communities need to do, emphasizing solutions, and focusing on the local.

Relevance and Connection
The career of Mark SubbaRao (NASA Scientific Visualization Studio (https://svs.gsfc.nasa.gov/), past IPS president) has been about hyper-non-local data, about getting people to think beyond their normal life experience and appreciating how big the Universe really is. Why care about locality? Two reasons: relevance and connection. The universe is profoundly connected across scales and we are profoundly connected to the Universe itself. What is often missing is the understanding of that connection. For example, patterns at the edge of the observable universe are quantum fluctuations at subatomic scales. He points out that we exploit that connection in some industries through the science of geodesy, which is fundamental for satellites and GPS. Essentially, we know where we are through observations of the most distant quasars, supermassive black holes, and other phenomena.

Making the connection between the local and the global is key to getting people to care about the global problem, as Ka Chun Yu also mentioned. NASA’s constituencies are policymakers, congressmen with whom Mark meets who want to see
local data too. Three strategies for cultivating a sense of place, both in terms of the local culture and their relationship to the sky, follow.

First, engage with local scientists (which is also a way to get local data); second, embed science in the local by presenting the data in public spaces; and third, constantly go back and forth between scales to make this connection, thus motivating people to pay attention to issues that concern us all.

The Modern Microscope

Jason Leigh (Laboratory for Advanced Visualization and Applications at the University of Hawai‘i, (https://www.lavaflow.info/)), considers developing scientific visualization systems analogous to building the modern version of the eyepiece of a microscope, which was state-of-the-art technology when he was growing up. How scientists do science today using telescopes, exploration vessels, and other sensors, is the equivalent of the microscope’s light source, where sensors feed supercomputers. This is the focus and magnification of the microscope. The eyepiece, where the viewer perceives all the hidden gems in the data, is the advanced visualization systems.

This “eyepiece” takes someone away from the point of view they are used to seeing and transports them into virtual worlds of greater and smaller scales. It is as if we are a giant flying through the universe or swooping down to the cellular level. We are not stuck in the local minimum but can see the whole picture. Fully immersive data environments also allow us to look at multiple scenarios side by side. Archival data can encourage people to be more aware of the beauty being lost because, if climate change continues on its current trend, we will not see pictures like them anymore. In all these ways, advanced visualization systems can juxtapose information to see both detail and context—the locality and globalness that Mark talked about—and make better decisions.

Furthermore, Jason has found that when advanced visualization systems are shown to non-scientific audiences, they become much more engaged and ask deeper questions. He thinks about the sense of awe he experiences when visiting planetariums and museums. Awe, that in the words of Summer Allen “makes us feel like we are part of something greater than ourselves”.

Community Action and Data

According to Jeff Kirschner (creator of Litterati at https://litterati.org/), data is driving and transforming our world. Applying crowdsourcing techniques over the entire planet and leveraging technology to clean up litter was the inspiration for founding Litterati. In the beginning, litter became artistic thanks to the power of Instagram. As Mark mentioned, it became relevant. Taking fifty pictures of pieces of litter and properly disposing of them meant fifty fewer things that people may walk on, or some bird might eat. In the same way people measure steps walked or calories consumed, Jeff was measuring the positive impact he was having on the planet.

Then, participation grew into what became a community collecting a ton of data on litter through photography. How? Every single photo tells a story. The moment you snap it, the image tells you who picked up what, where, and when. Computer vision models and machine learning help identify objects, what they are made of, and when possible, their brand. Jeff reflects that when we take the invisible and make it visible, and make it relevant, this allows individuals to take action and, as Ka Chun said, provide collective knowledge.

Individuals make a difference, but together there is impact. This demonstrates the power of community action when combined with data. Jeff cites how the city of San Francisco collected five thousand pieces of data in a statistically significant manner. It became a “city fingerprint” model that can work for other cities by getting to the root of the problem and paving the path to a solution. A brand that is causing environmental harm can learn and improve, reducing litter and also saving a penny with every plastic wrapper that is no longer thrown out. He concludes that when collecting data using technology, one must think about where we want to go.

The Puzzle of Conservation

Tanya Berger-Wolf (computational ecologist, professor of Computer Science Engineering, Electrical and Computer Engineering, and Evolution, Ecology, and Organismal Biology at Ohio State University) strongly agrees that crowdsourcing and direct participation, not only in data collection but action based on that collective data, can really enable global action. It starts with everybody taking part in putting together the puzzle of the global picture from local data.

Here’s why: We are losing biodiversity at an unprecedented scale, and we currently don’t know which animals we are losing and how fast. How do we even know if our conservation policies are working? Images are the most abundant source of information today, from what you had for lunch, to what trash is in your backyard, to animals in the same backyard, to animals seen on safari or a whale watching tour.

This is why Wildbook (https://www.wildme.org) was developed; to identify not only species but also individual animals by using the unique markings on their bodies. With information on where and when the images were taken, we can now not only track but count them, and even look at the animal’s social network. The system includes a YouTube intelligence agent who searches public videos containing species of interest and then comments: “Hey. 2m46s into the video you can see the whale shark MXA-700. Here is everything we know about it”.

And the response is “Wow! This is amazing! How can I help?” This engages people, and their vacation videos, who didn’t think they could contribute to science and conservation.

Tanya noted that many species are not local to any particular conservation project, some traveling thousands of miles. In these cases, one local project or person cannot have all the information, even about a single animal. Wildbook has assisted in researching and updating the conservation status for whale
sharks in order to put the right policies, protections, and resources in place. Another example is the bi-annual, two-day, country-wide zebra count that has already taken place twice in Kenya. Training programs have enabled people to collect thousands of photos and the management plan of the Kenya wildlife service is now based on this trusted data. Tanya concluded with the thought that part of enabling trust is giving agency in data collection. Immersive technologies can make a person part of the data, showing that the solutions one helped create are right for the setting, and also democratizing access and the actions taken from the data.

The presentations from these panelists (only partially described here) were accompanied by extensive graphical materials, followed by audience questions and rich interactions among presenters making connections between each other’s work, and identifying further aspects and areas of overlap. The whole session is accessible to IMERSA members at our Website and offers much food for thought for fulldome presenters and producers.

October and the Fulldome Festival Season

A key aspect of our professional development in the fulldome industry is the recognition of inventive and creative presentations, as evidenced by the number of fulldome festivals that occur each year or semi-annually. Due to the pandemic, 2020 didn’t see many festivals but this year they are starting to come back. In fact, October turned out to be THE month for festivals, led by the first-ever Dome Fest West in Los Angeles, the venerable Jena Fulldome Festival in Jena, Germany, and Fulldome UK in England. Fulldome Down Under was postponed due to the continuing pandemic in Australia. This year also saw the first-ever “Best of Earth” ceremony, heralding the winners of several festivals.

IMERSA co-hosted Dome Fest West at Orange Coast College Planetarium. The event, which took place October 8, 9, and 10 of 2021, featured 32 fulldome films, selected for the festival, screened over two days of programming. Along with the screenings, IMERSA provided speakers for a mostly in-person ‘IMERSA Day’ during the festival. An abbreviated “Fulldome 101” session acquainted attendees with the basics of fulldome production. In this session, IMERSA Board member Michael Daut contextualized fulldome’s uniqueness as a new medium. Former IMERSA board member Ed Lantz also presented with a look at the technical aspects of the dome. Board member Carolyn Collins Petersen joined virtually for a one-on-one discussion with Michael Daut about how the dome impacts production.

Following that session, Carolyn, Kate McCallum of Vortex Immersion, and Will Nix of the Creative Projects Group in Los Angeles, offered a panel called “Storytelling in the Dome, Transmedia, and Social Impact Entertainment.” Michael Daut shared a talk about “Audience Impact in the
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Age of COVID,” offering insight into how our audiences have changed and how we can best connect with them. The afternoon sessions featured a look at camera technology for dome productions, featuring IMERSA board member Ryan Wyatt (of the California Academy of Sciences) and Radiant Image’s Michael Mansouri. Attendees also heard from COSM’s Jeb Terry about shared reality and the future of immersive experiences. Ed Lantz, Mani Srinivasan, Michael Strauss, James Hood, and Jahna Perricone held a panel discussion called “The Transformational Power of Immersive: Domes and XR for Wellbeing.” Saturday’s festivities concluded with a concert by visual artists Michael Strauss and J Walt.

Along with Sunday’s screenings, IMERSA hosted a keynote address by filmmaker and VR pioneer, Brett Leonard, who provided compelling evidence that we are at the tipping point of immersive fulldome coming into the mainstream. Brett also joined a panel that discussed the future of immersive venues and their potential traction with audiences and their trajectory for the foreseeable future. Jenni Ogden of 4DFun, Hilary McVicker of the Elumenati, and Ed Lantz rounded out this fascinating panel.

Dome Fest West principal sponsor, COSM, presented a conversation entitled, “Masters of the Universe,” in which dome veterans, Mike Smail (Adler Planetarium), Michael McConville (COSM), Dayna Thompson (Ball State University), and Ben Gondrez (Denver Museum of Nature and Science) shared experiences about the power of their real-time computer graphics systems and efforts to develop non-astronomical programming that attracts new audiences to their dome theaters.

Finally, Eric Hanson (Blueplanet VR and USC Professor) produced a session that described the cutting-edge tools and techniques for virtual production in fulldome. Panelists included Hugh Ho (CreatorUp), Tobias Chen (Volumetric Camera Systems), Diana Reichenbach (Savannah College of Art and Design), and Edd Dawson-Taylor (The Lion King and The Jungle Book feature films). This mind-bending look at today’s future-tech inspired new applications for ground-breaking immersive filmmaking and was a perfect way to end the panels.

**Future IMERSA Activities**

A mix of live and virtual events will fill IMERSA’s presentation calendar for 2022. We are in the planning stages for several virtual IMERSA Days, including an IMERSA Day 2022 in conjunction with the IPS meeting in St. Petersburg, and, in the fall, will take our mission a step further by continuing our immersive conversation in Montreal, Canada. Recognizing that our organizations share similar goals and interests, we have planned a co-hosted event, IMERSA Montréal, to be presented by IMERSA with Planétarium Rio Tinto Alcan and the Société des Arts Technologiques from October 14 – October 18, 2022. In this way, IMERSA intends to support our shared desire to advance the art and technology of immersive digital experiences. IMERSA summits provide great opportunities to network and offer many chances to foster robust personal interactions between colleagues. “Collaboration is the way we help each other to uncover ideas and spark inspiration.”

IMERSA Day IPS 2022 is being planned in cooperation with IPS and our welcoming hosts, Planetarium One in St. Petersburg. We are pleased to announce IMERSA Day and LIPS June 24 and 25, following a full-dome festival June 22 and 23. The IPS conference dates are June 26-29, 2022, with many people around the globe attending on-line and as many as possible attending in person in St. Petersburg, Russia.

For more information about us and our mission, visit our website at IMERSA.org.
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Planetarium Director’s Log,
Stardate September 2021:

1, 2, 3, 4, 5…..I found myself counting as I numbered the seats in my planetarium. We are back. All the kids are in school, but the Delta variant has rained on our parade. I’m not one to think that the universe sends us messages, but it rained like I haven’t seen in years on our first day of school. If that was an omen, it sure wasn’t a good one. I had to number the seats because so many of my young visitors are not vaccinated. Daily case count reports resumed with disheartening numbers, and we will have to keep careful track of seating arrangements so that we can do contact tracing when each new COVID case arises.

Some things are better. I don’t have to teach the top of anybody’s head or their ceiling fan on Zoom. It is truly wonderful to have all the kids back in the school building. Hopes are high that we can keep them here, but time will tell. Face masks are back along with the constant battle to get everyone to wear them properly. Most of the kids and staff are pretty good about following the guidelines. I do understand that people are weary, tired, impatient and depressed. We thought it would be “back to normal” this fall.

While all of the other teachers got to have their kids in class, I wasn’t so sure that the planetarium would be able to host visitors from other schools. They want the kids in “cohorts” or groups that stay separated from other groups. I can do that; just don’t let my visiting groups mix with the rest of the school. They wouldn’t have been doing that anyways. Then there was concern about the availability of buses. Really? Are we not running sports this year? Of course we are. I assert that my CURRICULAR lessons should supersede the EXTRA-curricular activities. The next objection was to missing class time for field trips. Again, my lessons are CURRICULAR, and everyone reading this knows that a flat screen view of the sky is nothing compared to the immersion of a planetarium.

I have been around a long time, so I know that the first week of school is not a good time to poke any hornet nests. How do I break through and get my kids back? The first step is the high school kids from the school to which my facility is attached. That wasn’t hard. Next, the kids from the middle school next door. They walk over, so no busing is needed. The big hurdle is the kids from other schools who have to take a bus. Drivers are in short supply, as is all labor these days. It also doesn’t help that I can’t fit as many kids in the dome now. Normally, I receive groups of 75 which is three classes, half of a typical grade level team. Two shows back-to-back and I have the whole team covered. With 40 distanced seats, it is not quite enough for two full classes. If the classes come one at a time, that means six visits per team for each show instead of two. Needing six bus trips means even more pressure on the limited supply of bus drivers.

Planetarium Director’s Log,
Stardate 4 October 2021:

A nearby school district has already closed down for a week and a half because of their COVID outbreaks. However, the situation at the planetarium has improved. It was a good idea NOT to make too much noise because the talk of prohibiting our other schools coming waned quickly. I have had many high school and middle school classes, including groups from other schools in the district. I can’t do schools from other districts yet, but I suspect that will open up soon. My elementary school teachers are making appointments now for October and November. I just hope we can stay in school and not have to close like our neighbors.

I’m not going to say that I forgot how much fun it is but having the kids back in school has been truly wonderful. Having west actually be in the opposite direction from east instead of just on the other side of a flat screen is SO much better. Seeing the seasonal paths of the sun over your head is also so much better. It is easier to teach them and far more effective. I find myself feeling energized like I haven’t in a long time. I got so dramatic with one class as I taught them why we have seasons that time, so I know around a long immersion of a planetarium.

I have been feeling energized like I haven’t in a long time. I got so dramatic with one class as I taught them why we have seasons that time, so I know around a long immersion of a planetarium.

My first elementary school group that was supposed to be coming today had to cancel because of pockets of COVID outbreaks. They asked me to do a virtual show instead. I am seriously bummed out. Let’s talk about some other fun extensions of the planetarium instead.

**War of the Worlds LIVE** - by Chrysta Ghent, East Kentucky Science Center, Prestonsburg, KY, USA and Mike Shanahan, Liberty Science Center, Jersey City, NJ, USA

On October 30th, 2018, the actual 80th anniversary of the War of the
Worlds radio broadcast, the Liberty Science Center (LSC) staff recreated the notorious ‘night that panicked America’ in the newly renovated Jennifer Chalsty planetarium. The idea was proposed to make this an anniversary evening event, as part of the Halloween-themed programming for the science center, where guests could purchase a ticket and attend the show.

The original broadcast was aired on the CBS radio network during the Mercury Theater on the Air program as an adaptation of the novel War of the Worlds by H. G. Wells. Directed and narrated by Orson Welles, the radio program consisted of theme music, a prologue, a radio show interrupted by breaking news of a Martian invasion, and a survivor’s monologue.

LSC hired three local musicians (keyboard, violin, and trumpet) to recreate the musical interludes performed in 1938 by an orchestra under Bernard Hermann’s direction. 1930s-style microphones provided an added touch of authenticity. The staff dressed in era-appropriate costumes and were each assigned a role from the radio broadcast, including voice actors and a foley artist. Our exhibits department even helped out by building a robot ship with an alien inside that was lifted up by our staff at exactly the right time. All of this was placed at the front of the dome, as if the audience was watching it happen live in the radio studio.

The event began with a brief lecture by Planetarium Director Mike Shanahan on the history of the Mercury Theater of the Air, and on the unique set of circumstances (from unsettling news of invasions in Europe and the radio show’s lack of commercial interruptions) that led people to believe that they were hearing news of an actual Mars attack. This introduction led directly into the recreation of the hour-long radio broadcast from October 30th, 1938. To make this live reading more engaging for the 2018 audience, we utilized the immersive planetarium! Our team did an awesome job creating models with Digistar. For the radio show, the planetarium became the landscape. Planes flew overhead, giant towering robot aliens loomed across the dome, and lasers shot above the audience’s heads! Each of these images and animations were made into a user-friendly script where each event was engaged by clicking its own digital button on the planetarium computer.

I see this kind of event as a step into the theater realm, using the amazing acoustics of the dome and the invaluable immersive screen as a background. All in all, this whole event took a few weeks of planning, rehearsals, and digital planetarium scripting. There was a good turnout, considering this was the first theater-like event that was done in the LSC. Choosing this specific topic eased our memorization time and helped us cast the program with members of LSC’s STEM department.

In addition to testing the waters in theater, this performance allowed LSC to test out the effectiveness of live music in the dome, another important area for expansion for the new theater. The original radio show featured significant musical segments, and these were transcribed and arranged for the 2018 performance. The music enriched the show and demonstrated the dome’s potential as a live music venue.

**A New Collaboration Between Horwitz-DeRemer Planetarium and the University of Wisconsin-Whitewater - Lisa Swaney (Horwitz-DeRemer Planetarium) and Bob Benjamin (University of Wisconsin-Whitewater)**

A recent article in the September 2021 edition of Physics Today, entitled “Improving science education: It’s not rocket science, it’s harder!” by Stephen Pompea and Pedro Russo, highlights the importance of scientists partnering with museums and out-of-school programs, offering this mode as one of the “best practices” in transformation science outreach and education. This is a story of how one such partnership began.

In 2018, one of us—Lisa Swaney—started her position as the new director of the Horwitz-DeRemer Planetarium, while about a 50-minute drive away, the other of us—Prof. Bob Benjamin—was exploring the possibility of developing a new program of science outreach. Our collaboration began with a chance conversation in the fall of 2019. Bob had stopped by the office of Steven Diesso, an employee working in the UW-Whitewater Admissions office. Steve is an avid amateur astronomer, and Bob had returned from a year-long sabbatical with a couple of interesting discoveries that he wanted to share. During the course of the conversation, Bob mentioned my interest in getting into more outreach, which prompted Steve to mention that he had gotten involved doing volunteer work with Lisa Swaney at a planetarium near his home in Waukesha.

(Continued on pg. 60)
INTERNATIONAL NEWS

Dear fellow planetarians...

While a number of planetaria around the World have been able to reopen, at least partially, during the summer and autumn (northern hemisphere), our society is still heavily affected by the coronavirus pandemic with meetings and conferences being postponed or held virtually (see Society of German Speaking Planetaria for a remarkable example of this), educational activities being moved outside the domes, and other events limited in different ways. Despite all this, some institutions have been able to use the involuntary downtime for upgrades and refurbishments, and fortunately we also see new shows coming out. You will find many excellent examples of that below.

For this section, I’m indebted to contributions from Sumito Hirota, Zina Zsitkova, Andreas Schmidt, Loris Ramponi, John Hare, Bart Benjamin, Andrew Kerr, and Ignacio Castro.

Let’s start this tour around the World in Japan.

JAPANESE PLANETARIUM ASSOCIATION

The JPA annual conference has been rescheduled again. Originally, it was to be held at Kohriyama Fureai Science Center, Fukushima, and the JPA workshop was to be held at Itami Children Museum, Hyogo. Now, it is undercareful considered whether or not the conference should be held under the COVID-19 situation. See more details at planetarium.jp (Japanese only).

Kawasaki Municipal Science Museum celebrates its 50th anniversary this year. It was opened in August 1971 and renovated in 2012 with a MEGASTAR-III FUSION. More than 4 million people visited the planetarium of Kawasaki in these 50 years. See: www.facebook.com/660223954069940/videos/41390340010890

Legendary Planetarian Mr. Ikuo Kawahara passed away in March 2021 at the age of 90. He has been working for planetariums for over 60 years. He started his carrier in planetariums at Gotoh Planetarium and Astronomical Museum, Tokyo in 1957. At that time, there were only two planetarium facilities in Japan. He moved to Kanagawa Prefectual Youth Center in 1962. After he retired from the job at Kanagawa, he continued to give planetarium presentations at Kawasaki Municipal Science Museum. He worked for planetariums throughout his life and was standing at the console even the day before his passing. Mr. Kawahara had a passion for live presentation and trained many planetarians in Japan.

RUSSIAN PLANETARIUM ASSOCIATION

After the summer break, the remote S.V. Shirokov Planetarium Lecturers School continued its work. On September 30th, a Zoominar was held on the topic of Modern cosmology: Horizons of Universe Exploration. The well-known Russian cosmologist Alexander Ivanchik was the speaker. In his speech, key observational provisions of modern cosmology were outlined, a standard cosmological model was presented, problems of dark matter and energy were touched upon, and unresolved cosmological problems were considered.

Nizhny Novgorod

A large-scale modernization of the Great Star Hall of the Grechko Nizhny Novgorod Planetarium has been concluded. For several months, the Spherical Cinema Society carried out the work, as a result of which the Nizhny Novgorod Planetarium received an updated hall with a modern interior, a multi-channel laser system, premium acoustic outfitting and lighting, new comfortable chairs (the first developed specifically for Russian planetariums), and a new high-contrast screen from Fulldome.pro. On September 24th, the renewed planetarium hall was opened, and a bust of cosmonaut Georgy Grechko was unveiled in front of the Planetarium building.

In early September, the Spherical Cinema Society launched a project for the planetarium of the Kozma Minin Nizhny Novgorod State Pedagogical University: the renovation of the Zeiss ZKP-1 optical-mechanical star projector, which will become part of the Fulldome.pro HDX4 Mini Hybrid Planetarium.

Moscow Region

The planetarium of Podolsk School №29 is known for its innovations. Under the leadership of Igor Tsarkov, a great enthusiast of astronomical education and teacher of physics and astronomy, the school Center for Scientific Creativity named Poisk was created. The Center runs the School Space Telescope network project, in which students from different cities of Russia take part. The goal of the project is to train personnel for the domestic space industry.

The main idea of the project is the creation of a spacecraft by secondary school and university students using the Kubsat 3U format with an optical telescope on board for the design and research activities of schoolchildren in

RPA. Staff and guests of the Grechko Nizhny Novgorod Planetarium at the unveiling of the bust of Georgy Grechko on September 24th. Second from left is Olga Grechko, daughter of the cosmonaut, and the first person to the right of the bust is cosmonaut Andrei Boisenko. Courtesy of Z. Sitkova.
the second idea of the project is to create a network of school radio telescopes that can operate in the radio interferometer mode, providing high-resolution images. Project coordinator Igor Tsarkov can be reached at tsar@podastr.ru and sputnik.school29.ru/

SOCIETY OF GERMAN SPEAKING PLANETARIA
After the annual conference had to be canceled in 2020 with short notice, the Society of German-speaking Planetariums (GDP) wanted to restore the planetarians’ everyday (work) life to normal this year. Since all planetariums had to remain closed due to the Corona pandemic regulations, and larger groups were not allowed to come together, an alternative had to be found. Many of us spent our days in home offices with endless online meetings via Skype, Zoom, and others. The board of the GDP dealt with the organization of an online conference in a very special setting. This was brought to life by the support of the Kasama software (www.kasama-konferenz.de).

On an island in the middle of a lake, the Society of German-speaking Planetariums (GDP) welcomed its members and interested guests in the best spring weather. The conference center, which was visible from afar, offered enough space for an extensive poster exhibition, several meeting rooms for working groups and many nooks and corners for private discussions. In an area set up for their individual requirements, the numerous sponsors and supporters were able to get in touch with their potential customers and interested parties. The main lecture hall provided the perfect backdrop for a scheduled program of exciting lectures and presentations. During breaks, people met in groups in the open air and enjoyed the wonderful view in relaxed conversations. Those who wanted to give themselves some me-time found any sort of distraction on a walk to the beach or a hike to the nearby lighthouse. For a sporty balance, you could go to play some football or take a motorboat out to sea.

These experiences were made possible by navigating a personalized avatar through a digital world. Although we weren’t allowed to meet in person (yet), we were there on site, somehow. And those who put a lot of effort into creating their avatar were kind of recognizable to friends and colleagues. Almost as if you were really there. It is almost certain, that a few years from now we will still remember this conference as if we had experienced it physically. Then, there was even a little extra here than at any other back-breaking online meeting: last but not least, the successful finale with a joint firework display at the beach. But if the coffee was inedible again, you’d need to blame yourself...

ITALIAN ASSOCIATION OF PLANETARIA
The documents of the past help us to touch, in the true sense of the word, facts and stories of decades ago. Opening the drawers, leafing through the folders, looking among the old papers, we discover the first evidence of an idea or a project such as that of creating a planetarium. The idea to look for old planetarium documents and create a virtual, online archive began in Italy where the Planetarium National
Archive (PNA) exists, which collects old paper materials from the past about domes of the country. The initiative has been described on the Facebook page of Italian Association of Planetariums (PLANit), with an example of an old publication that announced the first Italian National Day of Planetariums 30 years ago.

The “Day,” since 1991, has been held in March, but will move to May 7th in 2024. Thereby, the date will be aligned with the creation of the first planetarium (after the Planetarium Centennial of 2023) and each year will become the “birthday celebration.” But the story of the beginning of this initiative remains in the archive, a simple black and white page printed in 1991 in an Italian newsletter. It is the document that shows where and how the idea of the “Day” took its first steps. A few years later, this special day, born in Italy, was extended to other countries until the final result became the International Day of Planetariums. It is now an official date on the Planetarian’s calendar of events updated by the International Planetarium Society.

The Italian Association of Planetariums invite not only Italian facilities, but anyone to collect and publish old documents, photos, leaflets, and publications that show the beginning of a project like a star dome on the web. PLANit invites colleagues to send the URL of these web pages to osservatorio@serafinozani.it. Serafino Zani study and research center is the site where the National Archive of Planetariums is situated. PLANit also invites the regional planetarium association to publish the first page that was published in the IPS Planetarian magazine as the first contribution to this column. The image from September 1989 that contains the Italian news, published for the first time in the Regional Roundup (the previous name of this section of the magazine), can be found at: www.facebook.com/photo?fbid=4789335647752523&set=gm.83113431100883

Linea Rosa (literally Pink Line) is a voluntary association, established in 1991, that offers free support to women who live through periods of difficulty after being subjected to psychological, physical, or sexual violence and who want to get themselves out of such situations. The association started the project Flowers of Ravenna – City friends of Women in 2013. Institutions, shops, and private citizens can show their support to the activities of Linea Rosa by displaying a mosaic flower.

“We at A.R.A.R. (Associazione Ravennate Astrofili Rheyta),” Daria Dall’Olio and Paolo Morini report “both as amateur astronomers and as managers of the local planetarium (based on an agreement with the town council), have asked Linea Rosa if we can show our support in a special way related to the institution we have the honor to run.” They discussed with all the Planetarium staff and decided on a very special sign, to be paired to the standard one. It is a special mosaic flower, representing both a flower and a star, similar to those that can be found in the Galla Placidia Mausoleum, a world-famous monument in Ravenna dating from the 5th century AD.

These mosaic plaques are evidence of the dedication in the dissemination of science and in the fight against...
discrimination and violence against women. They demonstrate that everyone can team up to combat these injustices. Also promoting astronomy and scientific culture, and by addressing an audience of all ages and genders and showing that science is accessible to everyone, we can surely play an important role. In this way, the Ravenna Planetarium has become probably the first “Planetarium Friend of Women” in the world, hoping to inspire others to walk with them along this track.

The next PLANit initiative includes the PLANit 2022 Award (10th edition), a fulldome contest open to anyone. PLANit also invites participants from other countries. Another contest is the “Lara Albanese” 2002 Award (2nd edition), conceived of during the corona pandemic to promote activities online.

Upcoming events also include the yearly Meeting of Italian Planetariums (37th edition), organized in Florence in collaboration with Fondazione Scienza e Tecnica (April 29th – May 1st, 2022) and the yearly National Day to Fight Light Pollution (October 2022).

SOUTHEASTERN PLANETARIUM ASSOCIATION

SEPA is pleased to announce the 2022 SEPA conference. The conference host is the U.S. Space & Rocket Center, Huntsville, Alabama, and conference dates are August 22nd-27th, 2022. The conference hotel is the Huntsville Marriott at the U.S. Space & Rocket Center in Huntsville. Due to last-minute planning issues, complete conference details will appear in the next issue of The Planetarian.

The postponed Bays Mountain conference will be held in 2023 as a multiregional event. Specific dates and further details will be available by early 2022.

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

GREAT LAKES PLANETARIUM ASSOCIATION

Illinois

The Adler Planetarium in Chicago finally has a scheduled public reopening date — March 4th, 2022. In the interim, they have been presenting public shows on summer weekends. The exterior roof work mentioned in the summer update wrapped up in late-September. Adler’s exterior dome looks like a new penny straight from the mint! In July, Adler hosted a Fender Sessions video shoot with local rock band Beach Bunny.

The ISU Planetarium in Normal welcomed visitors back to its dome in August! Autumn events included free programs for the Sugar Creek Arts Festival in early October, live performances for Halloween, a brief run of Two Small Pieces of Glass in November, and the holiday program

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BaysMountain.com/PlanetariumProductions/
Season of Lights in December. The ISU Planetarium has also reopened for school and community groups.

The Staerkel Planetarium in Champaign finally resumed in-dome programming for community audiences in August, after nearly 17 months of closure. The James B. Kaler Science Lecture Series will be in-person again, and their college’s television crew will film the lectures so they can later be posted to YouTube. The staff looks forward to offering programs in Spanish for the first time. The college returned Waylena McCully to her planetarium duties, and the planetarium rehired their part-time presenter, Tania Swigart.

The team at the Dome Planetarium in Peoria is enjoying the opportunity to learn the new Digistar 7 software, and discovering ways to make the digital Digistar system work with their Zeiss ZKP4 starball. They are working on a new live show called Dinosaurs vs. Asteroids about Earth’s geologic history, asteroid impacts, and the OSIRIS-REx mission. The Peoria Riverfront Museum had a busy summer, and they were able to add two part-time planetarium presenters to their team.

The Strickler Planetarium in Bourbonnais reopened this summer for public shows and, after the COVID hiatus, resumed a new series of live, monthly presentations called Skywatch Live. The June show discussed major solar system missions from the past year and July focused on the question of life in the Universe, prompted by the governmental report on Unexplained Aerial Phenomenon. After 13 years as planetarium director, Stephen Case is stepping down and moving into a position in Olivet Nazarene University’s Honors Program. Steve’s replacement is Jeri Lamont. Jeri is an Olivet graduate who has served for the past several years as a geology and astronomy lab instructor.

Out of an abundance of caution, and because 50% of a typical audience are youth who cannot yet be vaccinated, the Cernan Earth and Space Center in River Grove will not be giving any general public programs for the foreseeable future. Instead, they will actively promote virtual field trips into early 2023. Schools, libraries, and other groups can schedule a one-hour online program, free of charge. Many area schools are still planning in-person learning this fall, so the staff is also prepared to welcome groups in person into the dome on a limited basis.

**Indiana**

The Koch Immersive Theater and Planetarium at the Evansville Museum remains open four days a week presenting hourly shows each day. They opened two new shows over the summer. Its recent public outreach events, featuring telescopes on the entrance plaza, included a public Moon viewing event in July and Saturn viewing in September.

**Ohio**

The Ward Beecher Planetarium in Youngstown returned to a full public schedule in September. They had several tech people visit in late-August to tune up their video equipment and Chronos before the start of classes. This summer, they offered “pop up” public shows that have been very popular; they will follow the same format for fall shows. Tiffany Stone Wolbrecht was a partial casualty of the Great COVID purge of last summer. She is now part-time and will be taking a second part-time position as the STEM Education Officer at Associated Universities Inc. The staff have made several upgrades under the dome during the extended off-season. They now have seat numbers on all permanent seats. They have also replaced all eight photos in the astronomy “gallery” along the sides of the planetarium, a move spurred (Continued on pg. 64)
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 matching 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 I 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 I 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...

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**COLUMNS**

**TALES FROM DOME UNDER 3PD OR NOT 3PD**

Tom Callen
Vaxholm, Sweden
tcallen08@gmail.com
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 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
up the film on a “clothesline” strung tank after you were finished, you hung by painting them out with opaque. This would then have to touch-up each slide where there had been air bubbles. 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 Kodak film. 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 during development. It was accomplished by using a static-free photographic brush, which contained chips, were free of dust and lint. This was the only thing left to do was to Double-examine all of them to make sure they were usable.

With the 35mm color image and finished 35mm Kodak film 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 Kodak 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 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 Kodak slide, as

(Continued on pg. 64)
WWW.SATELIX.EU
A free fulldome show for everyone...
by former student and professional astrophotographer Peter Zelinka, who gifted YSU with three of his photos on metal mounts.

The Vandalia-Butler Planetarium at Smith Middle School in Dayton continues with another school year of limited capacity. This year’s focus will be the current billionaire space race. The dome is in use one hour a week for the high school’s elective astronomy class.

Alex Mak has retired after 39 years at the University of Toledo’s Ritter Planetarium. Heidi Kuchta has taken over for Alex. Heidi, originally from the greater Cleveland area, has worked at Ritter Planetarium for the past six years, first as an undergraduate and then as a graduate student.

In Bowling Green, the BGSU Planetarium under Dale Smith presented some programs for schools and a summer camp in May and June.

**Wisconsin / Minnesota**

In the fall of 2020, the original production of *Mysteries of Your Brain* by Bell Museum Planetarium (St. Paul, Minnesota) opened to public audiences. With Aurora Consulting, they conducted evaluation sessions to determine if this content was engaging in the immersive environment of the planetarium, and whether the program made viewers more willing to choose non-astronomy shows in the future. The short answers: yes, and yes!

After 16 months, the Manfred Olson Planetarium at the University of Wisconsin-Milwaukee offered its first live, in-person, public program with a favorite, *Stars & S’mores*, as part of their Fall Welcome for students and the community in early September. Salsa dancing lessons kicked off the month of Latinx Heritage Month programs. Their programs were a mix of in-person and virtual.

Dome doors finally swung open at the Soref Planetarium at the Milwaukee Public Museum on July 24th. Visitors were delighted with two of their original productions, *Stargazers of Africa* and *Constellations!* Next up is another Soref show, *A to Z Astronomy*.

**PACIFIC PLANETARIUM ASSOCIATION**

At the time of writing, plans for ASP2021, the Meeting of the Astronomical Society of the Pacific called Astronomy Teaching & Public Engagement: Sharing Best Practices were under way for November 18th – 20th, 2021. Astro 101 instructors, K-12 educators, scientists, science communicators, and public engagement professionals in astronomy (and related fields) were invited to participate in this virtual meeting. Plans involved plenary talks, panels, and oral and poster papers.

Program themes for ASP2021 included:

- Teaching Introductory Astronomy – What are We Doing Now?
- Engaging Astronomy Learners Using Smart Phones, Tablets, etc.
- Doing Public Engagement in Informal Settings
- Communicating Science Using Social & Traditional Media
- Advancing Diversity, Equity, Inclusion, Access & Social Justice
- Preserving Dark Skies & Addressing Climate/Environmental Science
- Getting Ready for Upcoming Eclipses – Lunar and Solar

Resource guides for educators have been collected in one convenient place. Over the years, a series of guides on educational materials by Andrew Fraknoi have been useful for astronomy education. The latest ones include:

- An updated guide to the work of women in astronomy, including more people of color
- A guide to copyright-free images of all Messier Objects
- This Day in Astronomical History (listing 158 anniversaries you can celebrate)
- A guide to resources on light pollution (including satellite swarms)
- A short set of resources to provide a skeptical perspective on recent reports of UFOs being spaceships or Earth craft with unexplainable motions

Now, a one-page directory is available for all the resources he has put together, with short URL’s pointing to each. You

(Continued on pg. 63)
A PRACTICALLY SEAMLESS DOME. IT'S THAT SIMPLE.

NANOSEAM.COM
MOBILE NEWS NETWORK

GETTING CREATIVE

Mobile planetariums are still struggling to cope with the Covid 19 global epidemic and resurgence, but many have gotten very creative and that is what I will share in this December column.

WINDOWS TO THE SKY

I am pleased to provide another contribution from our colleague in Italy, Loris Ramponi. He shared the following about observations of the sky by school children and their parents at home with the help of a virtual guide using WhatsApp. This project strives to develop life-long learners who will appreciate and share the wonders of the sky with others.

“During the pandemic and the long periods of lockdown in 2020, Serafino Zani Observatory invented astronomical evenings managed by a remote virtual guide. The public, groups, and school classes are involved in the observation of celestial bodies and phenomena visible to the naked eye. The activity is particularly interesting for schools because it enhances the observational experience. In fact, science lessons should always reserve part of the time for carrying out practical and laboratory activities, experiments, observations, and outings in nature. In the astronomical field, this translates into observation of the sky. This experience, if carried out before the scheduled visit to the Planetarium, will make the educational outing under the dome more productive and rewarding. The same can be said for booking an evening with a telescope, or visiting an astronomical observatory. It is an attractive proposal and deserves to take place. Unfortunately, its limitation is reducing the observing experience to a single time according to the quality of the sky and meteorological events, among other things.

The possibility of multiple observations instead offers the possibility of deepening knowledge of the real sky and the discovery of numerous celestial bodies and phenomena that can be admired at a simple sight, without tools, and from windows or the garden at home. The involvement of parents, given that the proposed observations obviously take place after school hours, has the advantage of extending this experience to the student’s family. A beneficial aspect is that this may lend continuity to approaching the sky, extending a lesson beyond the school period during which it takes place.

The start of the project coincided with National Pollution Day which takes place every year on a new moon Saturday in October. This initiative was invented by Serafino Zani Observatory in 1993, the year of its official opening. This was the ideal time to officially kick off the observation activities that involved the schools and continued from October to the end of the lessons in June. This year, the evening coincided with the conjunction between the crescent moon and the bright planet, Venus.

Each month, the virtual guide prepares audio recordings with observation suggestions and sends them to the teachers. In turn, the teacher will send the recordings to the parents, using the class’s WhatsApp list. Thus, all family members can be involved in the experience, even distant relatives. All the classes at the Rossaghe Primary School in Lumezzane will follow the “Sky Project” this year. And this is what a little student from that school did; she informed her grandmother, who lives in another Italian region, about the activity. The student, like all her companions, could not see the conjunction because the clouds prevented the observation. Nevertheless, she saw what appeared in the sky thanks to the images that her grandmother sent from Tuscany where it was clear that night!

Other children took pictures of the cloud-covered sky of their country. The following evening, however, some children had the idea of taking a look at the sky again. By comparing the photographs that arrived from Tuscany and what they saw the next day, they were able to discover differences which will be studied in depth in class.

The diary of this first experience will be told in student notebooks where the children will write down their observations and also included their drawings, sky maps, and the photos collected during each event. These materials will be exhibited on posters on the walls of the classroom.

Each month, the virtual guide of the Observatory prepares audio recordings describing what to observe in the sky. The approach between the Moon and the main celestial bodies are easy observations that never fail and help to recognize planets and stars, as last October when the Moon approached the planets Saturn and Jupiter and the Pleiades cluster.

The ‘Progetto Cielo’ does not limit itself to suggesting evening observation experiences, but also proposes different didactic activities from month to month. For example, following the seasonal...
variations through the changes in the height of the Sun, observing the shadows of a sundial month by month, and imagining transforming the classroom into a Planetarium on whose walls the sky maps will be displayed. These maps are periodically sent to and commented on by the virtual guide. In the classroom there will also be creative activities, such as ‘inventing’ new constellations after drawing the main stars of a constellation on a sheet that will inspire the student’s imagination. Each student will write down everything they observed in the sky in a special diary.

Perhaps some child will keep this notebook into the following years, continuing to write down all the curious things in the night sky of the future, because the list of phenomena and celestial bodies visible to the naked eye is very long and not all of them can be seen within a year. Sooner or later there will also be a bright comet, an eclipse, and many other sky shows to admire. Perhaps in adulthood they will begin involving their own children who will thus benefit from the “Sky Project” that mom or dad started many years earlier while still attending school."

**Portable Planetarium Committee at IPS Conference 2021**

The portable planetarium committee has existed for 33 years. All of the committee members, and others, have been involved in welcoming and serving all mobile dome colleagues, as well as suggesting international initiatives that serve the entire community. If you go to the IPS Portable Planetarium Resource page (https://www.ips-planetarium.org/page/portableresources) and scroll to the bottom of the page you will find IPS representatives for mobile dome directors in many of our affiliate countries. This list is incomplete: many countries need a dedicated individual to forward information from the committee and to inform the committee of questions, concerns and celebrations in their home regions, news for the column, and requests for immediate help. This is an area where you can volunteer!

During this year’s e-conference, several mobiledome directors shared some news. You can view these sessions on youtube: https://www.youtube.com/watch?v=aiPsVLqg-IE

Here are descriptions of the presentations:

1. **Marco Avalos** of the Planetario Aventura in Costa Rica explained that although his portable planetarium is not very active lately, he could still tell the story about outdoor Astronomy camping activities with one of their domes (the one that can sustain humid environments).

2. **Guilherme Frederico** Marranghello from Universidade Federal do Pampa (Unipampa) Brazil, shared how they analyzed the data they collected during 2019. A summary of the results: they traveled all over the state, which is about 700km x 800km in size and has only 3 fixed planetariums. They conducted the study with future teachers in the teacher training course they offered. They found that the chances of a person having visited a planetarium reduces by 68% for each 100km of distance to the closest planetarium. The chance of someone with better income having visited a planetarium can be 15 times greater. Their research certainly shows the relevance of outreach with a mobile dome.

3. **Lionel Ruiz** of the Planetarium of Marseille, France (https://www.fddb.org/author/lionel-ruiz/ “Co-founder of the LSS Fisheye planetarium system and Developer of SpaceCrafter software (based on Stellarium), produced 400 pedagogical scripts and fulldome videos.” He wrote, “I know of some people wanting to project in a 45° tilted half sphere where people are outside but, in my opinion, we are lacking the feeling of immersion. I would rather talk about all of the interactive content that has been produced by our LSS community “thanks” to the covid confinement period.” **Dhyana Salazar** presented two PowerPoints and answered questions for Lionel, who was working and unable to attend the conference. The PowerPoint was about an open project to build an affordable planetarium projector (Lloumeau Sky System-http://lss-planetariums.info/), open source fisheye planetarium software (SpaceCrafter), interactive content that was produced by the LSS community, and a continuous ventilation system to more actively recycle the air in the mobile dome to try to prevent covid particles from staying inside too long.

4. **Ken Brandt**, director at Robeson Planetarium and Science Center in Lumberton, North Carolina explained that since the flooding of his planetarium he is now located in a small school cafeteria. He told us about how 20 students can safely interact with exhibits and the mobiledome. He has everyone use hand sanitizer and wear masks; he maintains social distancing by using traffic cones outside the dome and NASA Stickers on the floor inside the dome. The planetarium is outfitted with an air purifier inside the dome.

5. **Patricia Reiff** from Rice University, Texas presented a video from Carolyn Summeers (Houston Museum of Natural Science) about a portable “Discovery Dish” screen and how it works for presentations.

Then, Pat made her own presentation, “Pandemics and portables” which was a update to their pandemic protocols. (See https://www.ips-planetarium.org/page/portableresources Portable Planetariums in the Age of COVID-19.)

She explained, “In the summer of 2020, we did all our shows virtually for free, one movie and one live star show each week. We discovered that the ‘cropped warped’ format best gave a widescreen immersive feel while still in a 16:9 format best for sharing. We reached over 2,300 registered visitors, including a number shown with Spanish audio (and English subtitles). There were many ‘repeat customers’ with over $1000 in donations. In November and December we had four more virtual events (including the Crew-1 launch) for another 387 visitors. We published a white paper on our results:
In Spring 2021 HMNS started sending out the “Discovery Dish” for rentals. http://www.eplanetarium.com/discovery_dish.php

In the summer of 2020, we wrote up a paper on COVID protocols for portables: http://www.eplanetarium.com/publications/Portable_Planetariums_in_the_Age_of_Covid.pdf. However, with 2-meter spacing, that meant that most domes could only hold a handful of visitors unless the users were in ‘pods’ of family groups. With the new 3-foot spacing rules, however, the portable inflatable domes have opened up and our customers are getting bookings around the world. We did an outreach tour to South Texas and reached 300 students, primarily Hispanic, in two days with plenty of space and time to air out between groups. All children (and operators and teachers) were masked. (A new seating chart and protocols for the more relaxed situation was presented.) With Delta surging, some caution is still recommended, and all staff should be vaccinated and all visitors and staff masked. Positive pressure inflatable domes have faster air flow and thus less time to transfer the virus in the dome, and UV lamps between groups can help kill the virus.”

Dome Dialogues

To gather more information about mobile domes during Covid, I put out some questions on Facebook from Dome Dialogues. I wrote, “I would love to hear from portable planetarium directors about how they are coping with the Covid epidemic. Are any of you able to present in your dome yet? If so, how are you handling it - publicizing, sanitation measures, etc.? If not, how have you pivoted to other things to stay afloat? Any future plans for when you can come back?”

Here are the answers that I received:

• Michael J. Narlock Cranbrook Institute of Science, Michigan “We are not doing any presentations.”
• Asis Carlos Santa Fe Children’s Museum, New Mexico: “I won’t take out my portable until kids can get vaccinated. Since last year, I have been doing virtual programing for schools. Space Engine has been a really good tool for virtual programing. Also, I have been able to expand available subjects to Life Science, Geology, and Weather. I may do in person programing for rural schools but with a projector and screen, not a planetarium.”
• Mike Francis Stars Science Theater, Massachusetts “I managed to do one Summer camp, but the Massachusetts legislature is debating whether to require masks for this whole year in all schools. I don’t think I could do five or six programs a day with a mask, so things are not looking good here in Massachusetts. Maybe I’ll get some New Hampshire schools!”
• Ryan Marciniak Astronomy in Action, Toronto, Canada “I haven’t done a live program since March of last year but I do have a dome that can be set up outdoors, so I have a couple of bookings. I’ve been doing virtual programs and camps in the meantime to stay afloat and they have worked out very well, though they are harder to sell. I’m hopeful that masks and vaccines and prerecorded programs will let me operate in schools.”

And here are some emails that I received:

• Paul Krupinski Mr. K’s Mobile Dome Planetarium, Buffalo, NY “My portable planetarium went out once to a private school last December and most likely will stay out of schools until field trips resume, which doesn’t seem likely anytime soon. Looking forward, I didn’t see myself hitting the road again w/ my dome until 2022/2023 school year and my prediction might be correct…again.”
• Karrie Berglund Digitalis Education Solutions Bremerton, Washington “Some of our customers have been using their control computers for in person or virtual flat screen programs.”
• Walter Riva Genoa, Italy Our Starlab traveling Planetarium has stopped since the outbreak of the pandemic. We hope to be able to resume Starlab activities in autumn or, at the latest, next spring. Instead, the two fixed Planetariums are working alongside the Righi Astronomical Observatory.
• John Meader Northern Stars Planetarium and Educational Services, Fairfield, ME 04937 “I have several tentative bookings for the coming school year, one in October, the rest in January and beyond into spring. I’m not sure if any of these will happen or not. My plan, if I’m able to go into schools, is to only offer my larger 22’ dome, which I normally put 65–70 kids into but limit it to a single class at a time (20–25 people max). I’ll be masked, and probably everyone else will be too. Maine just instituted mandatory mask wearing for everyone in public schools - teachers, students, and visitors. I’m not sure what will happen, and the teachers and principals that I’ve talked with aren’t sure either. My guess is that I’ll be doing a lot of Zoom lessons again, even if some schools will let me visit. I have also been offering some outdoor activities such as building a model solar system to scale, safe solar viewing, and night sky tours (no telescopes, just me and my green laser pointer under the real sky). These undoubtedly will continue to be a way for me to keep my schools engaged.”
• Matthias Rode Schulplanetarium, Germany “We are fearing a 4th wave of infections in autumn and for that reason we do not have many bookings, and we don’t know if they will happen or not. During the long time with very few bookings, we have created a new brochure.”
We created LaunchPad to support planetariums as you reopen and reengage your communities. Let us help you fill your theater and connect with your audience like never before.

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If you read my previous column, you will recall that we were planning to hold LIPS in person in late September. We were lucky enough to have the Buhl Planetarium in Pittsburgh offer to host, and the plans were sounding fantastic.

However, it became obvious just a few days after my September column submission that we wouldn’t get to our minimum attendance requirement of 30 people; that was the budgetary breakeven point. I made the call to pivot to a virtual conference as meeting in person would not have made sense. But don’t worry: we will be at the Buhl Planetarium for LIPS 2023, so all of those exciting plans will not go to waste! More information on future LIPS is at the end of this column.

Although e-LIPS 2021 was put together very quickly, we still ended up with a full and high-quality program. This was the second e-LIPS, so it was faster and easier to plan as I knew what to expect. One of the advantages to a virtual meeting, of course, is that it opens the doors for more people to attend. We had attendees from around the world, including Iran, South Africa, the United Kingdom, France, Canada, and more. I tried to offer sessions that were at reasonable times for the various time zones. It was fun and enlightening to hear from planetarians in so many different locations.

This year we decided to include sponsor presentations, and in true LIPS style, we limited the sponsor presentations to 10 (first come, first served). We also asked sponsors to focus on how their products/services are used in live, interactive programming, and if possible, to have a customer do the presentation. In alphabetical order, the e-LIPS 2021 sponsors were:

- Audio Visual Imagineering (AVI)
- Digitalis
- E&S and Spitz
- e-Planetarium
- GOTO, Inc.
- ilumbra
- Laser Fantasy
- OpenSpace Project
- Seiler Instrument
- Sky-Skan/SSIA Technologies

Thank you to all sponsors for your support of live, interactive programming!

I also want to extend a huge thank you to Jeff Nee of NASA’s Museum and Informal Education Alliance. Jeff edited all of the recordings and chats, saving me massive amounts of time. All of the recordings are available via the Pacific Planetarium Association YouTube channel: bit.ly/LIPS-2021.

Jeff set up a team chat (hosted on the Ryver platform) to continue the great conversations from LIPS, as well as to share future updates and resources with everyone. The team chat is 100% free to you and unlimited. In addition to the full, organized collection of recordings, it also contains the chat history and downloadable mp3 files for podcast-style listening. You are welcome to join the chat even if you were not able to attend e-LIPS 2021.

To sign up and start connecting with other live presenters, go to (case sensitive):

bit.ly/LIPS-chat-signup

Those already registered can go to (case sensitive):

bit.ly/LIPS-team-chat

Jeff is also handling support for the team chat: Any questions, concerns, or issues with either the chat or the recordings can be directed @JeffNee in the team chat, or jnee@jpl.nasa.gov. We hope you’ll enjoy visiting sessions you missed, rewatching sessions you loved, and collaborating in the chat.

What did attendees think about the 2021 e-LIPS? I asked for feedback, and here are some of the comments I received.

Elizabeth Bracey, Franklin Park Arts Center, commented:

It is so inspiring to attend a conference that is all about engaging audiences! So many ideas are generated from this conference –sometimes it’s a small idea that you can take back to your own site and adapt.

For example, [Emily Peavy of ‘Imiloa Astronomy Center] commented that they are not calling their planetarium programs “shows” because it sounds...
like something where you just sit back and listen/watch. She started using “experiences” – it really got me thinking about how we describe our programs to the public. A small change like that can make a big difference in setting expectations for your audiences before they even step inside your planetarium.

I love those ah ha! moments that percolate throughout LIPS. Emily’s comment definitely also got me thinking about how best to describe our planetarium offerings so that our audiences are prepared to be active participants, rather than passive observers.

Jeff Nee, NASA’s Museum and Informal Education Alliance, wrote:

While it would have been wonderful to see everyone in person, eLIPS was certainly still fun and impactful, and it was amazing to include all the people who wouldn’t have otherwise been able to attend.

Having all the recordings posted for posterity, as well as the team chat for continued conversations, chat history, and downloads, are also great benefits.

I loved all the sessions, but for those who only have time to see a few, I ardously picked my personal favorite from each day (all links are case sensitive):

- Live From the Planetarium: The Sequel – Sarah Schultz - bit.ly/LIPS-2021-1x6 (We hope you participate and submit a recording.)
- Tanabata: The Japanese Star Festival - Elizabeth Bracey and Patty Seaton - bit.ly/LIPS-2021-2x6 (You should moo while watching the recording, too!)
- Sound, In the Dome and Out - Michael McConville - bit.ly/LIPS-2021-3x5 (The talk with the broadest utility for any dome.)
- Quasi the Robot’s Cosmic Cookbook - Charissa Sedor and Mike Hennessy - bit.ly/LIPS-2021-4x1 (Can’t wait for their content to be published freely for all.)

I’ll reiterate that I loved all the sessions. I thought they were all worthwhile for my work, and it was difficult to single out just one per day. Karrie did an exceptional job organizing a stellar lineup! The full playlist is posted here: bit.ly/LIPS-2021

The “stellar lineup” was more due to attendee submissions than to me, so I’ll forward Jeff’s compliments to all of our presenters. Well done, folks!

April Whitt of the Fernbank Science Center, wrote:

(Continued on pg. 64)
The great circle of life...things are born...things live...and then things die. Some are reborn to live another life, but most go through the great metamorphosis that happens in a somewhat closed system. While some might think I’m babbling on about organic life, or perhaps lions in an animated world, I am actually thinking about the things that the human mind conjures up and then human hands build.

One such non-organic construction ended its life last October after enjoying a fifteen-year life. Originally created as a clearing house for amateur planetarians to throw ideas back and forth, “Planetariums as a Hobby” was born as an add on to “Observatory Central,” and it grew much bigger than I ever expected. While the observatory side of the bulletin board never caught on, the planetarium threads generated tens of thousands of posts and hundreds of thousands of views. Perhaps some of you might have visited, who knows.

Anyway, it was all on a private server which was shut down for good in October and moving it, well...let’s just say was beyond my pay grade, both mentally and financially. I guess the final nail in the coffin was when I set up a Facebook page for those still interested. Four people joined “Amateur Planetarium Makers.” Que Sera, Sera.

And yet, while this part of my life ends, another part begins. Welcome into this world, my second grandchild, which I must admit is a very good trade.

Keith’s Captured Quips ~ Chapter Seventeen

“At first, I didn’t have interest in the stars, planets etc. but now I have many wonders.”

“Thank you for letting us come to the atotoream. It was very long. I almost fell asleep.”

“I might visit the planetteareaum again.”

“I hope we can com again next time. If we can, I will be the first one to wave at you.”

[Overheard on her way out] “I want to stay here forever!”

10 years ago (2011):

Chris Janssen investigates a most unique planetarium built by Eise Eisinga and first put into use in 178, still running 230 years later (actually, 240 years considering this is from ten years ago).

Mark J. Percy tells us about “Chinese Art in the Sky,” stories from a different view. One can never have enough star stories.

Perhaps the greatest living editor of all time, Sharon Shanks, can come up with a great line every quarter and this issue proves it. Said with respect to the boiler plate verbiage required with any and all grant applications. She defines verbiage as, “an insulting term usually meant to disparage needlessly wordy prose.”

Alaz Cherman tells us about East Germany paying off some of its debts with planetariums. More proof that planetariums are very valuable and can be used as currency. But as a supporter of the old style optical mechanical planetarium, I will point out that the Spitz model B that was put into operation in 1955 is still educating and first put into use in 178, still running 230 years later (actually, 240 years considering this is from ten years ago).

If we can, I will be the first one to... One can never have enough star stories.

As we enter the Christmas season, how can we not re-read or re-watch a
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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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Under the Classdome (con’t.)

Bob was intrigued to hear that there was a state-of-the-art planetarium there with a new projection system, a new director, and no connection with any professional astronomer. Even more intriguing was the fact that this facility was in Waukesha, a school district that sends a large number of its graduates to the University of Wisconsin-Whitewater. Steve put Bob in contact with Lisa and in the following month we had a meeting to discuss common interests. After Bob dropped by their facility for a public show, he was sold on the idea of partnering with this facility for a regular program of science outreach. He wanted to focus on Middle and High schools since part of the goal of the outreach was to recruit students to come study STEM disciplines at UW-Whitewater. In the winter of 2020, Bob agreed to a plan in which he would use some of his “Federal Indirect” funds to purchase half of a planetarium show that both addressed some of the science standards covered in 7th grade and tied in with his own research. (At UW-W, some of the “overhead” funds from Federal grants are returned to the principal investigator to serve as seed money for future research programs.) Lisa and Bob put together a plan where students would have a short talk (basic constellations, etc), and then watch the planetarium show (Lucy’s Cradle). After the show, Bob followed up with a 10-minute description of his research at UW-W, ending with a Q&A session about any topic the students wanted to ask.

After a year’s delay due to the pandemic, we are now implementing this plan. The Horwitz-DeRemer Planetarium gets a knowledgeable astronomical professional, and UW-Whitewater gets to do outreach without having to deal with the logistical hassles of arranging visits. Moreover, Bob has found that he can rely on Lisa’s experience as director and her connections to the teachers to make sure that the material provided is aligned with the topics that teachers are covering in their classrooms.

Our shared goals for the future are to develop new materials for each grade level, involve more UW-Whitewater faculty and students in the programs, involve more high schools in Planetarium activities, and to make these programs available to more and more school districts in the vicinity. We’re only in year one, but things are already looking quite promising.

Keeping the Best Parts

So far, almost all of my students have been IN the planetarium. However, I did learn how to do some interesting new things last year while teaching via Zoom and Google Meet. My current challenge is figuring out how to use some of those new skills without the use of video conferencing software.

During the fall, I run a lab about latitude and longitude for several teachers. We practiced finding Polaris and then used that to determine our latitude. In “the before times” I would guide the students through the process and then ask them to train their eyes on the star that they thought was the north star. “Don’t bother pointing because I can’t see what you are pointing at...it’s dark!” To assess whether or not they could find it, I would ask for a verbal response after I turn the label on. Maybe a Homer Simpson “woo hoo” or a country style “yee haw.” That always got the kids going and involved because they like making noise. (These are 9th graders, by the way.)

The whole verbal response thing couldn’t work over Zoom, so I developed a set of star tags for each time we would try the new skill. As usual, I would spin the sky really fast (for fun) as we changed where we were on the Earth. Then, I turned on four star tags labelled A/B/C/D. I asked the kids to send me their guess privately through the chat. The answers would roll in and I could see how they were doing, but with no noise.

With the kids back in the planetarium, it was tempting to just go back to the old way. However, I thought that I could combine the old and the new to make something even better. The scripts that label the stars still worked, so I tried using the verbal response format.

This time, they got to give me a “woo hoo” or “yee haw” when I asked if Polaris was star A, or B, etc. Now I am thinking that I could use a set of those clickers so that they can vote on which lettered star Polaris is. That would allow me to assess whether or not ALL of the students can really pick out the correct star. However, they wouldn’t get to make any noise. I’ll have to find a way to do both because 9th graders are really good at being noisy. :)

You may also recall my writing about my Spectrum Lab for high school Chemistry classes. In addition to figuring out how to show the bright line emission spectra via a DSLR camera fitted with a diffraction grating, I incorporated a spectrometer, which was a big hit with the teachers. The kids got to see the spectrometer display and relate it to what they saw through the diffraction grating glasses. I was teaching in hybrid mode at the time, which meant that I had to teach kids in the planetarium and kids at home at the same time. What I figured out was to use Zoom on one computer to capture the spectrometer’s live graph and another computer in the same Zoom meeting with a video projector to display the graph on the dome.

How could I do this without using video conferencing software, or spending any money? I’ll have to figure that out and get back to you in the next exciting edition of Under the Classdome.
Furthermore, we have written up a list of hygienic measures that we offer to organizations on demand. It does not help very much that two presenters, Tilo and Philipp, have found other jobs and I don’t expect our planetarium to ever come back to the number of visitors we had before the crisis. Nevertheless we are still alive, and I hope that we will get back into an economical mode and that the planetarium is profitable again. Reducing the number of participants per show, exactly like John does, is unavoidable for us, too - and it’s raising the cost and makes things very complicated.”

- **Tilo Hohenschlaeger**
  Schulplanetarium, Germany
  “When the incident numbers are down, we have some sporadic bookings for the mobile dome. At the moment, school holidays are in full swing and everybody is waiting to see what will happen with the Delta variant hitting Germany.”

- **Dace Balode**
  NPA board member, Riga, Latvia, Science Centre Tehnoannas Pagrabi
  “The portable planetarium in the “Tehnoannas pagrabi” (The Cellars of TechnoAnn) science centre in Riga, Latvia has been closed to the public since October, 2020 because of Covid-19. All this time, schools in Latvia were closed too, but our staff kept working. You could ask – how? Let’s to explain, how. Because we operate with quite a small mechanical projector in our planetarium, a lot of our sessions depend on the story that we tell. That is why we focused on these stories in two aspects. First, we started to work with sounds and music. One of our presenters created two background sound tracks for the sessions to supplement the story and to effect visitors’ sense of hearing. This is connected with our aim to develop the mooring of sessions. For example, we want to be more theatrical when speaking about black holes. We remember a performance in the planetarium with sounds during the Nordic Planetarium Association conference in Helsinki (2015), but this was too radical. We do not want to make our background sound the main focus. The planetarium is first! But this was a good experience in Helsinki, and do not forget that children need an emotional story! Maybe we are old fashioned, but we still think that the task of science centers is not to back up the school curriculum or to give a lot of information. Our task is to raise curiosity more emotionally! The second aspect we worked on during this time is science history, especially in astronomy. Our director, Alvis Balodis, received a gift – a collection of postal stamps from the Soviet times. We do not know the collectors value of it, but the value for us is the possibility to create an exposition, not for children but more for their parents and grandparents who remember these times. It is a good challenge to make this exposition a good supplement for our planetarium.”

- **Hiroshi Futami**
  Skylight Studio Tokyo, Japan
  “We are doing intermittent presentations.”

- **Jaap Vreeling**
  Lynch Planetarium on St. Eustatius, Kingdom of the Netherlands
  Lynch Planetarium on St. Eustatius is temporarily on hold due to the hurricane season. Jaap wrote, “We had a wonderful start in March and in April /May when almost all children of the island visited the Planetarium. The visitor counter is on 756 visitors, on an island with around 3000 inhabitants. We are almost Covid free but with an active case on the Island we will close down for that reason. The plan for the future is to have a fixed building for our dome and after the hurricane season we will start visiting other surrounding islands by boat. It is very difficult to get funding for our fixed building due to the lack of tourism and income of the various businesses on the island. But we will continue searching for funds.”

**Galaxy Drawings Slides Theme**

I learned of a great resource at this year’s IPS econference. Go to [https://www.slidescarnival.com/iris-free-presentation-template/3923](https://www.slidescarnival.com/iris-free-presentation-template/3923)

The website says, “Enjoy this fun, free PowerPoint template or Google Slides theme with a space & stars illustration. Your presentations will never be boring again with this template from a faraway galaxy. Use the purple and blue gradient background or choose more lively colors to make it even more fun. Besides, all the assets are editable (even the illustrations of the planets and astronaut!). It’s a great theme for presentations to a child audience or for a talk about astronomy, the universe, space exploration or even NASA missions. Delight your young audience in your next class or presentation!”
Our newest planetarian, Lauren Albin, really enjoyed Brian Koehler’s story-making session, and tuned in for a few more. Well done, as always! That’s the part that sticks with me – Brian’s excellent “write a story” segment. Every break-out room was creative and collaborative. Clever use of historical documents, and a good exercise for students. Literacy and science is a big part of this year’s curriculum, so it’s a double win.

And last but not least, Chrysta Ghent of the Eastern Kentucky Science Center commented:

LIPS is a top conference for me. The general goal of engaging audiences aligns right with mine, and the interactions I have are always so positive and inspiring. e-LIPS is, in its own way, extra great because of the accessible recordings and ability to chat during presentations (maybe distracting at times, but nice to share thoughts without being too intrusive). Yay planetarians, and yay e-LIPS!

One of the most eye-opening ideas for me from e-LIPS was Jamboards. I had never heard of these until Sara Schultz used them in her session, and I believe I am now addicted. What a dynamic and flexible way of capturing ideas from a virtual group.

Thank you again to all e-LIPS 2021 attendees, sponsors, and presenters!

I will end with some information about future LIPS. 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.

We opted to shift LIPS 2021 to September to improve the odds of meeting in person, and of course September on a college campus means finding meeting space is extremely challenging.

But don’t despair: The Fiske Planetarium is going to host LIPS 2022, with the dates tentatively set as August 2nd – 5th. The main LIPS days will be Wednesday through Friday, August 3rd through 5th, with an optional half day workshop on kinesthetic astronomy led by Cherilynn Morrow on Tuesday, August 2nd. During the main LIPS days, we will have a presentation skills workshop with Eddie Goldstein, opportunities for LIPS attendees to present public shows, and much more.

Needless to say, I am already excited for LIPS 2022. I’m planning to add on at least one weekend to do some exploring in the gorgeous Rocky Mountains.

As noted above, LIPS 2023 will be hosted by the Buhl Planetarium in Pittsburgh, Pennsylvania. Given the plans we had for LIPS 2021, I know it will be worth the wait!

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 and Live Interactive Planetarium Symposium Facebook group. Now I can add the LIPS team chat to the list of connection options, thanks to Jeff Nee! Contact me (karrie@DigitalisEducation.com) if you need information about any of these.
holiday favorite, “A Christmas Carol” by Charles Dickens. Since no true artist can leave anything alone, I read George Reed’s adjusted retelling of this famous work with interest, now called “The Marley and Scrooge Planetarium.”

Much of it is borrowed from the original. Who else could write such delicious lines as, “He carried his own low temperature always about with him,” (Why can’t I come up with lines like that?) but has just enough new material to keep the reader interested. “Due to budget considerations, years of declining interest, and attendance, the Marley and Scrooge Planetarium will be closed. It will reopen as a multi-media theater as soon as the star projector has been dismantled and removed.” One wonders what happened to that machine.

There is much more, but you must seek it out for yourself as it is well worth the read.

Now, how about an administrator wanting to close a planetarium in 1995, that was built in 1969, because the planetarium certainly couldn’t be useful any longer because it was built for a 1969 sky? (Do these people really exist?) I really like things like Richard McColman’s write up on building baby food jar projectors, especially since I just welcomed my second grandchild into this world. They are so much more fun than computer programming and I might get a substantial supply very soon.

45 years ago (1976):

I always have fun with my shows, especially with those dealing with star stories. While I always like the Greek and Roman classics, I must admit I really enjoy other viewpoints on the pictures we think we see in the stars. Thus, I ask you to peruse Larry Sessions article, “Star Myths of the North American Indian.” For those of us that still do live star programs, these stories are worth reviewing.

Alan Friedman and his fellows pen an interesting article called “Audience Participation and the Future of the Small Planetarium.” Large planetariums that serve 200 to 700 viewers have a difficult time involving the audience. Certainly, a smaller planetarium can take on this very special niche of involving an audience.

Jeanne Bishop interviewed one of the first planetarians, Dan Snow, who could keep visitors enthralled with a simple Spitz A-2. With one of his shows, people were often drawn into the planetarium by intrigue with the strange contraption in the center of the room, and they leave with a little better understanding and appreciation of the universe about them. That first view of the Zeiss is what sucked me in.

International News (con’t.)

can find the list at: bit.ly/fraknoiguides.

The Silicon Valley Astronomy Lectures (co-sponsored by the ASP), featuring talks on new developments by noted astronomers, now has more than 3.7 million views on its YouTube Channel: youtube.com/svastronomylectures. Entering its 22nd year, the lectures will continue remotely on YouTube during 2021-22. The series is also beginning to be available as a podcast and can be found on many of the popular podcast services. Its home is at: www.buzzsprout.com/1805595.

Recent talks include Nobel Laureate John Mather on the work that will be done by the Webb Space Telescope, Dr. Tom Shutt on new experiments hunting for dark matter, and Dr. Elinor Gates on how the pandemics of 1918 and 2020 affected the Lick Observatory.

ASSOCIATION OF MEXICAN PLANETARIUMS

The new Toluca Planetarium was inaugurated on October 14th. The Toluca Planetarium is part of a science-cultural park in the middle of Toluca, capital of the State of Mexico, and is equipped with a Digistar 7 System using six 30-million-pixels laser projectors on an 18-meter Spitz dome with 18 degrees inclination and a seating capacity of 163.
BOOK REVIEWS

New in the World of Lit

How Do You Find an Exoplanet?
https://press.princeton.edu/books/hardcover/9780691156811/how-do-you-find-an-exoplanet

Reviewed by April Whitt, Fernbank Science Center, Atlanta, Georgia, USA

He uses the example of his own research of HD94834 and the velocity measurements that indicated the presence of a planet around that star. Pointing out that it took years of observations to collect that evidence, the author clearly explains how spectrometers work, and the equations used to examine “how planets belie their presence by gravitationally tugging on their host stars.” (p. 57)

That stellar wobbling (Doppler effect) is the first of four methods of planet-finding detailed in the rest of the text. Transits and their light curves, microlensing, and direct imaging fill the rest of the planet hunter’s toolbox. The author concludes with ideas about the futures of each.

How Do You Find an Exoplanet? meets the goal of a clear, concise and interesting account of searching for the “alien worlds” so dear to human hearts. I recommend it.

The Great Courses: Great Heroes and Discoveries of Astronomy, Emily Levesque, Virginia: The Great Courses, 2021, DVD plus Course Guidebook, varied price

Reviewed by Francine Jackson, Ladd Observatory, Providence, Rhode Island.

I’ve taken far too long to write this review. How Do You Find an Exoplanet? is an excellent introduction to the varied ways in which modern planet hunters are discovering new worlds.

During the author’s work at Caltech, and later at Harvard, he noticed that the summer internship programs attracted students with good physics skills but little astronomy experience. This book was to be a resource in how planets are discovered and studied.

Beginning with Copernicus’ ideas and the early history of discovering planets with telescopes, the author traces the development of the understanding of our own solar system, and the study of stellar wobbles.

Have you ever wanted a quick reference right at your fingertips, but didn’t want to pour through an entire book? The Great Courses might be a good alternative.

This one, by Emily Levesque, introduces a vast array of topics, all based on astronomical discoveries, some of which may be very familiar while others might be either a new topic, or a nice twist on an old. For example, we are all mainly aware that Vera Rubin is credited with the discovery of dark matter, but how did she come to find it? Why didn’t Astronomer Margaret Burbidge accept the Annie Jump Cannon award? How does LIGO really work?

With 24 half-hour DVD sessions, and the complementary course guidebook, each topic can be easily referenced and understood. These sessions, although meant for a beginner, still have enough material for those of us who might need a refresher in varied astronomical subjects. Also, for those of us always looking for trivia materials to entice a student, the author has placed enough of them to be useful.

Listening to the entire set of lessons will take about 12 hours, as each one is close to a half hour, but they are positioned such that the listener doesn’t have to actually go through the entire set; each one is separate enough such that the listener doesn’t have to wade through the whole disc to get to a topic of interest.

The Great Courses has a fair list of astronomical lessons, but this one is especially worthy of taking the time to watch. The author is both interested in her subjects and interesting to listen to. It will appeal to all audiences, even those who might just want a review of a few topics.


Reviewed by: Bruce L. Dietrich, Wyomissing, Pennsylvania, USA
Our new integrated offering brings the best of Spitz Education into Digistar.

DIGISTAR7 + SCI dome = THE BEST OF BOTH WORLDS.
On June 6th, 2020, asteroid 2002 NN4 safely flew past the Earth at a distance of more than five million kilometers. About eight hours earlier, the United States Postal Service had delivered a copy of this fascinating book to my door. Although not one to engage in celestial paranoia, the timing did get my attention. About 160 years ago, Thomas Huxley observed that “those who would judge a book must read it.”

I immediately turned to Section Seven, Near-Earth Asteroids and the Impact Threat. There, I learned about using both the Torino and Palermo Hazard Scales to estimate the potential level of threat. Hours later, I was both reassured and well into the remaining six sections off this wonderfully useful book.

The eighth and final section details various Spacecraft Missions. It covers past, current, and future spacecraft missions to asteroids and how these missions help us understand the geological histories of these bodies. From the beautifully written preface and acknowledgments pages, and indeed throughout the entire text, a supportive, collegial tone prevails.

This text is the seventeenth book in the Cambridge Planetary Series. It now fills a welcoming space in my library—immediately adjacent to volume sixteen, Planetesimals, which fittingly may be their antecedents.

Reviewed by Francine Jackson, Ladd Observatory, Providence, Rhode Island.

Cecilia Payne realized at the age of eight, when she encountered a flower that her mother had told her about and then found in her neighborhood, that her “life as a scientist began at that point.”

Very often, when a famous (or infamous) person’s biography is written, the reader spends most of the time hearing about the fantastic work done with the author extolling the wonder of the person, often like a comic book hero. The reader, therefore, never realizes that this person is just like the rest of us, except he or she had a goal and worked very hard to accomplish it. This is the beauty of What Stars Are Made of.

In this book, Donovan Moore introduces Cecilia Payne as an ordinary girl with an unbelievable thirst for knowledge. Able to listen to and recall almost anything she heard, she spent much of her time listening to such heroes as Henry Norris Russell and Arthur Eddington, then running to her room and writing the lecture verbatim.

Payne came from a regular, middle-class British family who, surprisingly for that time, encouraged their oldest child to acquire knowledge. Other women of her generation were trained to set a good table and smile at their husbands’ fellow workers. Mother Emma, on the other hand, seemed to understand her daughter’s thirst for learning. Although there was very little money in the family for education, Cecilia was fortunate in receiving a scholarship to attend Cambridge. After her graduation, however, further education seemed out of reach until she was introduced to Harlow Shapley, newly appointed Director of the Harvard College Observatory. She would stay at Harvard her entire career.

In order to earn her Ph.D., Payne had to find a topic that would satisfy her insatiable curiosity. Determining the composition of stars became a perfect match, but her conclusion, that stars are mainly hydrogen and helium, was against the ideology of that time. It would be many years before Stellar Atmospheres would be accepted as a

(Continued on pg. 84)
See the magic in Salt Lake City

es.com/domex
Despite 2020 being a year of unprecedented difficulty, there were parts that can be considered positives. The many unfair misfortunes that were/are a result of the Covid-19 pandemic are as real as can be, but I hope to point out a few silver linings that can be gleaned through the lens of a planetarium practitioner.

As part of our school district science team, I am part of the planning and professional development for teachers in our K-12 district with 38,000 students. One request we heard regularly went along the lines of, “What can we cut? We can’t get through all the curriculum in a typical year, so there’s no way we can do it remotely!” This forced our team to dig deep into the Next Generation Science Standards (NGSS) that emphasize scientific practices and crosscutting concepts just as much as disciplinary core ideas. We all know there is no way for science teachers to pour the vast and ever-growing body of knowledge we call science into students’ brains, but we can teach students to think critically about phenomena, collect evidence, propose solutions, and craft their own explanations of the natural world based on their investigations of the content. The “doing” of science is more than just a collection of many topical facts, but to focus on doing science using natural phenomena and supporting a possible explanation they could check. I became aware of (and decreased) the excessive questions we ask. I helped students narrow down a list of questions about phenomena to a few powerful ones and learned not to answer them, but rather to poke around for clues and evidence to support a possible explanation they came up with. It was very disorienting for teachers to be told to not cover as many topical facts, but to focus on doing science using natural phenomena and reflecting on it to learn the content. It made veteran teachers feel like new teachers, and it is never fun feeling like you don’t know what you are doing. We didn’t cut any of the required curriculum, but we changed how students show us what they know and can do. And that’s a good thing. It also forced me to re-align the lessons that I present to more fully reflect the shift to 3-dimensional teaching and not to overvalue facts, but to equally value the process…the thinking and doing that leads to discoveries and understanding of our world.

Those of us who were not allowed into facilities, the gas costs, traffic headaches, and time saved by not commuting were a bonus. My travel time down the steps into the basement to my “office” space was pretty sweet. I am really seeing this now as we are back to live teaching and traffic is back to its annoying normal. I needed that extra time to figure out how to create engaging Zoom presentations that aligned to the curriculum without having a live class to give me verbal and non-verbal feedback - no small task. I also learned that a dog can train a human to get into daily routines that are noticed, if not followed with regularity. Going for a walk around 3pm became a necessity. As a teacher in a school district planetarium, I think we (the entire district) now have a pretty solid understanding of how to do both synchronous and asynchronous learning in a remote setting. Living in the US Great Lakes states means

(Continued on pg. 84)
Season’s Greetings to everyone! I can’t believe we are already at the end of 2021. Don’t we all feel that, somehow, we have a year-and-a-half-long hole in our lives? On the positive side, we are returning to live meetings and getting to hug and shake hands with colleagues again. Let’s hope that by the March issue, we can talk about Corona in the past tense.

In recent conversations with customers, the term “accessibility” is becoming more and more of a theme. The most common type of accessibility measures used in planetariums the past years have been architectural features like ramps and handicapped seating. But specifically for the hearing disabled, there are a number of technologies in use.

You may have seen this sign in various shops or theaters. You can find out more about the origin and use of this sign here: http://www.hearingloop.org/logo.htm

When you see this sign, it means that an inductive loop or “T-Coil” is available with audio that is compatible with hearing aids that support the function. It also serves as good PR for the facility that has made this service available. Unlike other portable headphone or other listening devices, the T-Coil works specifically for the individual. Also, one does not need to borrow, or remember to return, a device.

So how do they work? Let’s focus here on theaters like planetariums and how this technology is implemented in such venues. The simple explanation is that a “loop” is installed around the perimeter of the theater. The loop is simply a copper wire or tape with an electrical current passed through, which generates a magnetic field that is modulated by the audio program. Usually, the audio broadcast with this system is just a narration or spoken commentary in order to avoid overlapping complex audio signals like music, which can cause audio confusion for many with hearing disabilities.

Here is a simplified illustration of a hearing loop system, called an induction loop system, in operation. Those who have a hearing aid that support the T-Coil function simply need to be within the loop and they can receive the broadcasted audio program. The T-Coil is like a mini-antenna, and it converts the magnetic signal into a small electrical signal with the audio information that is then fed to the hearing device. For those who do not have a hearing aid with T-Coil functionality, there are wearable accessories like headphones with an inductive receiver that most venues supporting this technology have available to loan. Hearing Loops are actually mandated by law in many countries, especially for new spaces constructed for the general public.

The loop itself is often installed as a copper tape under the carpeting, if possible, before carpeting is completed. Sometimes, in a round room, the flat tape is a bit difficult to lay and, in such cases, one can also use a suitable gage copper wire. I’ve often tucked a copper wire into the junction between floor and wall, just tucking the wire under the carpet edge and using hot glue at various intervals to ensure that it stays put.

As the signal being generated is magnetic, there can be complications of course. If there is a lot of metal in the floor or walls of the theater it can interfere with the signal and cause drop out. Before permanent installation, it is often useful to simply lay the wire on the floor around the theater and test the system’s operation. I haven’t experienced any interference from projection domes themselves, and I would expect that the newer aluminum domes don’t cause much interference because they are non-ferrous.

It is also possible to run the loop around the theater wall at about head-height. Many theaters with coves have a fascia or other architectural element at an elevated height that may provide an easy place to tuck a wire. A theater can even have 2 loops in parallel, one on the floor and one at head level, in order to increase the signal strength: . While installation is easy and the materials are not very expensive, it is best to leave the supply and installation to professionals with sufficient experience. The cables feeding the loops need special attention, and there are dozens of factors that affect performance that only a seasoned professional can evaluate to make the right choices.

The current in the copper loop that creates the magnetic field is generated by special amplifiers. These amplifiers

(Continued on pg. 81)
ATLAS of a Changing Earth: Mapping Our Climate Future
**IPS 2021 BOARD MEETING NOTES**

19-20/21 June 2021, held Via Zoom

**DAY ONE: 19 June**

**Officers Present:**
Kaoru Kimura, President; Mark SubbaRao, Past-President; Michael McConville, President-Elect; Mike Smail, Treasurer; Patty Seaton, Executive Secretary; Jennie Benjamins, Director of Operations

**Board Members Present:**
Alex Chapman, Latin America; Jiri Dusek, Europe; Martin George, Oceania; Sumito Hirota, Asia; Susan Murabana, Africa; Dayna Thompson, North America; Bjorn Voss, Europe; Michele Wistisen, North America; Jin Zhu, Asia; IAU Representative, Lucia Marchetti

**Unable to Attend:** None

**Special Guests:**
Kenan Bromann, Experimenta Science Center; Wolfgang Hansch, Jena/Berlin; Johan Gyensbergs, Jena/Berlin; Evgeny Goodov, Planetarium 1; Anna Green, Stiftung Planetarium, Berlin; Tim Florian Horn, Stiftung Planetarium, Berlin; Stefan Harnisch, Zeiss-Planetarium, Jena; Manos Kitsonas, Awards Committee Chair


**Meeting called to order at 12:07 UT**

Kaoru welcomed all members and thanked everyone for their participation. She thanked Adam Thantz for his flexibility in inviting us to meet in person at Bays Mountain which had to be canceled as we moved to virtual.

Kaoru highlighted the Board/Council meetings that were published in the December PLANETARIAN and called for discussion. Martin George thanked Patty for the minutes; Mike Smail said they were an accurate representation of what he had noted. MOTION: Michael McConville moved to approve the minutes as published. Michele seconded the motion. Kaoru requested any further discussion. Patty thanked Sharon Shanks for her edits. Kaoru called for a vote. The motion passed unanimously.

Lucia Marchetti (IAU):

IAU election ended yesterday and new roles have been established. She is now part of Division J. Galaxies & Cosmology steering committee rather than C2. She will continue to be the liaison between the IAU and IPS as member of Commission C2. The next general assembly will be in Cape Town, the first one held in Africa. She would like to use this opportunity to highlight our collaboration. She has established a working group within the African Planetarium Association and would like to invite others to join her in exploring ideas for the future. Kaoru requested that Lucia send her more information that she can share with the rest of the Officers for further discussion. We noted that we haven’t had much communication recently due to the pandemic, with hopes that projects will pick up in the future. Kaoru would like the Board members to consider ways to collaborate with IAU for discussion at future Board meetings. Lucia has different ideas she would like to promote, but she needs to consider the goals that the new team within C2 would like to meet. She suggests collaborative workshops, such as creating content to promote education using planetariums and how to use planetariums for research. Since 2024 is an important anniversary for the IPS, this could be pitched during the general assembly of the IAU; a history of astronomy and the planetarium. Lucia will write some of the ideas down for future discussion. Takeaways: we want to think broader planetarium. Lucia will write some of the ideas down for future discussion. Takeaways: we want to think broader

**2024 Bidder Final Presentations**

Kaoru thanked both bidders for attending. Each bidder will be given 20 minutes to present, with 20 minutes Q&A following. She encouraged Board members to prepare their questions.

Heilbronn - Experimenta - Wolfgang Hansch, Kenan Bromann, Johan Gyensbergs

Dr. Barbel Renner was unable to attend. Dr. Hansch thanked IPS for their mission. (SEE PRESENTATION: [https://bit.ly/3ogUih](https://bit.ly/3ogUih)).

**Highlights:**

- Experience hosting large conferences
- Unique planetarium with rotating floor; largest science center in Germany
- Generous support, which will enable them to provide many scholarships
- New approaches: focus on the next generation of planetarians through community engagement (focus on content rather than technology)
- Compact city: all the venues are nearby, making transportation a non-issue and allowing for increased networking time (and reducing costs)
- Post conference tours include city trips (Munich, Vienna, Jena, Berlin) and Fulldome Festival
- They are working with the Zeiss/Deutsches Museum in Munich to transport the first Zeiss projector to their site for the conference
- They have space for the trade fair, and will bring in a vendor consultant to better design the spaces. One option is to use the Harmonie conference center; however, they will have to pay for that space. They noted that financing this will NOT be a problem.
- They have budgeted money for professional services for marketing and event management
- They pledge that the conference fee will not be higher than what is proposed

Jena/Berlin - Stefan Harnisch (Jena), Anna Green and Tim Florian Horn (Berlin)

Stefan Harnisch welcomed everyone on behalf of the Zeiss Planetarium in Jena and expressed gratitude for being able to co-host with his colleagues in Berlin. (SEE PRESENTATION: [https://bit.ly/3phPVjG](https://bit.ly/3phPVjG)).

**Highlights:**

- They plan to make the conference accessible to everyone, with low...
BLACK HOLE

FIRST PICTURE
QUESTIONS to the Bidders:
(H = Heilbronn; J/B = Jena/Berlin)

Q: We have heard about refurbishments at both sites, to clarify, there will be no building works during the conference; everything will be fully accessible at the time of the conference?
A (J/B): Absolutely, yes. All of the sites will be fully accessible. The renovations are making them even more fully accessible. The new airport is finally open!
A (H): There are no current works in progress or planned before 2024.

Q: To H - You shared the budget and anticipated surplus. If events are moved to the Harmonie Hall, how will this affect the budget.
A (H): The projected surplus is $75,000. If needed, facilities from the Foundation itself require no invoicing, expect using the Harmonie will not.

Q: The IPS general meeting is vital; when and where is the meeting scheduled?
A (H): Friday afternoon
A (J/B): Wednesday, in the largest of the rooms to ensure everyone can fit. Everything will be livestreamed, including this.

Q: Could both sites talk about your experience in livestreaming activities as part of the conference?
A (J/B): Since the pandemic, they have much experience livestreaming all events in multiple languages. They had at least 2 livestreams a week with hundreds of thousands of viewers, and look forward to doing a hybrid conference for 2024. They also did virtual contests/competitions with thousands of attendees both online and in person.

Q: Regarding stipends (“scholarships”), they noticed that J/B has specified 12. Do these follow the stipend rules for IPS or are they proposing a new way of approving?
A (J/B): were not aware that there was a stipulation other than a minimum of 10. They absolutely will follow the stipulations of By-Laws.
A (H): plan to offer $6000 Euros for 12 people for members of all regions.

A (J/B): Anna highlighted her experience working with vendors in the Pleiades conference in the US. Their pricing is aligned with past conferences. They have possibilities of local sponsors which would enable them to adjust their pricing structure for the vendor packages. Her goal is to allow time for vendors to mingle with attendees.

Q: H mentioned that they will explore options for younger members. Can both address the options?
A (H): The sponsorships, as well as “Breakfast Club” between students and veteran planetarians.
A (J/B): Understands the importance of mentorship, especially for international conferences. She will have language support, and arrange mentors to meet online prior to the conference. Wants to work with regions that typically have fewer members attend conferences to explore ways to reach out to their membership. Day Camp available to not just provide child support but provide the families activities related to what their parents do.

IPS 2022 Update - Planetarium 1
( Evgeny Goodov) 

Highlights:

- Easy global access through flights, trains, and ship
- Electronic VISA available for many countries
- Interesting venues: Planetarium One is large, and will be used for presentations and banquet hall.
There is a street planetarium & BBQ zone.

- Program: 21 June arrive; 22-23 June Fulldome Festival; 24-25 June IPS Board meeting; 26-29 June conference
- Events include evening shows: orchestra, ballet, light shows, media artists
- Weather is “perfect” during these dates
- Many sight-seeing events in Saint Petersburg: museums (incl. State Hermitage Museum and Museum of Cosmonauts)
- Three planetariums: Lachta centre Planetarium and Old Planetarium in addition to Planetarium One
- They have almost finished the presentation for the vendors with different packages; shared the proposed sponsorship packages (from “Black Hole” to “Dark Matter” levels). Some packages offer the vendors use of the Street planetarium and BBQ zone.
- Applications will be made in Google forms.

Next month they hope to finish the website.

Q: Can you talk about financials, specifically if there has been any change to delegate registration and hotel prices.

A: The numbers for the hotel have been verified and sent to Patty. The price for delegates will remain $350. Applications will be made in Google forms.

Q: Will sessions be available online/livestreamed?

A: Yes. All events can be streamed on Facebook, including the parallel sessions. They have done this for other conferences.

Q: Re: COVID, we expect it to be better/gone. Is there a plan to address the situation if there are any remaining limitations?

A: The number of expected members for this conference is low enough to not be a problem for their planetarium. The level of vaccination in Russia is increasing (currently only 13% compared to the 50% of the US population). Russia is offering bonuses to those who are vaccinated, including free admission to museums.

Q: Are there alternate options than Google forms for registration? Not all countries can access Google documents.

A: Delegates and vendors will be able to download and scan forms.

Q: Is the largest vendor dome available with the BBQ?

A: No. There is a 120m screen presentation hall with 360 degree projection. Planetarium One can make their dome available for presentations. Board members stressed the importance of having a large dome available for the largest sponsors.

Q: You budgeted to make $35,000, but the largest exhibitor fee is $50,000. Mike pointed out that if they received one sponsor at each of their suggested levels, that would be $122,500 in revenue.

A: He needs to adjust these projections, since their expenses will not be as much as Edmonton. Action: He will have adjustments prepared for the next Program Committee meeting on 8 July 2021.

Q: We haven’t seen the allocation for stipends; we can defer the question for the next Board meeting.

A: Evgeny asked for clarification on stipends. Action: Martin will email Evgeny regarding this topic. Kaoru will invite Evgeny to our next monthly meeting.

Q: What is the schedule for submitting presentations?

A: Open call for presentations will open soon. Planned speakers include professors and cosmonauts.

Q: How hard is it to navigate St. Petersburg for those who don’t read Russian? Will translations be available?

A: Translators will be available for the excursions. All Russians will speak English.

Kaoru thanked Evgeny for his presentation and reminded him that he will be invited to our next monthly Board meeting to discuss the budget.

**Awards Presentation:**

Manos Kitsonas, Chair

IPS Awards include: Service Award (can be an organization, which we have never had up until now), Technology & Innovation Award, Fellow.

We stressed how difficult it is to get people to nominate for the awards, so we will have a discussion on how to encourage more nominations.

**IPS Medals (SEE PRESENTATION: https://bit.ly/3DxYFHH)**: Silver for a Commemorative Present to a person/organization, decided by the Officers to be given at any time; Gold for worthy people within the planetarium community that deserve honors that don’t fit the rules for the other IPS Awards. This medal would be nominated by a member and voted upon by the Board. Exact rules have not been agreed upon. Action: Manos will share the committee ideas on the suggested procedures.

Examples of the medals within a presentation case were shared with the Board. Quotes were shared; Manos stressed that the Nothers Award company was the easiest vendor to work with along with reasonable pricing. The prices are a one-time cost and projected to last us up to 50 years.

Board members appreciate the work done on these medals. Dayna asked if other quantities were considered; Michele wondered if 250 silver awards were needed. Manos pointed out that lower quantities don’t typically change the initial price by much. He is open to requesting further quotes. Manos needs approval to move forward with the revised design and then he will get revised quotes. Manos can request photos of gold and silver awards from the Nothers Award company.

We were reminded that the silver award was potentially to give to invited speakers or when the President is invited to speak at external events. Manos anticipates awarding 6-7 silver medals/year and 1 gold medal every 1-2 years. Bjorn wondered about the longevity of the design: would 10 years supply be sufficient? Note that the majority of the cost goes into the production and manufacturing of the design: price of the actual medals won’t change much between amounts requested.

The current glass trophy given for service has been discontinued; this
will be the last year that they can be manufactured. Manos recommends that we find another vendor within the US or Canada. Manos requests that Board members send him any ideas, and he will work with Jennie to finding a new vendor.

Manos will send the next steps for the process for the medals and the new trophies.

Kaoru asked for any further comments for today’s meeting. She reviewed the schedule for tomorrow.

The first day’s meeting was called to close at 3:37 UTC.

DAY TWO: 21/21 June

Officers Present: Kaoru Kimura, President; Mark SubbaRao, Past-President; Michael McConville, President-Elect; Mike Smail, Treasurer; Patty Seaton, Executive Secretary; Jennie Benjamin, Director of Operations

Board Members Present: Alex Cherman, Latin America; Jiri Dusek, Europe; Martin George, Oceania; Sumito Hirota, Asia; Susan Murabana, Africa; Dayna Thompson, North America; Bjorn Voss, Europe; Michele Wistisen, North America; Jin Zhu, Asia; IAU Representative, Lucia Marchett

Recording Lin: https://bit.ly/3lsVgPk

Unable to Attend: None.

Special Guests: Kenan Bromann, Experimenta Science Center; Wolfgang Hansch, Jena/Berlin; Johan Gysergergs, Jena/Berlin; Anna Green, Stiftung Planetarium, Berlin; Tim Florian Horn, Stiftung Planetarium, Berlin; Stefan Harnisch, Zeiss-Planetarium

Meeting called to order at 10:05 UT

Kaoru shared a reminder from Manos Kitsonas to keep all the names of the award recipients confidential until IPS 2022.

Officer’s Reports

Secretary - Patty reminded everyone that they voted on the minutes from the 2020 Council/Board meeting yesterday. She will continue to create minutes using Google docs with links to presentations, but will also create pdf versions of the files.

Treasurer:

- 2020 End of Year Report (https://bit.ly/3oi7Fia4). For being a pandemic year, the numbers were positive for the organization. Usually during a conference year, we have higher numbers in membership. With the transition to a virtual meeting, we saved expenses that way. He highlighted the expenses for the Mini-grants, Associated Management fees, and G Suite/Zoom costs. The PayPal account was created last year, and a significant number of people use this method for membership dues and journal ads. Net gain $45,000.

From the notes, he highlighted the Eugenides Award Funds issue where the 2016 recipients were not able to receive funds, and Mike is in the process of working with the 2018 recipients. He also noted that the Final journal postage costs were not paid until 2021 and will reflect in that budget.

- Mid-Year 2021 Report (https://bit.ly/3DmW03t). Highlighted that the majority of memberships expire at the end of the year, so there is a boost in renewals at the beginning of the year. He also noted that many vendors choose to pay for a year’s worth of advertising costs at the beginning of the year. We are saving money on publishing and postage for the journal with a change to a new editor/source for publishing/mailing. Currently we are $32,000 in the black. The Spitz and StarPartner funds have received small donations, so these numbers are slightly higher from the end of last year.

- Draft 2022 Proposed Budget Report (https://bit.ly/3GdsChE). Mike projected a safe number of membership dues for the upcoming conference, and still expects to be able to cover our expenses despite not knowing exactly what the surplus from the conference will be (we received 70% of the profits). Once we receive the committee reports by the middle of next month, he will be able to update their projected expenses. We know that we will need about $1000 for Awards.

- Mid-2021 Membership Update (https://bit.ly/3EmeNND). Mike took the initiative to compile numbers for our information. He highlighted the Public Directory number - driven by privacy rules and regulations, we asked if people would opt-in to the directory. He shared the breakdown of numbers by continental zone. He highlighted that we have a couple affiliate regions that are below the minimum required to maintain affiliate status. We also have affiliate reps that are not current members. He encourages us to target these areas for increased membership.

Past-President Report - Mark provided a summary of events that happened during his Presidency. Despite the challenges of the COVID pandemic, he was able to mark several accomplishments, such as implementing the Vision 2020 governance changes, increasing member communication through the newsletter and forum, formation and elevation of EDI committee, production of important white papers on science education and education, the addition of three new affiliates, the COVID grant program, and a successful virtual conference.

President’s Report - Kaoru highlighted the challenges and disappointments of the pandemic. She also highlighted the positive addition of the expansion of online activities. She was able to attend multiple Affiliate planetarium conferences. She was able to work more with IAU.

Martin thanked the Officers for their reports, recognizing the great effort of all officers, expressing gratitude for their meeting the challenges of the last year and a half!

VCon Update - Michael McConville

https://bit.ly/3G8U7Jm

He shared the tentative schedule for August 9, 11, 13, with tiered starting times to accommodate various regions. Keeping this in mind, and that this virtual conference is intended to be a committee and Board update:

Day 1: State of IPS: the first public time to formally introduce the 2024 Conference bid winner. And update for
IPS 2022. This will be a day of updates rather than deliverables. Intro of Board Member candidates. This time frame should be most appropriate for international participation.

Days 2-3: each four hours long with a break and one invited panel or talk. These are the six most active committees that usually don’t have time to present. Day 2: Education committee will have a presentation which can be an update or workshop. The committee chair will be in charge of preparing the panel/invited talk session for this day. Day 3: The EDI committee, in addition to their presentation, will be responsible for preparing the panel/invited speaker talk for this day. The panel they presented at our virtual conference resonated very well with the membership. Susan Button will highlight the importance of portables and the specific impact of the pandemic on portables.

Dayna suggests that we not present the schedule as-is, but to “dress this up a little” to further encourage and interest people to attend. She suggested re-naming the titles (Example: “Value of Education to the Planetarium Environment” to “Education Presentation”). Bjorn suggested filling in the presentations. Michael said that this an excellent idea; this is just the structure of the conference. He will solicit titles and updates from each committee over the next two weeks.

Alex asked if it would be possible to invite people to submit brief videos of the status of their sites, to make them feel that they are more a part of this conference. (“I was thinking more of short clips, 1-3 minutes, from people around the world, so we would get a sense of the state of our community as well.”) Michael pointed out that the video poster sessions were well received for our Virtual Conference, so agreed that we could add this to the VCon. Michele says that as this is a non-conference year, she sees the value of this alternate format.

Michael reminded everyone that this VCon will be free to all IPS members.

**Informal Board Member Roundtable**

The Affiliates provide reports; the Officers wanted to know if the Board felt like there should be a formal report. Alex said that the monthly meetings are the best way for us to communicate and would prefer no further paperwork. Michele says that she feels comfortable bringing Affiliate concerns to the monthly meetings and additionally provides Patty with her reports and trusts that she will also bring up any concerns that she sees from this report. Michele further added that the Affiliates appreciate having regular contact with the Board members. Mike said we just didn’t want to exclude the Board from creating reports. Patty stated that reports are made available to the membership.

Round table: Michele is concerned that due to the pandemic and tentative travel budgets, it may affect members ability to attend the IPS 2022 conference. Martin said that currently Australians are not allowed to leave the country, projected until not being allowed to travel until mid-2022. Australians do have a travel bubble with New Zealand, but that is all. Australia has done well with coping with the virus, but not doing well with getting vaccinated. In Japan, usually June/July is their busiest time since 7 July is the traditional date of the Tanabata Festival. It is difficult to take vacation during this time. In Japan, vaccination rate is only 6%, so they are concerned about the Olympics this summer, and will be carefully considering what happens with the virus in August, following this event.

**Discussion on 2024 Bids**

Kaoru mentioned that the EDI provided us with a toolkit and a summary of the website results (INSERT REPORT). Dayna suggested that we had great presentations and wondered if we should have a straw poll to see where we are to help generate discussion. Jennie provided a straw poll so we could remain anonymous. Results of the straw poll: 5-Heilbronn, 6- Berlin, 1-Abstain

It was mentioned that it feels that the generous amount of support Heilbronn is getting is NOT being reflected in the registration cost. Berlin is cheaper to get to than Heilbronn. There is $450 additional cost required in transportation to get to Heilbronn, which makes the costs approximately equal. It appears that Berlin would be ready to run a conference TODAY, but Heilbronn could not. The Berlin proposal appears to be more thought out.

At least one Board member repeatedly heard Heilbronn say IF we get the bid, we will fill in the details. They have shown evidence of running large conferences in the past. Some Board members are locked into the vote based upon the input from the representatives.

It was noted that the student pricing for Berlin is much lower than the student pricing from Heilbronn.

Concern was raised that many people may want to go to Berlin simply because they want to visit the city rather than considering the bids. One Board member noted that Jena is a historic site that may draw many to want to visit there.

One member said that while they recognize issues with both bids, none would prevent either site from hosting a great conference.

One member shared that the perceived extra travel from the airport to Heilbronn was not appealing to them, not from a cost standpoint but from a motivation point of view.

The “Small Big City” feel of Heilbronn, as well as their focus on the younger generation, was appealing to another member. The $60,000 going to scholarships was another plus, although it was mentioned it may be more effective for them to offer twenty (20) $5000 scholarships versus ten (10) $6000 scholarships. We have never offered full travel scholarships before, how much would that impact/encourage students to participate? We also wondered if the proposed method of selecting two scholarships per geographic zone was the best method. We can have further discussions with them.

The question of language as a possible barrier was brought up as an overall consideration. Jin shared that the younger generation of Chinese are especially well versed in English. Alex shared that language is always a barrier for Brazilian members. He did a straw poll with his affiliates, finding they prefer to travel to places they never would have dreamed of before. He also pointed out that there was success in Alexandria and Beijing, there will be success in Germany!
Looking through the lens of a vendor, it was noted that the largest dome in Heilbronn has 150 seats. Berlin has two facilities of over 200. The amount of work required for vendor presentations is a big concern. Scheduling is important for the vendors (and attendees). Heilbronn did not appear to have as open of a scenario for installing equipment in their dome.

We considered what the goal of the conference was: to get as many people as we can to attend? To make the conference go as smoothly as possible for attendees? These goals can overlap!

The Board reflected on the input from the membership from the conference site feedback form, noting how the comments showed careful consideration of the bids and evidence for their choice.

One Board member was missing from the vote. Martin George restated that Article 7 section 2 makes provisions for a proxy. As no proxy had been appointed, Martin stated that we would move forward with no vote from this member.

Results of the final vote: 4- Heilbronn, 7- Berlin, 1- Abstain. The final decision is for IPS 2024 Conference to be held in Jena | Berlin.

Breaking until 11:55 UTC

The Emerging Communities committee goals overlap with the International Relations Committee. The decision was made to start the conversation with the Emerging Communities committee about integrating into the International Relations Committee. ACTION: Martin will reach out to Dave Weinrich about the idea before connecting with the other committee members. Martin will provide an update at the next Board Meeting. The other former Emerging Communities committee members are Jacob Ashong, Derek Demeter, Jack Dunn, Glen Moore, Susan Murabana, and Joanne Young.

The question was raised on whether or not we should connect with the recipients of the 2020 Mini grants for a written update. This could be used for promotional materials on Facebook or the Planetarian. ACTION: Michele and Kaoru will meet to discuss reaching out to past Mini-Grant recipients. Additionally, there was discussion on the regularity of mini grants, how often and how many do we want to offer in the future. VCon 2020 replenished the fund. ACTION: Mike will update the 2020 Budget to include mini-grants. The following was suggested for the IPS mini-grants:

- Offer the grants in the off-conference years, as an incentive to renew memberships.
- Allocate a mini budget to each board member to distribute in their area, possibly $1000 or more per continental zone.

New business - discussion

IPS needs additional members from Africa and Asia. Board Members to consider how we can reach out to the younger generation. Discussion around promotion of Affiliate activities. Request for the Board to let the Officers know if they need budget support from IPS.

IPS started the discussion with IAU about a future partnership, Lucia joined the call yesterday. Kaoru also wants to establish a partnership with the National Astronomy Education Coordinators.

Fulldome Festival BRNO 2021 (continued)

first time. Format, choreography, and the beautiful setting of this festival are second to none. Simply the best event to visit – every year!” Thomas Kraupe, Planetarium Hamburg

There were four prizes awarded at the Fulldome Festival Brno 2021. The Brno Observatory and Planetarium Director’s Award grants the rights to present the Czech version of the awarded fulldome film in Brno’s planetarium. The winner of the Audience Award was chosen by the employees of European planetariums, as well as fulldome producers. The decisions about the next two prizes, the Best 2D and 3D Movies, were made by the international expert jury consisting of Paulina Majda (Lodz Film School, Poland), Bjorn Voss (Gesellschaft Deutschschprachiger Planetarien, Germany) and Tomasz Dobrovolsky (Maximilian Hell Observatory and Planetarium, Slovakia).

And the winners are...
- **Audience Award**: Signs of Life (produced by Dawn Fidrick and Bob Niemack)
- **Best 2D Movie Award**: Hayabusa 2 - Reborn (produced by LiVe Company Ltd.)
- **Best 3D Movie Award**: Making Magic – A Visual Effects Story (produced by Norrkoping Visualization Center C)
- **Brno Observatory and Planetarium Director’s Award**: Magic Globe (produced by Creative Planet)

The Fulldome Festival Brno 2021 dispersed as quickly as the photons from the projectors projecting the last fulldome show. But the joy of getting together and glancing into the fulldome world again will remain in everybody’s heart for a very long time.

See you at the Fulldome Festival Brno 2022, which will probably be held between June 8 and June 10, 2022 at the Brno Observatory and Planetarium, in the centre of Europe. We are already looking forward to your visit!
used to be a pure analog technology, but the newer models on the market accept digital audio. There are even Dante-networked models available now. The amplifiers must be selected based on the length and characteristics of the copper loop. Again, it is best to work together with a professional to ensure the best solution.

If you have an inductive loop system, it is good to keep a pair of headphones or other testing device at the console so that you can make regular checks that everything is ok and functional. The worst is to advertise that you support such devices and then deliver a poor or disappointing experience to your visitors.

If you are completely unable to install an inductive loop system due to architecture or other restrictive situations, there are other possibilities. Infra-red (IR) and radio frequency (RF) transmitters can provide suitable coverage and performance for listening devices. Newer systems are emerging now that work via Wi-FI allowing visitors to use their own tablets or smartphones to receive broadcast audio. I haven’t had any experience with these up until now, but I’ll report back later if I find anything interesting.

These alternatives are really not a complete substitute for an induction loop system that is specifically designed for hearing impaired visitors, but if assisted listening is legally mandated you will need to find a solution. However, any efforts to accommodate visitors with special needs will certainly be appreciated.

Please feel free to respond with any comments by writing to the editor. I think that feedback regarding any of the various articles and columns in The Planetarian would be welcome, especially if you are sharing your own experiences or helpful tips.

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INTERNATIONAL PLANETARIUM’S CALENDAR

COMPILED BY: LORIS RAMPONI

2021

- 17-19 December. Workshop of small digital planetariums, Marseille, France. Contact: lionel.ruiz@live.fr
- 31 December. Deadline for the contest “A week in United States”. The winners’ travel schedule will be dependent on the situation with the pandemic in both the United States and the countries of the winners. 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 Serafini Zani Astronomical Observatory. Contact: Susan Reynolds Button, sbuttonq2c@gmail.com; http://www.ips-planetarium.org/?page=pagesofstars

2022

- January. 40th Anniversary of Strasbourg Planetarium, France.
- 13 March. International Day of Planetariums, public initiatives between 12 and 13 March. Ips-planetarium.site-ym.com/?page=IDP
- 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. Contact: segreteria@planetari.org; www.planetari.org
- April. Italian Association of Planetaria (PLANit), National Conference, dates and site coming soon. Contact: segreteria@planetari.org
- 23-25 April. Gesellschaft Deutscher Sprachiger Planetarien e.V., (GDP), Annual Conference of the Society of German-Speaking Planetaria, Heilbronn. Contact: bjoern.uoss@hel; www.gdp-planetarium.org
- 2-4 June. European Network Science Centres & Museums (ECSITE), Annual Conference, Heilbronn, Germany. ecsite.eu/activities-and-services/ecsite-events/conferences/2022-ecsite-conference
- 31 December. Deadline for the contest “A week in United States.” For information and application requirements go to: www.ips-planetarium.org/?page=WeekinUS

2023

- 20-24 June. “Stars for All 2023”, 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
- 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 Contact: ips2024@planetarium.berlin; https://www.ips-planetarium.org/page/conferences
LAST LIGHT

As part of the pre-retirement office clean-up, I came across scribbled notes from previous conferences, with notations for future columns. Here’s a selection:

Alan Davenport was demonstrating a planetarium lesson for young children at one such conference. Pointing to the dome’s horizon, he asked, “What do you call this? Where the sky comes down to the ground?”

A voice from the dark answered, “The cove.”

At another lesson demonstration, the audience was barely awake:

“T’re pretending I don’t know anything.”

“I’m not pretending.”

After an answer using a vague noun to describe a sky object: “Can you tell me a word other than ‘it’?”

“Creampuff.”

“How do you know we’re at a different latitude?”

“There’s pizza in the sky.”

“Do you see how this is getting you thinking?”

“I would if I’d had more coffee!”

“This workshop should NOT be on the last day of the conference.”

At the MAPS conference in Mystic, Connecticut, delegates got to see a logbook from a ship’s captain, neatly written out in ink. The author used small symbols of the Sun and Moon in his recording, including one tiny drawing of the Moon with a face.

“Look!” the docent said, “Emojis!”

Charlie Rau was demonstrating a small section of Zeiss’ ZKP4.

“And if you shake it, you get scintillation when the stars fall into the holes of the dome!”

Voice from the dark, “Does that cost extra?”

Visitors to the Challenger Center are assigned roles for simulated missions.

One elderly woman was told, “You’re on life support,” to which she replied, “Not yet, sweetie.”

Followed by another voice from the dark, “What?”

Astronaut Scott Altman described a parade in which he was to participate, but when he arrived, he’d forgotten his flight suit. His mother pointed out that one of his was on display at the Taswell Museum. Borrowing it for the parade, he remarked that it came “Off one dummy and onto the other.”

In the movie Top Gun, there is a scene in which the character Maverick is flying inverted over a Russian plane, and the pilots exchange a derogatory hand signal. “I can tell you,” Scott reported, “that was my finger.”

Astronaut John Grunsfeld was commander of one of the Shuttle missions that serviced the Hubble Space Telescope. As commander, he wasn’t allowed outside the shuttle, and instructed the other space walkers, “OK. When you’re out there, DON’T be looking around saying, ‘Oh, Scooter! It’s so beautiful!’ Too bad you only have that little window.” Because at the end of the mission, when you want to come back in, I get to open the door.”

Gary Lazich’s five-year-old son David met astronaut George “Pinky” Nelson at an airport.

“You aren’t an astronaut,” David said.

“Where’s your suit?”

At a 2006 conference, the latest images of Saturn’s moon Hyperion highlighted the chaotic rotation.

“More like a comet nucleus than a moon.”

“It’s darker than the black background of an Elvis painting.”

“Looks like Sponge Bob without the pants.”

Ryan Wyatt, then at New York’s Hayden Planetarium, was introduced by Gary Tomlinson. “Our next speaker comes from a poor, one-room planetarium in New York City.”

Keith Johnson shared some notes that students sent, after their planetarium field trips:

“It was really cool when the ceiling was turning.”

“You taught us a lot about space it was cold and funny.”

“Thank you for letting us come to the astoream. It was very long, I almost fell asleep.”

“I hope we can come again next time. If we can I will be the first one to wave at you.”

“I got dizzy when the walls moved.”

“I’m going to be a scientist when I get older like you I’ll be like you, except I’ll be a girl not a boy.”

“I learned that the bear with a long tail had a long tail.”

“I loved how you showed the stars in the huge thing.”
“Thank you for the most wonderful, learnful, beautiful, and amazing show ever!!! P. S. I made up the word learnful.”

And at this year’s virtual LIPS conference, participants shared valuable ideas and information. Between sessions, discussions ranged widely.

Why don’t more people come to the planetarium? “You can be the sweetest peach, but not everyone likes peaches.”

“What DO you call someone from Massachusetts?”

“Yankee.”

“Dumbass.”

“Bay Stater.”

Geoff Holt described a video a friend sent to him. Geoff had given a presentation using Stellarium as the night sky, with the cursor as the ever popular laser pointer. The video showed the friend’s cat watching the presentation, and batting at the cursor as it moved from object to object.

Intrepid host Karrie Berg shared a demonstration of different states of matter.

For solids, hold two fists facing each other, fingers touching, and press them tightly. Not much molecular motion in a solid.

For liquids, rub the fists together. More motion in a liquid.

For gases, shake your hands in the air, fingers outspread. Lots more motion in a gas.

To which John Erickson added, “For plasma, shake your hands until your fingers fly off.”

During a light pollution discussion, the subject of poetry came up, and Julie Tomé mentioned that, “No one ever wrote a poem about sickly orange barf-glow.”

IN MEMORIAM:

Mark Bunker Peterson

August 2nd, 1943 – September 2nd, 2021

by Ian C. McLennan and Marci Peterson

Mark B. Peterson was a significant contributor to the development of two inter-related fields, namely the planetarium profession and, more recently, the GS (Giant Screen or large format film) industry. I first met Mark when he paid a visit to the Strasenburgh Planetarium in Rochester, NY in the early 1970s. We hit it off immediately as friends and fellow warriors on a mission to bring new vision to the planetarium field. Over the years, we kept in close touch, both professionally and as friends. We occasionally found it possible to work together on projects, sometimes through Mark’s long association with our mutual friends, John Jacobsen and Jeanie Stahl of White Oak Associates. John has written eloquently about Mark’s contributions to the GS industry, especially on the GSCA (Giant Screen Cinema Association) website.

Our friendship transitioned into a more personal one when Mark, his wife Marci, and a bewildering assortment of cats and dogs found their way to Washington State - just across the border from where I live in Vancouver, British Columbia. Before the pandemic, we often visited on one side of the border or the other. There were long walks on windswept Pacific beaches, with the remains of ancient volcanoes providing a dramatic and decidedly photogenic backdrop. A pair of beautiful dogs (Belle and Betsy) provided endless entertainment as they romped all over the beaches in wild abandon, although only a whistle away from their devoted master, Mark. Betsy remains at home – and misses Mark just about as deeply as Marci.

Mark was a deep thinker, philosopher, inveterate jokester (and fellow groan-inducing pun-artist) and, not too surprisingly, a highly regarded poet with many published works. His loyalty as a friend, his passion for planetariums and large format screen theatres, and his deep love for animals (his love of Marci was a given) all made him a special person to be around.

His widow, Marci Peterson, authored the following obituary, yet another testimony to the high regard in which Mark was held by his family, friends, and professional colleagues...

Mark collapsed at home in Port Hadlock, WA and was airlifted to Harborview Medical Center Hospital in Seattle where he passed away of heart failure, unable to say goodbye to Marci, his wife for 45 years.

He was born in Salt Lake City, UT, the youngest child of Ervin Miller and Grace. (Bunker) Peterson. After graduating from East High School in 1961, Mark served an LDS mission in South Africa from 1962 – 1964. Upon his return to Salt Lake City, he married Carol Jean Wahlquist and attended the University of Utah, graduating in 1968 with a B. S. Degree in Geography with an emphasis in Astronomy and Cartography. During this time, he was employed by the Hansen Planetarium as a staff lecturer, giving public and school presentations and assisting with star parties arranged by the planetarium.

More than anything, Mark loved to share his knowledge of astronomy with others and intended to make a career of it. In 1968, an opportunity presented itself to do just that. So he, his wife Carol, and their daughter moved to Denver, Colorado, where Mark was hired as Assistant Curator.

Mark was held by his family, friends, and professional colleagues...
of Gates Planetarium at the Denver Museum of Natural History. A year later, he earned the title of Curator and Director of Gates Planetarium. Under his guidance, he and his staff wrote and produced twenty planetarium programs, two of which were shared with fifty planetariums: Strangers in the Night, underwritten by Columbia Pictures in association with the release of their film Close Encounters of The Third Kind, and Whirlpools Of Darkness, underwritten by Buena Vista Distribution Company upon the release of their film The Black Hole. Eager to share his passion of the night sky beyond planetarium audiences, Mark taught astronomy at Metropolitan State college in Denver and at Arapahoe Community College in Littleton, Colorado. He designed and published a planisphere and mapped the night sky in a creation he titled Chart of the Heavens, which was originally published in 1969 and is still in print today.

Mark and Carol divorced, and she moved back to Salt Lake City with their two children. In January of 1976, he met his future wife, Marci Kasperski. They were married on August 14, 1976.

In 1982, Mark’s career went in a different direction when he conceived the idea of transforming the museum’s Phipps Auditorium into an IMAX theater. He raised $4.5 million dollars for the construction and the Phipps IMAX Theater became a blueprint for other museums wanting to build their own. It was known as, “the theater where everything was done right.” Mark worked as an independent IMAX/large screen theater consultant before joining White Oak Associates in the same capacity until his retirement. In all, he completed over a hundred projects around the world.

Astronomy was in Mark’s blood and retirement just a word. In the summer of 2016, he was hired as an assistant Park Ranger at Cape Disappointment State Park in Ilwaco, Washington. One of his assignments was to conceive four topics relating to nature and present them to day tourists, as well as the evening visitors in the park’s campground. His night sky lecture and telescope viewing had more attendance than any other staff member. There were two uncompleted projects that he was working on at home: a Hubble coloring book and zodiac coffee table book.

Mark will be remembered by those who knew him well as a gifted poet, philosopher, loyal friend, and animal lover who volunteered at Center Valley Animal Rescue (a no kill shelter in Quilcene, Washington). He was an excellent sailor, had an expert class ham radio license, but most of all, Mark was a compassionate and kind man with a great sense of humanity.

He is survived by his wife Marcia A. Peterson, Port Hadlock, Washington; two children: Christy (Bruce M) McDonald, West Jordan, Utah; Scott (Sherrie) Eggenberger, South Jordan, Utah; six grandchildren: Carter Prescott, Ryker, Tanner and Kemmer Eggenberger and Ryan and Alec McDonald; two siblings, Caryl Hepworth, Kaysville, Utah; Douglas (Bev) Peterson, Murray, Utah. He was preceded in death by his parents and one grandson, Andrew McDonald.

A collection of Mark’s poems will be published next year titled, Paint the Wind with Clouds. However, you can read some of his poetry now on:

www.poetrysoup/Mark Peterson

A GoFundMe account has been established to assist Mark’s wife, Marci, with the unexpected medical costs. To make a contribution go to,

https://gofund.me/380ae71b

Mike Bennett

September 12, 1944 – October 22, 2021

by Astronomical Society of the Pacific

The ASP and the astronomy community lost a friend last month. Michael Alan Bennett was a passionate life-long astronomer, educator, leader, coach and friend to many. He spread joy with his daily jokes, stories and puns — often co-opted from other sources — but always delivered with expert timing and a sly smile. He was also an avid sailor, like “Ratty” in Wind in the Willows who loved nothing more than “simply messing about in boats.”

At the ASP, Mike led the development of education and outreach programs funded by the National Science Foundation (NSF) and NASA, including the Night Sky Network, which supports public outreach by amateur astronomers nationwide. He also led teacher training programs, outreach to families and young children, and to professional astronomers through ASP’s professional publications. A seminal NSF-funded initiative instigated by Mike trains national park rangers across the country to establish and develop night sky programs. The goal of these park programs is to help the American public and international visitors appreciate this increasingly endangered resource.

As Lassen Park ranger Kevin Sweeney wrote, “[Mike’s] contributions toward the park, science, and education made an incredible impact. I am grateful to have been one of his students.”

While at the ASP Mike also put together the proposal for the Education & Public Outreach (EPO) component of NASA’s multi-million-dollar project to put the world’s largest infrared telescope in a 747 jet. This ongoing, now fully implemented program, SOFIA, the Stratospheric Observatory for Infrared Astronomy, allows research astronomers worldwide to make the observations necessary to understand the origins of galaxies and stars. As part of this huge NASA project, over 160 teachers since 2010 have observed its research operations while flying for ten hours in the 747 jet at the edge of Earth’s atmosphere. In turn, their students participate in the excitement of these voyages of scientific discovery.

Mike Bennett’s love of sharing astronomy with people is best expressed...
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Photo shot during the 2021 Digistar Users Group conference in Salt Lake City, Utah.
in the successful transformation of the ASP into the leading astronomy education organization in the United States, if not the world. Upon retirement, he chaired the ASP Advisory Council which provides strategic guidance and helps with fundraising. In later years Mike became well-known for his annual speech at the ASP fundraiser, known as the “Sermon on the Amount.”

Mike was the son of Leo and Anne Bennett, brother of Ced Bennett, and uncle to Dennis Williams, Clint Bennett and Zack Bennett. Mike passed away on October 22, 2021, having lived courageously for more than a decade of his life with cancer. His last day was spent onboard his yacht, Pacific Star, with his wife, Leslie Larson, afloat on the San Francisco Bay.

Mike, fair winds and following seas.

Donations in Mike Bennett’s name can be directed to the Astronomical Society of the Pacific.

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**Seeking What Works (con’t.)**

snow days, but I think from this point forward snow days will mean some academic time online satisfying the requirements of a school day, plus some playing in the snow without actually losing a day of school. No need to fret overnight if I’ll need to drive in dangerous weather in the morning. We can have remote programs/lesson plans ready to use. When we know of potential risky weather (not hard to do), the district can call it and not disrupt the calendar by having to make it up at the end of the year. Not perfect, but less disruptive in the end. I just have to remember to bring my laptop home when the snow is flying.

I posed this silver linings question to planetarium colleagues and received more to share.

Jenny Shipway pointed out that online conferences have allowed for a wider reach of participation. Some of us have attended conferences we never had the time or financing to participate in in the past. The conferences that have been online have been handled with grace and expertise as far as technical issues and glitch handling. I mean, isn’t that what we all do as part of our work anyhow? We are good at it! Online conference sessions are easy to click in and out of in an instant. Concurrent sessions that were recorded are easy to watch later and are easy to follow because it was intended to be online anyhow.

Alan Gould had a similar idea but pointed out that this did force us to become adept at Zoom or Teams or whatever new platform your institution required. I agree. And in so doing, it made us stretch the gray matter while frustrated because nobody wanted any of this to happen in the first place. Change (whether intentional or not) sometimes forces growth. Another positive spin is that empty planetarium chambers allowed time for improvements or work to be done that is hard to complete when shows are in session.

Simonetta Ercoli shared a similar thought that we HAD to find new strategies to engage our visitors online. This online Zoom thing is pretty much the opposite of our biggest strength, the experience of immersion being under a dome of a fantastic, simulated sky. It made us recognize the value of the human interaction with our live visitors that makes the learning most powerful. I saw that too. We planetarians are flexible and intelligent and experts at presenting what we know and live, so we managed to find ways to thrive in a limiting environment.

Shannon Schmoll shared that with online public programming, we were able to expand our audience. For instance, I did virtual shows for preschoolers in Florida and a holiday party for folks in Germany! Online programming has also allowed us to connect more directly with Sky Calendar subscribers who join our Facebook live sessions from all over the US. More local people recognize me now as the lady from Facebook. I feel more connected to our audience and our audience has broadened significantly.

Which brings me to Sara Shultz, who mentioned that she was actually giddy with excitement at her first live show with kids this school year. She is really grateful for the in-person shows she is able to do again. There is really nothing like having a group of people in the dome with you who can react and interact.

I hear you and I’m with you, Sara!

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**IPS Meeting Notes (con’t.)**

(NAEC). Kaoru and Jin are members of NAEC. Kaoru will connect with the officer of NAEC to start the conversation. Kaoru would like to start a working group to establish these partnerships. Michele mentioned Board Members can look to their affiliates for volunteers. ACTION: Kaoru will connect with Michele about finding volunteers among the affiliates.

New Business proposals for discussion will be added to the agenda for the July Board Meeting

Meeting called to close at 1:02 UT
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