

Vol. 50, No. 3

September 2021

# PLANETARIAN

Journal of the International Planetarium Society



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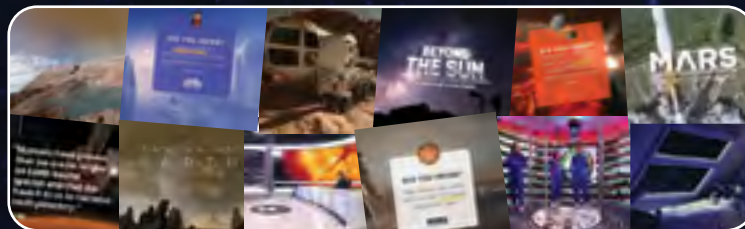
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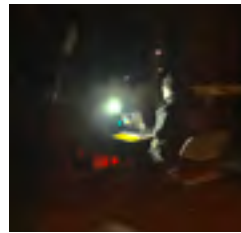
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## ON THE COVER

5.3-Day old crescent Moon  
Adam Thanz  
Captured April 17, 2021, 8:50 p.m. EDT  
Northeast Tennessee, USA

Astro-Physics Gran Turismo 130mm f/6.3  
Sony A7II, ISO 100, 1/20 sec.



The image was taken during one of our live observing sessions for YouTube hosted by the Dyer Observatory in Nashville, TN. We were a consortium of live broadcast telescopes in Tennessee. I

covered East Tennessee from my home. The other image is by Robin Byrne. You can see me on our deck with the telescope, computer and light on me. That image was taken in February.

During the April viewing, I was supposed to show a live view of the Moon. Unfortunately, the clouds were a real problem. Of course, after I did my first bit for the broadcast, the skies opened up for a little while. I captured this image and was able to share it in my second part of the broadcast. The clouds came in, but I was OK since I had this image. We were commenting on the sharpness of the image even with turbulent skies and shooting across our roof. We were also able to answer a question about color on the Moon as this image does reveal some subtle color. Serendipity does happen. Or, should I say selendipity?

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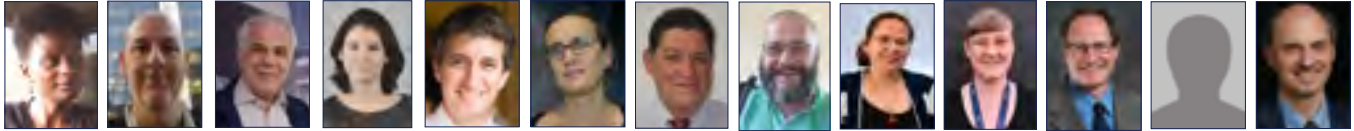
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Seriously. (And not just because that's how I started by calling last time.)

The past few months have been very surreal. We have been reopened for six months, and to my pleasant surprise, things have been going well! I can't lie, I was worried – would people have missed coming to the planetarium? Would they still want to come inside and explore science? Turns out the answer is a resounding “yes”! Shows are busy, requests for field trips are pouring in, and visitors are exploring the exhibits again.

Still, I have a feeling of constant uneasiness. COVID-19 case numbers are almost where they were a year ago at the peak. Hospitals are getting full again. For legal reasons, many places cannot require masks to protect those who are unable to be vaccinated. Many of us are having *deja vu*, returning to having

only one degree of separation (or fewer) between ourselves and somebody with a breakthrough COVID infection.

I find myself constantly waiting for the other shoe to drop and asking “this time around, what will that shoe-drop mean for us?”

I don't mean “us” as in myself and my Science Center and Planetarium, but yours, everyone's. All the Museums, Science Centers, Planetarium Theaters, etc. The spaces where people come to learn. Many were able to find ways to subsist through closure, but many lost good people due to the lack of revenue and audience.

I worry that we might be heading in that direction again; honestly, it keeps me up at night.

So, to you, my fellow planetarians, I ask, what keeps you at night? Am I alone

in this thinking? What helps you get through these kinds of things, and what steps might you and your planetarium be taking to be prepared for what comes next? I would love to share some responses and open a dialogue about what we can do to help support each in this as we move forward.

I would also like to thank the many planetarium facebook groups that have popped up, especially the meme ones. They are a vital source of levity in my day.

Also, unrelated to all of that. I would like to apologize to Tom Callen for mis-titling his column, and to anyone whom has dealt with the growing pains of the transition over the last few issues. I appreciate your patience, and I appreciate you letting me know what I can do better.

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# STAR OF BETHLEHEM

## HOW TO TELL THE ASTRONOMY CORRECTLY

By Susanne H. Hoffman

### Abstract

The star of Bethlehem is a popular and standard topic in many planetaria all over the (Christian) world. Since the production of dome planetariums started in the 1920s, the most common story that is told deals with a great conjunction of Jupiter and Saturn. Alternatives are hardly discussed in the public, although it has long been known amongst researchers that there was no special astronomical phenomenon that coincides exactly. Here, I present a brief discussion of all suggestions, including an analysis of the nova question with my recently developed, data-driven method that was successfully presented to the public. The goal is not to present an explanation, because there is no historical proof that the star existed at all. This paper is dedicated only to the suggestion of a narrative in the planetarium that communicates that this star is a symbol with a function in the story. Additionally, it provides the possibility to demonstrate a huge variety of astronomical objects and their appearance to the naked eye.

### INTRODUCTION: THE POPULARLY “KNOWN” EXPLANATION



Figure 1 Morning twilight in 7 BCE: Jupiter, Saturn and the Moon met on the 23rd. Simulation: Stellarium 0.20.3.

In the year -6 (7 BCE), there was a Great conjunction between Jupiter and Saturn: Within seven months, these two planets met three times.

On May 23rd, Jupiter and Saturn were separated by only  $1^\circ$  and the lunar crescent stood close to them (Fig. 1). Yet, the scenario took place in the

morning twilight. Therefore, Jupiter and the Moon were clearly visible but, because it is only as bright as the brightest stars (around +0.5 mag), it was hard to see Saturn.  $1^\circ$  separation means that the two planets (which appear very close in our small picture) had a visible distance of roughly two apparent Moon diameters.

During that summer, the two planets first moved away from each other and then approached again. They re-met at the beginning of October with a minimum separation of  $54'$  (almost  $1^\circ$ ) on October 5th and had another close approach at the beginning of December with a separation of a bit more than  $1^\circ$  on the 5th to 8th (Fig. 2). The astrological narrative for why this triple conjunction would have led to the voyage of three Babylonian astral scientists is, in most cases, the following: Jupiter is the planet of the king, Saturn is the planet of the Jews, and when they meet, something happens to the king of the Jews. This triple conjunction took place in the constellation of Pisces and, as we know, this constellation shows two fish that are connected by an umbilical cord, thus representing birth. Ferrari d'Occhieppo (1999) combines this story with zodiacal light.

For decades, it has been demonstrated in public talks and planetarium shows (e.g. Letsch, 1953: 62; Mucke, 1967) that the asterism that (according to Matthew's gospel) guided three scholars (magi) from the East (Babylon) to the place where Jesus was born, refers to the above-mentioned conjunction.

### CRITICAL POINTS IN THE POPULAR EXPLANATION

#### 2.1 The constellation

In Greek antiquity, the two fish were connected by an unexplained cord that was metaphorical and never explained. Only Aratos (362-370) describes it as the ribbon binding the two fish together, reaching to the comb of the sea monster, and that the two parts meet at an acute angle.

Eratosthenes reports that the two fish are descendants of Pisces Austrinus (PsA), a comment which might have led to the interpretation of the constellation as a sign of birth.

However, the gospel of Matthew reports that it was Babylonian, not Greek, astrologers who travelled to Israel. In Babylonian astrology, the



Figure 2 (Top): Two further conjunctions in October (left) and December (right) 7 BCE, Simulation Stellarium 0.20.3.

Figure 3 (Below): Babylonian constellations in the 2nd millennium (left) and the re-interpretation of the 1st millennium (right). Photos taken in Planetarium Jena (installation and photos: SMH).

constellation was not considered to be two fish. In the 2nd millennium, the astronomical compendium, MUL.APIN, reports that the Great Swallow constellation sits in place of the Greek constellations Pisces and Cetus (Hunger and Pingree, 1989; Hunger and Steele, 2018). Around the time of Jesus' birth, this huge constellation had probably been forgotten and replaced by the constellation of the Swallow-Fish, an unexplained creature that we can see depicted on seals from that time (Fig. 3). It is possible that the term originally designated a certain species of fish but was transformed into a strange image in the sky.

In Babylon, since the 7th century, there were astronomical 'diaries' that were created monthly to record happenings in the sky. Up to fourteen astronomers worked simultaneously on observations, computations of phenomena, and the development of algorithms for those computations. In the astronomical diaries, the great conjunction is described as occurring in the constellation of "the Tails"

(Hunger and Sachs, 1988-2014). This is an abbreviation of the "Tails of the Swallow," which is the part of the huge constellation that intersects the zodiac (cf. Hoffmann, 2017).

Obviously, the Babylonian constellation did not depict any descendants.

## 2.2 The planets

It is true that, since the beginning of written astrological records on significance, Jupiter has been considered the King's planet (Hunger and Pingree, 1999).

The interpretation of Saturn as the planet of the Jews seems to not be of ancient origin, but rather modern. Handbooks on omen writing have been preserved from Babylon showing that Saturn was known as the planet that stands for evil. It was so evil, in fact, that one should not call it by its name, but rather by the euphemism "the Sun of the Night" (Reiner and Pingree, 1998).

The interpretation of asterisms being associated with certain geographical regions exists in Babylon (Horowitz, 1998), but it is relatively rare in divination and not a concept of zodiac astrology. It was not used to determine the fate of single people.

**Result 1:** Neither the constellation (Pisces) nor the planet (Saturn) fit Babylonian omens and concepts of divination.

The idea of the Star of Bethlehem as a planet conjunction goes back to Johannes Kepler. He observed Supernova 1604 in an area of the sky where a conjunction of Mars and Jupiter had taken place one year prior. Thus, he suggested that it was possible that planetary conjunctions could create new objects. In his time, the weekday on which the Jews closed their shops and went to the synagogue was the day named after the planet Saturn (since Vettius Valens, +2nd c.). Thus, in the modern era, Saturn may have been considered somehow related to the Jews, but not in Antiquity.

In Kepler's time, Babylonian divination and the omen handbooks we have today were unknown. Cuneiform was only recently decrypted in the 19th century. Afterwards, it took some time before our understanding of Babylonian culture, astral divination, and practise and mathematical astronomy became complete enough to judge whether the suggested interpretation had merit.

## WAS IT A NOVA?

Transients are rarely reported in Greco-Roman and Babylonian astrology but there was a strong focus on them in Chinese divination (Pankenier, 2013). There is one record from China, with a copy in Korea, dated 24 April 4 BCE that reports "a fuzzy star in Hegu." A fuzzy star could be anything, e.g. a comet or a stellar transient that is blurred by the atmosphere or that has rays due to its brightness.

To exclude the possibility of a nova or supernova, we probed the area of the Hegu asterism for modern counterparts of such high amplitude stellar transients. Hegu is an asterism of three stars among which the brightest is Altair,  $\alpha$  Aql.

The record is listed among the possible "guest stars" in Xu et al. (2000: 130), which strengthens the hypothesis that this could be a stellar transient rather than a comet.

The map in Fig. 4 shows the little asterism surrounded by a circle with a radius of  $4^\circ$ . This is the main search field for possible counterparts. In the whole area, there are a few pulsars but no supernova remnants – not even

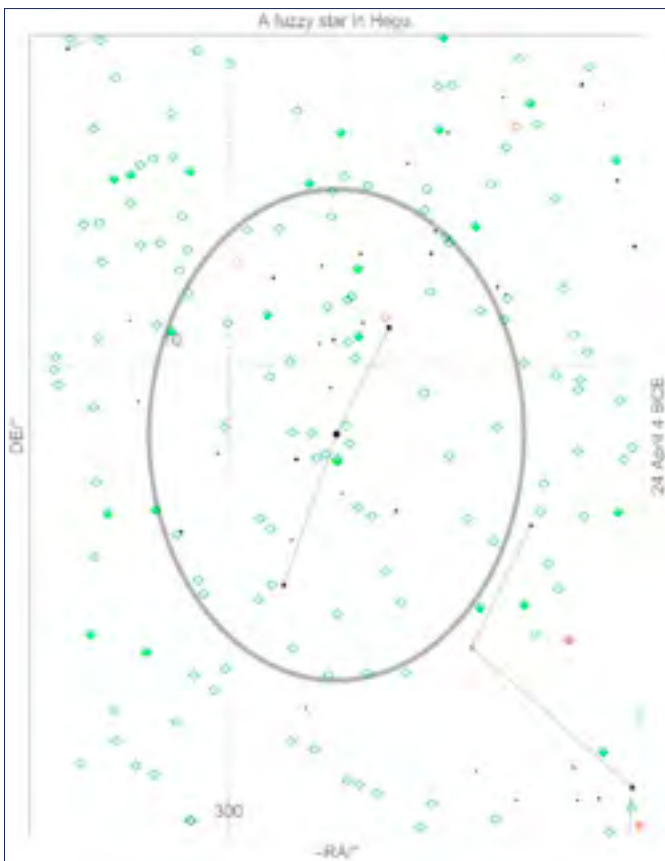


Figure 4 Map of cataclysmic and symbiotic binaries around Altair (coded in Wolfram Language: SMH).

just outside the search circle. This area includes part of the Milky Way, and thus, we expect a possible supernova relatively close (inside our Galaxy). A pulsar without a gaseous supernova remnant was found but appears much older than ~2000 years. Therefore, a supernova observation is not probable in this case.

A nova should also have produced a remnant in the shape of a nebula, but it is unknown on which timescales these objects evolve and vanish and if it would still be visible. There is no suspicious nebula in the field. Thus, we checked the field for all cataclysmic variables and symbiotic stars, which are depicted in green and orange, respectively, in our figure. Most of them are much too faint to flare up to naked-eye visibility, according to predictive methods and criteria defined in Hoffmann, Vogt and Protte (2020).

The five cataclysmic variables in our figure (highlighted with filled diamonds) passed our brightness filter of first instance and could,

theoretically, become visible to the naked eye. They are PSI-3PI J195042.77+082545.3, MASTER OT J194850.95+102828.1, MGAB-V850, V0725 Aql and MGAB-V1275. The Master optical transient has been detected only one time and is, thus, assumed a dwarf nova at peak. The quiescence magnitude is unknown. Both MGAB objects and the PSI have quiescence brightness of ~20 mag and, thus, turn out to be too faint in this area of bright celestial background (within the Milky Way) to become visible.

V725 Aql is the only remaining candidate

for a nova in Hegu. Its quiescence magnitude is 16.2 mag and typical nova amplitudes are 11 to 13 mag. If this system permits a classical nova, it could become 5 or even 3 mag. In case of a fast nova, the time of decline by 2 mag would be a few days, in which time it would fade to invisibility for naked eye observers.

However, a “new” 5 mag star could likely be overlooked, and a “new” 3 mag star would be easily visible, but not really bright in, or next to, a crowded star field.

**Result 2a:** It is demonstrated that there are no convincing candidates. A nova in Aquila in 4 BCE is not excluded, but highly unlikely.

There is one further possibility for a nova. In 5 BCE (year -4) a transient is reported in the Chinese asterism of Qianniu (the Draught Ox), 6 stars with β Cap as the principal star (western most). Only the records from the month of its appearance, March, is preserved and the duration of visibility of 70 days (Ho, 1962). The terminology “broom star” and the duration of more than two

months suggest a comet in preference of a nova, which is why Pankenier et al. (2008) and Xu et al. (2000) did not include it in their list of potential guest stars. However, since the list by Clark and Stephenson (1977) included it, we are sometimes asked to discuss it as well in public presentations.

As terminology in chronicles could be wrong or misleading, we did search for possible nova remnants in this field. No further records are preserved, i.e. no movement is reported. A stellar transient with the duration of 70 days could have been a slowly declining classical nova (Hoffmann, Vogt and Protte 2020; Hoffmann and Vogt 2020a, Hoffmann and Vogt 2020b). In the zodiac (Capricorn), it would likely be observed by any astronomer - in Rome and Alexandria as well as in Jerusalem or Babylon. Whatever this was, a nova in this area of the sky appears unlikely regarding the possible counterparts that are known from surveys on cataclysmic variables.

**Result 2b:** The suggested transient in 5 BCE was likely a comet.

### IS AN ALTERNATIVE SUGGESTION MORE LIKELY?

There is another suggestion of a possible conjunction of two planets that makes more sense in the thinking style of Antiquity: a close conjunction of Venus and Jupiter. Both planets have generally positive connotations in Babylonian astrology and are therefore more likely to serve as a good omen.

For instance, the clay tablet BM 75228 from the British Museum preserves a list of Venus omens with the schema ‘If Venus ..., then ...’. Of particular note is sentence number 9, which reads:

dDil-bat u dGAL it-te-mi-du LUGAL BE-ma BALA KUR2-ir dSAG,ME.GAR dDilbat ina iti [...]

“If Venus and the Great Star meet: the king will die, the dynasty will change – Jupiter Venus in month [...]”

Citations: Reiner and Pingree (1998:68,69). It should be mentioned that dGAL designates an asterism (the Great God). This shows that there are omens of the required type that announce a change of dynasty in connection with Venus and others.

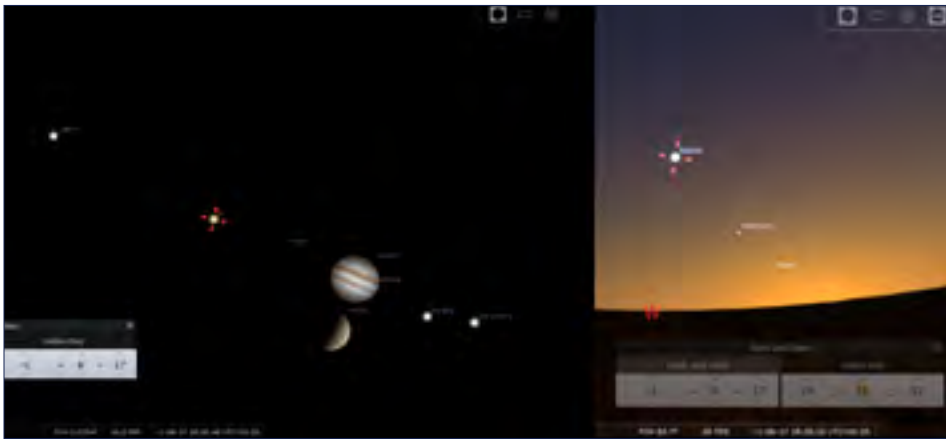


Figure 5 Apparent merger of the two brightest planets, Venus and Jupiter, in -1 (2 BCE) next to Regulus, the king's star. Simulation with Stellarium 0.20.3.

Interestingly, there had been two extraordinarily close conjunctions of Venus and Jupiter in the years -1 and -2 (2 and 3 BCE), both in northern summer, which does not fit the time of celebration of Christmas. Both conjunctions took place in the constellation of Leo the Lion, whose brightest star, Regulus, had been considered the king's star since the early times of Mesopotamian astrology (Hunger and Pringree, 1999). Its Sumerian name, LUGAL, the King, was also used later in Akkadian.

We can conclude that a conjunction of Jupiter and Regulus is a meeting of the king's star with the king's planet, and a conjunction (apparent merger) of Venus and Jupiter means something really good and strong for the king – at least in Babylonian astrology.

**Result 3:** The conjunctions of Jupiter and Venus appear more attractive to explain the “Star of Bethlehem” in regard to i) visibility, ii) concepts of divination in Babylon.

#### 4.1 Astrology in the epoch of Jesus' birth

Jesus' birth falls in the era of Caesar Augustus in Rome. As he, Octavian, was only a nephew of the earlier Caesar Gaius Julius, he systematically built a case to legitimize his claim as the rightful ruler of the Roman empire. In the biography of Augustus, ancient historian Sueton reports that Octavian, at age 18 a year before Gaius Julius' murder, had been in Apollonia with his friend Agrippa and visited the astrologer Theogenes (Augustus, 8,

94). Because Theogenes predicted an extraordinarily great fate for him, and a comet appeared a year later during the funeral games of Gaius Julius, Augustus put strong focus on astral signs. In contrast to the normal concept of comets as a bad omen, Caesar's comet was commonly connected with the deification of the dead dictator and a sign of hope. During this period, astrology flourished in the Roman empire and Augustus was a master at using this in his propaganda.

**Augustus' sign:** According to the oracle of Theogenes, Caesar Augustus, who was born in September, considered the sign where the Sun stood during his conception (in January) as “his” sign (Schumacher, 1988: 324). Thus, the strange creature of Capricorn decorated many coins, seals, art and official documents during the whole epoch of Caesar Augustus (Schütz, 1991). Capricorn is a Babylonian figure, a so-called Goat-Fish that was not understandable in Greek culture but had always been considered a good and helpful daemon in Mesopotamia. It is often depicted above Augustus's head (e.g. on the Gemma Augustea, cf. Zanker, 2009: Fig.182, p.233), or holding the globe of the Earth between his front legs (on several coins).

**Augustus' goddess ancestor.** Gaius Julius had already established a myth around his legitimacy as ruler of Rome due to his family's patrons. The Julian family was considered to be founded by the goddess Venus herself (Zanker, 2009: 46). This tradition was continued by Augustus when he also imprinted

images of this Venus Genetrix as his own ancestor on coins. In his old age, Augustus again applied these images to his designated heirs to the throne (Zanker, 2009: 218-227).

**Augustus' usage of Caesar's comet.** Since 42 BCE, Octavian had already started to promote himself as the *divi filius* (son of a god or of the deified dictator) and the newly appeared comet as sign of the *saeculum aureum* (the golden age) that was subsequently dawning. Therefore, he also used images of the Julian comet on temple walls and on his helmet, as it was considered extraordinarily positive by the public.

**Augustus in Alexander's tradition.** In Hellenism, it had always been tradition to depict a successful warrior king as Zeus/Jupiter. This tradition started with Alexander the Great when he was considered deified in Egypt and his own entourage adopted this view. The depiction of Augustus as Jupiter on the Gemma Augustea is most famously known, but the tradition was widespread (Zanker, 2009: 232-239).

In summary, Caesar Augustus was equated with the god Jupiter and legitimized himself by claiming the goddess Venus as his ancestor. An apparent merger of the planets of Venus and Jupiter was, therefore, yet another great propaganda tool for him, demonstrating his legitimate claim of autocratic rule.

As it was visible all over the empire and easily recognisable by everybody, this was a welcome ‘confirmation’ by the gods of Augustus's claim.

**Result 4:** The conjunction of Venus and Jupiter suits Caesar Augustus's propaganda perfectly.

#### 4.2 The context of Matthew's story

Jesus was murdered ~30 years later and Matthew wanted to convince people of the deification of Jesus. As explained in the literature, the Jewish religion requires the messiah to appear together with a star – as is the case in many cultures. Furthermore, there is a strong legitimacy lent by the family tradition

(Continued on pg. 22)

# JAWAHARLAH NEHRU PLANETARIUM IN A NEW AVATAR

By Pradmod G. Galgali



Aerial View of Jawaharlal Nehru Planetarium, Bengaluru, India. The planetarium dome is on the left side and the dome on the right houses a Zeiss 150 mm Coude Refractor.

Jawaharlal Nehru Planetarium (JNP), Bengaluru (Bangalore), was established three decades ago by Bangalore City Corporation. It is now administered by Bangalore Association for Science Education (BASE). JNP is a non-profit organization, fully funded by the Karnataka State Government. It conducts six planetarium shows every day barring Monday, which is the weekly day off. The first two shows are preferentially reserved for schools on prior arrangement, who need to book the entire theatre of 200 seats. Students make up 50 percent of our annual visitors, and a large percentage of those come from neighboring, rural areas. Under-privileged students, children from orphanages, children of migrant laborers, and physically challenged persons are admitted to the planetarium without an entry fee. Every year, over 5,000 such persons make use of our facility.

JNP has two objectives: the popularization of science, and non-formal science education. Our popularization activities, apart from sky-theater shows, include a visit to Science Park, monthly sky-gazing program, and viewing of astronomical events. During eclipses, transits, and conjunctions, JNP becomes the place to go for the citizens of Bangalore. Thousands of people, and a large amount of print and electronic media, assemble at JNP to view such events. Arrangements made by JNP benefit a large number of on-campus visitors, and also the numerous people watching the event on television from the comfort of their homes. These celestial events, especially the eclipses, not only arouse people's interest in science but give us the opportunity of debunking the age-old myths and superstitions associated with eclipses.



Above: Students escorted by teachers waiting for their show. Below: Viewing of Partial Eclipse at JNP.

Non-formal science activities cater to students of varied levels: Science Education for Early Development (SEED) for primary school students, Science Over Weekends (SOW) for high school students, and Research Education Advancement Program (REAP) for undergraduate students. More than 135 students who attended JNP's non-formal science education programs, such as REAP, have proceeded to complete their Ph.D.s and have joined different Research Institutes as faculty in India and abroad.

## The long journey from the opto-mechanical era to hybrid systems

In the beginning, the sky-theater had an opto-mechanical projector, RFPDP with its three standard auxiliary projectors (orrery, Jupiter with 4 moons, and shooting stars) manufactured by Carl Zeiss, Jena (of erstwhile GDR). JNP opened to the public in December of 1989 with an in-house, pre-recorded sky-theater show, "Our Sun & his



The Zeiss RFPDP projector, a video projector stands near the center, seating is concentric - a few years before modernization.

family.” The show was successful, and its appeal drew from a good amount of science interspersed with references of the star, Sun, and its family in Indian culture and history. The illustrations, cartoons, and music used in the show all had local flavor. So far, JNP has produced over 25 shows on diverse topics in two languages, English for cosmopolitan visitors and in the state language of Kannada. With every passing year, the planetarium has gradually gained popularity among the public, and the current (pre-pandemic) annual attendance was over 300,000.

Before the video and digital era, the special effect projectors (mostly slide projectors) were very important for illustrating themes of the show, and every show demanded a new set of unique special effects. These were designed and fabricated at the planetarium and our stock steadily grew. The availability of small, fractional rpm motors and a variety of lenses was a game-changer; over a period of time, we fabricated more than 100 special effect projectors. And then, in the mid-nineties when 3-gun RGB video projectors became easily available, we installed one and added another a few years later to show animated videos relevant to the show theme. Apart from using off-the-shelf, commercially available video clips, we created our own content as well. The video projection technology changed and improved with time, so in 2007

we replaced our video projectors with three new ones. Evolution was also taking place with audio system technology. In the beginning, JNP played back its show-audio through a 1/2” Revox spool deck. In just five years, the first transition came, and the entertainment

industry began to move to Digital Audio Tape (DAT) players. At JNP, we updated our audio system from spool to DAT, DAT to CD, then into DVD, and finally to digital audio recorded on computer disk drives. Haven’t we all undergone this process?

### Mirror Dome Projection System



The author (right) in dialogue with Dr. Paul Bourke as the latter installs a new Mirror Dome projection system in 2012.

In 2007, we had a major up-gradation in the form of an additional Mirror Dome Projection System. It was conceived of by Dr. Paul Bourke of Swinburne University, Australia. We used it for all-video shows, like Hubble Vision-2 by Loch Ness Productions and our own biographical show “Acharya Jagadish Chandra Bose”, “Mars – The Red Planet”, and others. For some shows, the Mirror Dome system was used along with the opto-mechanical RFPDP projection system, such as, “Our Solar System.” These shows were made of an initial star-talk where

stars, constellations, and the zodiac were discussed, and digital video was projected from the Mirror Dome System to illustrate some phenomenon.

Our show operating engineers became so dexterous with the manual control of RFPDP and Mirror Dome System that it gave viewers the impression of some kind of automation system in action. Some of these shows were hearing impaired friendly. For this, we produced special shows with Kannada and English subtitles.

The Mirror Dome System was upgraded in 2012 to a new version with higher resolution.

### The new Hybrid Avatar

Finding spares for our aging RFPDP projector becoming impossible, and growing popularity and availability of the new paradigm of computerized projection systems prompted us to go for a whole-hog revamp of our sky-theater in 2016. We opted for a Hybrid Projection System: a ZKP4 opto-mechanical projector and six-channel fulldome Velvet Digital Projector System, both from Carl Zeiss, Germany.

The occasion provided an opportunity for a complete overhaul of everything in the sky-theater: projectors, audio system, seats, sound-absorbing material, electrical

wiring. Everything was dismantled and replaced, including the central air-conditioning system. Only the old projection dome was retained and repainted. The seating arrangement in the sky-theater was changed from all-on-one level concentric seating to unidirectional tiered seating with a slope of 90. Normally, it is expected that a transition from concentric to unidirectional brings a reduction in seats, however, we have squeezed in and retained the same number of seats – 210. We are a little cramped but so far no one has complained. Since we



(Top) Overhauled sky-theater with new ZKP4 and velvet projectors, unidirectional tiered seating arrangement. (Above) Constellation artworks by renowned artist Mr. Chandranath Acharya.

decided to retain our old aluminum, 15-meter projection dome, we did not disturb it from its horizontal alignment as this would have entailed making drastic changes to the dome structure and perhaps even building a new outer structural dome.

Retrofitting the new hybrid system into the existing building necessitated several modifications. A service corridor along the periphery of the dome was created to house the digital velvet projectors. The flooring tiles of the sky-theater were removed to reduce the burden on the supporting structure, and also to make room for the additional load of the steel structure required for tiered seating.

All these jobs, and installation and commissioning of hybrid system, were completed in a nine-month period between March and November 2016. After tests and trial runs, JNP was ready for operation in its new avatar in December 2016.

In the meantime, JNP introduced another piece of customization: installing unique artwork of constellations by a renowned local artist, Mr. Chandranath Acharya, in the new digital system. Now JNP has two sets of constellation figures, the line drawings provided by Carl Zeiss in ZKP4, and our own constellation artwork in digital format.

The new system projects stars and planets with good image definition by the ZKP4 star projector and seamless immersive video through the high contrast, six-channel velvet video system. The 5.1 audio-system enhances the experience.

Planetary bodies with vivid details, floating in the starry sky projected with the video projectors, give the feel of space travel. The Powerdome III Zeiss proprietary software integrates smooth control of the star and video projectors. Another addition to the sky-theater is the LED cove lights with many hues and features.

In keeping up with its tradition of in-house show production, JNP has produced two shows for the new hybrid system. They are, “Celestial Fireworks,” which covers explosions on various scales like a meteor burst, supernovae, and the big bang (if that can be called an explosion), and another show on a popular theme entitled “Our Solar System”.

The new computer powered projection system, unlike the earlier system, is compatible with other digital systems. This feature has enabled JNP to screen excellent shows produced by other producers. Such shows screened

so far are “Dawn of the Space Age,” “Exploring the Universe,” “Stars,” and “To Worlds Beyond – Journey through the Solar System.”

JNP regularly conducts live night sky observation sessions in the sky-theater. These are followed by viewing of planets and lunar craters through telescopes. It is an enthralling experience, for both the viewers and the presenters. A visit to the planetarium is considered incomplete without a walkthrough of the science park, which has over 45 hands-on exhibits to enjoy and learn science. Our ‘Anti-gravity Cottage’ is a big draw; it gives visitors an unforgettable experience of skewed gravity, like water flowing up, wayward pendulum, and visitors precariously leaning while standing on a platform.

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### Jawaharlal Nehru Planetarium, Bengaluru – timeline & milestones

- Website: [www.taralaya.org](http://www.taralaya.org)
- Opened: December 1989
- System: Zeiss RFPDP
- Projection dome: 15 meter perforated aluminum dome
- Seats (concentric): 210
- Addition of Video Projectors: Began in mid 90s
- Addition of Mirror Dome System: 2007 and its up-gradation in 2012
- Closed in March 2016 for 9 months for overhaul of the sky-theater
- New Hybrid Avatar: December 2016
- System: Zeiss ZKP4 and 6-channel Velvet projection system, 90 tilted floor, horizontal dome, 210 unidirectional seats.

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# SURFACE VS. VOLUME NEBULAE, TAKE 2

By Nico Koning & Wolfgang Steffen

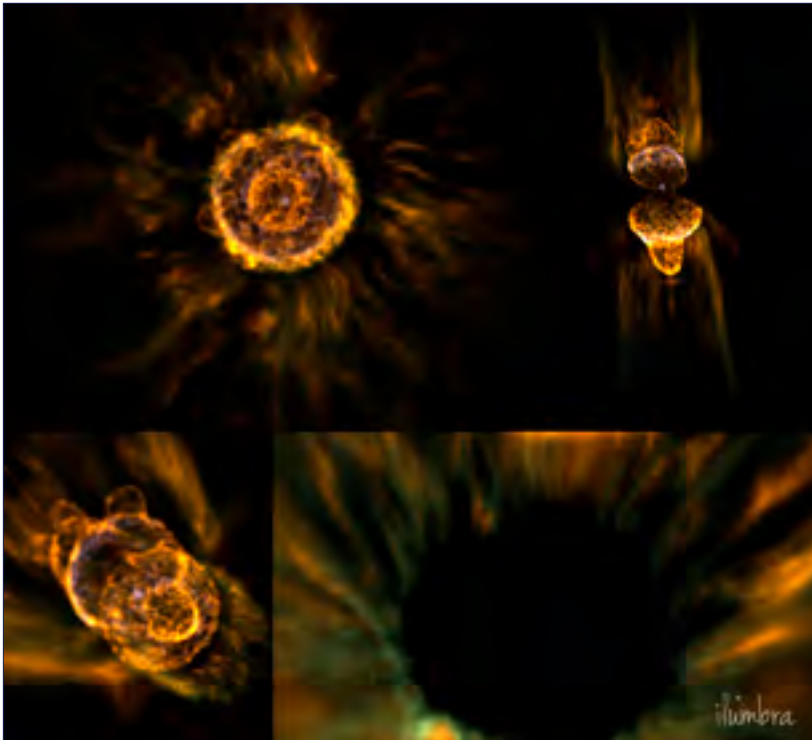


Figure 1: Different views of ilumbra's volumetric model of the Ant Nebula are shown as captured from an interactive visualization. The view at the top-right is as seen from Earth, whereas the views on the left are during a flight into the nebula. At the bottom right, the virtual camera is inside the nebula, looking outwards (Image: ilumbra.com).

again, that is true only for the optical emission that comes from the outer shockwave.

An important aspect of most supernovae is x-ray emission. It provides proof that the interior is still a very hot gas. This emission is distributed throughout the volume enclosed by the optical bubble, and therefore requires a volumetric representation. Omitting the x-ray emission from a model would be withholding a key piece of information for the understanding of the phenomenon. Although the x-ray emission is not visible to the human eye, it has become customary to include it in images as a light-blue glow. Volumetric, 3-D models can take care of this, while a surface representation will not allow a filled interior of the bubble to be visualized correctly.

Supernova remnants, such as the Crab Nebula (M1) or Cassiopeia A, have more complex filaments throughout much of their volume, even for the optical emission. This makes a surface representation unsuitable if the planetarium presenter endeavours to fly around or even through the nebula.

Planetary nebulae are similar to supernova remnants in that they are ejecta from a star and often have a mixture of filaments and shells. In this case, it is a star with a mass similar to the sun that is running out of hydrogen fuel. Usually, planetary nebulae are more complex than supernova remnants, having several shells in addition to complex bi- or multipolar structures that may penetrate each other. These cannot be considered thin surfaces.

The Ant Nebula (Menzel 3) is a beautiful example. In Figure 1, there are several views of ilumbra's volumetric model of this nebula. The reason for this complexity and variety is that a planetary nebula is not the result of a single explosion, but rather a sequence of ejection events and stellar wind interactions at different times and velocities. Bipolar structures, such as those in the Ant Nebula, are thought to be caused by the changing interaction between two stars in a gravitationally bound binary central star system.

In Take 1 of this discussion of surface versus volume rendering for interactive visualization of astronomical objects in planetarium live-presentations, we found that surface rendering wins big over volumetric modeling for the solar system. Surfaces rule in the solar system, and they allow efficient and realistic rendering of most objects in our solar neighborhood.

What about further out? This time, we will discuss surface and volumetric rendering for supernovae, planetary nebulae, and star forming regions.

## Nebulae from stellar ejecta

Supernova remnants are the ejecta from the explosion of a massive star after it runs out of thermonuclear fuel and collapses onto its core. The rebounding shock wave hurls much of the star's material into interstellar space, replenishing it with gas enriched in heavier elements that were synthesized during the lifetime of the star.

The structure of the supernova ejecta varies a lot. The cases where surface models might be adequately employed are the few supernovae remnants that are similar to soap bubbles with an emitting shell of gas that is very thin compared to its diameter. An example is the "Red Bubble" (SNR 0509-67.5). Then

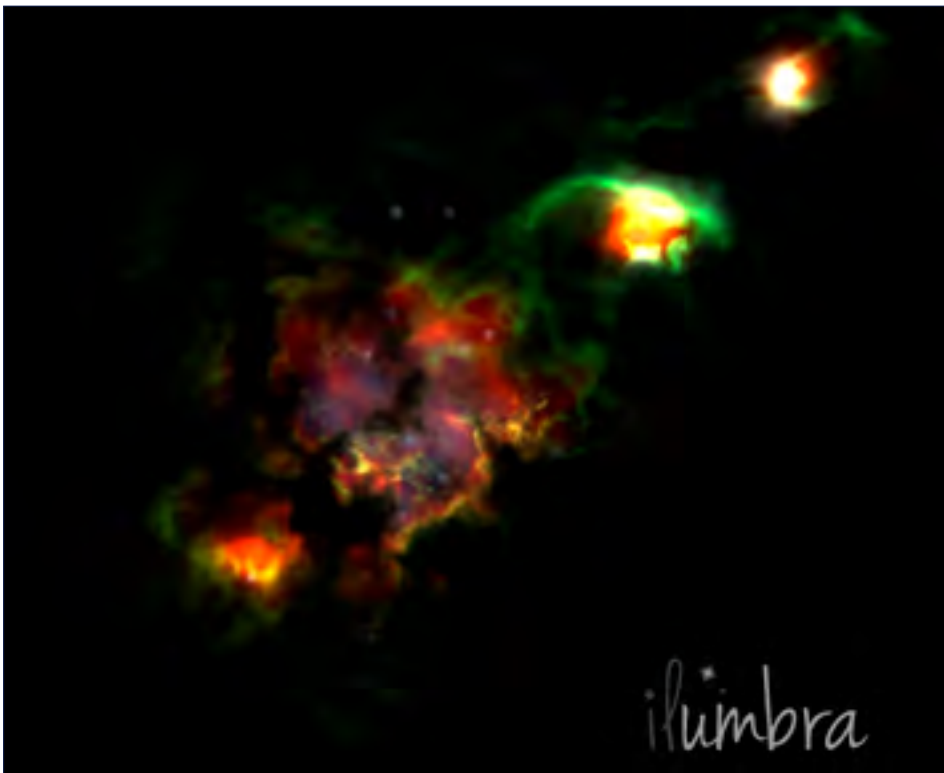


Figure 2: A rendering of a volumetric model of a generic star forming region with multiple bubbles and a popular color scheme frequently used by astrophotographers (Image: ilumbra.com).

Unless the planetarium presenter does not move the virtual camera too far from Earth's line of sight, a suitable representation with a surface model is hopeless and volumetric 3-D models are the only real option.

What about nebulae such as the Orion Nebula and other cradles of star formation?

### Star forming regions

Star forming regions are highly complex clouds of gas, dust, and stars. The radiation and the stellar winds of fast tenuous gas, that young stars eject, interact with the very cloud from which they formed. The combination of stellar winds and radiation creates high pressures on the inner region of the cloud, which causes it to expand. Eventually the young star emerges from its shroud by blowing out a cavity in its environment through a mechanism known as "champagne flow". It is like a champagne bottle that suddenly opens, and it blows away the cover of gas in the weakest region of the environment. Thus, on this blown out side, the dust shroud clears and the new star cluster

becomes visible to observation in an optical telescope. In the form of beautifully structured dust filaments and gas, excited by the young stars to emit in a characteristic pink color, a new star forming region appears in the landscape of interstellar space.

The complexity of structure in star forming regions, along with the highly variable transparency of dust filaments, results in several challenges that apply to both volumetric and surface models. First of all, there is important structure to be shown at all spatial scales. The spatial resolution of the model sets the limit to which details can be appreciated. This might prevent important phenomena, such as stellar jets or the so-called proplyds, from being suitably included in volumetric models.

Currently, volumetric models have limited resolution for depicting this amount of detail on conventional commercial graphics cards. A secondary consequence of this is potential aliasing problems in regions with sharp edges and high opacity, such as the famous dusty columns in the Eagle Nebula (M16) that are being evaporated by photons from nearby stars. Special algorithms in the modeling, together with

antialiasing corrections by the graphics cards, alleviate this issue. Future advancements in graphics card capacity will greatly reduce these problems.

New methods are under development at ilumbra that will allow small-scale details to be incorporated into the model landscape without substantially increasing the memory and processing footprint. These are prospects for amazing interactive "rides" through interstellar landscapes in the not-too-distant future of live presentations in planetariums.

While surface models have fewer problems with spatial resolution, their key challenge is that most of the volume of star forming regions is filled with absorption from dust and emission from gas at various densities. Modeling this with surface methods, in a way that is convincing from different viewpoints in an interactive show, is not really possible. There will always be sharp edges in the wrong place and regions without appropriate emission or absorption.

Hence, a surface model does not work at all in this case if the camera view is to change substantially during a live presentation. The incredibly complex physical and structural situation in a star forming region requires a volumetric model, since filling the space with structured gas and dust is part of the requirement.

In conclusion, in the realm of supernovae, planetary nebulae, and star forming regions, it is a clear win for volumetric, 3-D models over surface modeling methods.

At this stage, you will probably be tempted to ask how we, at ilumbra, figure out the structure along the line of sight that can not be extracted from images? In Take 3 of this series of articles, we will look at "the line-of-sight problem," providing a more detailed explanation of how we determine the structure in the depth direction, that in most cases is not directly accessible from photographic images of a nebula. Hint: astrophysics' most powerful tool is key.



# THE SOUND OF A CHILD REBORN

## REVISITING AN OLD FRIEND

By Charles Lawson

*A once planetarian revisits an old friend, and tries to put a new shine on its classic form.*

One of my most memorable life experiences is my mom taking me to a presentation of Jack Horkheimer's *Child of the Universe* during its original run at the Miami Space Transit Planetarium in 1972. I was literally a child myself then, but I was mesmerized by the entire adventure from the moment we entered that enormous (to me) dome.

Me: "Why is there a kaleidoscope up there?"

Mom: "It's pretty, isn't it?"

Me: "Why is the word 'attitude' spinning around over there?"

Mom: "Well, maybe it's like what 'attitude' means for an aircraft or spacecraft. In space, there is no absolute up or down."

Me: "Why are they playing this crazy singing music? It doesn't sound modern and spacey like the stuff they play at the Buehler Planetarium before a show."

Mom: "I don't know. There's probably a reason, though. Maybe they will explain it later."

Well, anyone who ever saw this show during its various runs in various institutions around the world knows that everything I asked about does, indeed, appear for a reason. The music choices in particular fascinated me and accelerated my developing passion for music of all kinds. I had never heard of Kurt Weill before that day, nor had I ever heard Gregorian Chant or music by György Ligeti, but as the narrator, William Hindman, entreated us, I allowed *Child of the Universe* to open my mind as well as my eyes and ears. I was never the same afterward.

Part of the ear-opening was the stereo soundtrack (this was the first planetarium show I experienced in stereo) and, because the speakers were hidden behind the perforated dome, the sound seemed to be coming from everywhere, beaming at me from space itself. I absolutely loved it. I could never be satisfied with flat mono sound in a planetarium again, or even in a cinema or on television.

Zoom forward a few years, and I became a console operator (or "performer" as Jack Horkheimer used to remind some of us) at that very planetarium. Would I ever run *Child of the Universe* myself? Well, the show had made at least one reappearance since I first saw it, but Jack did not seem to think it would come

back again. After all, NASA had landed Viking on Mars by that time, and the Pioneer craft had sent back stunning new data and images of the solar system beyond Mars. The early 1970s planetary tour featured in *Child of the Universe* was rapidly becoming archaic. However, to my great surprise and delight, I was asked one day to come watch a demo of the show as a prelude to learning its operation. *Child* was returning, after all!

I had done a lot of audio production by then and, upon beginning my work with the show, became keenly aware of what the ravages of time and repeated playback had done to the analogue show tapes. I even offered to remix/re-produce the audio for this run, but Jack was unenthusiastic and seemed convinced this would be the show's swan song. Still, I continued dreaming of renovating the soundtrack to preserve this program that so many people in the industry had called a "classic."

I eventually moved into a broadcasting career that enabled me to follow the digitally remastered releases of much (if not all) of the music used in the show. I collected a lot of it to enjoy on its own outside of the planetarium and, when I discovered that the Miami STP was still running *Child* on a regular basis many years after I had left, it rekindled my notion of renovating the soundtrack with the modern digital tools now at my disposal. I finally had enough good reasons to touch up the soundtrack when I heard that James Albury of the Kika Silva Pla Planetarium in Gainesville, FL had created a full-dome version with new, more modern visuals and the goal to keep *Child* available as a museum piece of sorts. With the looming 50th anniversary of the show in April 2022, and with the COVID pandemic limiting my other work in early 2021, it seemed to be the time to bring as much of the *Child of the Universe* soundtrack into the 21st Century as I could.

After I posted a speculative message to a Facebook group, James Albury made a digital transfer of the existing soundtrack available to me to audition and determine what I could do. The transfer had obviously been made with great care, but the source material was suffering badly. The first thing that struck me was the hum. Layer upon layer of 60Hz hum and harmonics were burned into the original production mix. I remembered it from my time running the show decades ago, but I didn't recall it being this bad! That is probably because added noise of this kind was much more common in

the '70s and '80s before digital audio took over the world, but the ensuing decades had made the hum all that more objectionable in today's environment. There were multitudinous audio dropouts in the aged analogue original, too, and I began to think only a full remix would be adequate to truly clean up the show enough to match a modern, visual presentation.

Was it possible to do a full remix using the original voice track elements? I asked everyone I could think of if they had access to that material, but I came up empty handed. It would seem that the best I could do would be to apply the latest noise reduction technology to the existing material and, perhaps, drop in some of the newly remastered music (where it appeared clear of narration) to help combat tape dropouts.

I began with a spectrum analysis of the complete program to identify exactly which noise elements could be removed without digging into content that was actually part of the show. Then, using some forensic software, I was able to design custom filters and employ them segment-by-segment to decrease the hum without adversely affecting the essential frequencies. Next, using the original file as a timing template, I reassembled the de-hummed segments and auditioned the result. Big improvement, I thought, but there is obviously still a lot to be done.

Aside from the hum, I noticed a little nagging thing when listening to the Galileo scene early in the show. I distinctly remembered Galileo's character being on the right side of the dome, yet he was appearing in the left channel of the audio. Could there have been a channel swap? I listened carefully to some of the orchestral music in the show and, sure enough, the orchestra orientation was reversed from a typical recording. The left/right presentation of "Desiderata" (used at the end of the program) was also reversed compared to the remastered CD release, so I determined that somewhere between original production and this digital transfer, a channel swap had crept into the process. I did a global left/right switch, and things subsequently matched my memory as well as the remastered music.

Once the hum was removed, though, the room and turntable rumble it had

been masking in the narration and music became all too evident. I ran another spectrum analysis, isolated the offending frequency ranges, and came up with some customized algorithms to reduce the rumble, once again without cutting into any desired frequency content. Getting better still.

With this new level of cleanup, the large thumps that occurred at every splice on the original analogue tape were now pretty objectionable. Where possible, I remixed the thumps away using remastered music or effects elements. Where a remix was not possible, a forensic de-thump tool smoothed these jarring transitions.

Next, it was time to fight the dropouts at the top of the show by replacing the first bit of the Overture from Weill's *Threepenny Opera* with the digital remastering of that material. This went a long way toward giving the show a fresh start, since time and usage had taken an especially heavy toll on that early section of the analogue tape.

The rocket launch preceding the main title sequence had bothered me from the first time I experienced the show because there were two large and very obvious "needle skips" in it! Apparently, the LP used during the original production was damaged and impossible for the stylus to track. I desperately wanted to fix that, if possible, but I had no idea what the original source material was. I checked with one of the people who produced the soundtrack, but that crucial bit of information was beyond easy recall. Some quality time with a few search engines finally uncovered the original album, and I looked to see if a modern remastering had been done and might still be available for purchase. Yes! There was one copy left and I ordered it immediately. When it arrived, I plopped the remastered launch into the show, but the sequence was now a little bit longer since the needle skip repairs had reinserted material previously passed over. Would this cause a problem for the fulldome video? It seemed likely that some adjustment would be necessary in the timing of the program down the line. James Albury confirmed this when I inquired but creating more work for him was something I wanted to avoid. I had planned for this project to be a direct drop-in replacement for the audio,

after all. To keep James from having to resync and re-render anything, I found an appropriate spot to make a digital crossfade that would maintain the show's original rocket launch length. So far, so good.

The song used in the main title sequence is a classic rendition of "Lost in the Stars" by Kurt Weill and Bertolt Brecht performed by Lotte Lenya. The original version used in the show was taken from a monaural vinyl LP, but I knew there had been a stereo version released, too. When it became available on CD, I snapped it up right away. I dropped it into the show right after the revamped rocket launch, and now the entire main title sequence was refreshed and in stereo for the first time.

The short narration segment between "Lost in the Stars" and the creation of the solar system was completely in the clear and had always been plagued by a crackle/buzz in one channel for the first few seconds. I could have just grabbed the cleaner of the two channels to use here, but Jack Horkheimer always liked to record his narrators with two microphones in a spaced stereo arrangement to make playback in the dome more all-enveloping. If I had suddenly collapsed the narration to mono at this point, it would have been pretty harsh. Also, the better of the two channels, noise-wise, was not the better of the two in actual sound quality. I suspect different types of microphones were used in each channel during the original production. Consequently, the repair method would have to be digital noise reduction and buzz/crackle removal. I employed three different processes to best expunge the objectionable noises while preventing the introduction of significant audible artifacts. It's easy to push it a little too far, when using digital de-noise software, such that the artifacts are more noticeable and objectionable than the original intruding noise might have been.

The next big task I always wanted to tackle was to redo the solar system tour in stereo. The original sequence was mixed brilliantly with spectacular Bernard Herrmann music, but for some reason it was not produced in stereo. That always bothered me when I ran the program in Miami because the sound suddenly condensed down to mono at that point and robbed the most dynamic sequence in the show of considerable drama. I really wanted to remix that tour,

even way back then, but I never got the chance. It appeared I never would since no one could locate the original voice reel to allow a proper remix. However, recent developments in audio restoration software suggested it might be possible to extract the narration of Sally Jessy Raphael from the original mono music mix and slip it into a new stereo remix. Why not give it a try? Well, the individual extracted elements sounded pretty rocky at first, but with judicious massaging, I was able to smooth out the narration well enough to use in a remix.

I had not given enough thought to speed variation, though, and this proved a huge issue to overcome. The original tape machines (Ampex 600s) were orders of magnitude less stable in the time domain than modern digital gear. Consequently, each music element to be replaced had a slightly different tempo from the digitally remastered version I intended to use. I naively thought one speed difference measurement would be enough to calculate what correction to make for the entire sequence, but oh my, no. Each individual chunk of music had to be measured against the proposed replacement, and a correction factor calculated, to maintain even a semblance of synchronization. Even so, there was enough speed variation in some of the longer segments to require careful re-sync nudges here and there. With help from human psychoacoustics, the entire process came out surprisingly well. After nearly half a century, my favorite part of *Child of the Universe* is now in stereo and more dramatic than ever!

The next technically troublesome part of the show was the prelude to the sequence discussing the history of Earth life. It opens with a ticking clock, which soon overlaps Ruth White's electronic realization of "The Snow is Dancing" by Claude Debussy. The clock itself had a lot of odd, harmonic 60Hz buzz that needed to be removed. There was also a bit of mechanical thumping from manipulation of the huge Rek-o-Kut® transcription turntables used in production. In addition, the clock ticking, and the music, rapidly went out of synchronization as they blended, which tended to aggravate musically sensitive people. (During my time running the show in Miami, I was

approached at the console about half a dozen times by folks who were truly bothered by this and stayed after the program was over to complain! Hard for me to believe, but there it is.) I extracted the clock ticks that were not marred by turntable thumping and strung them together into a new block of ticks. Then, I de-buzzed them and measured the difference between the tick rate and the music tempo in order to adjust the clock ticks to maintain the beat. Perhaps musicians will be less disturbed by this new mix when it appears.

The tail end of the Monolith sequence, which considers the possibility of extraterrestrial life, was blighted by extensive dropouts and a mechanically noisy transition into the poem, "Desiderata." I was able to replace the Ligeti music there with a digital remastering, which solved the dropout problem, and I made a new transition into the remastered version of "Desiderata." Finally, a remastered version of the Tchaikovsky Symphony No. 5 excerpt at the end of the program was added in place of the dropout laden version from the analogue show reel, so the audio is now clean from the end of the narration through "Desiderata," the closing credits, and walkout music.

Many more minor adjustments and fixes have been made to the audio, all done with careful regard to the original cues and music posts so this newly renovated version of the soundtrack can be a direct drop-in replacement for any presentation of *Child of the Universe* that may still exist. Without access to the original voice track recordings, the sound is as pristine as I could make it with current technology while adhering to the spirit of the original production.

After reading this far, you may justifiably be wondering: "Why go to so much trouble for such an old show?" Well, I know the program is woefully out-of-date in many factual regards, but not nearly as much as I would have expected due to its generalized content. I also know that *Child of the Universe* holds a special place in planetarium history for changing the way an awful lot of people viewed The Planetarium and what they could expect from one. Even planetarians who hated the show, for whatever reason, could not escape the influence it had on star theater

presentations, and I personally heard from facility directors and producers around the world who told me how it changed the way they did things. A star show so influential, and one which garnered an international multimedia award, deserves some commemoration. As we approach the 50th anniversary on April 20, 2022, it seemed a perfect time to try to bring the soundtrack a bit more up to date to match the fresher full-dome visuals put together by James Albury. It also seemed an appropriate homage to Phil Trick, George Singer, and Jack Horkheimer himself (a founding member of the IPS), who did such an amazing job on the original soundtrack production all those years ago.

Plus, I confess, it was just plain fun for me to revisit this material while exploiting the capabilities of modern audio software. And, if any other planetaria/full-dome theaters around the world see fit to celebrate the golden anniversary of *Child of the Universe*—however briefly—using this renovated soundtrack, no one will be happier than I.

.....

Charles Lawson is Senior Recording and Production Engineer at WETA in Washington, DC and Recording Engineer/Producer for the National Symphony Orchestra at the John F. Kennedy Center for the Performing Arts. It's unlikely he would have either position without the benefit of his multimedia planetarium experience as a youth.

Special thanks to Phil Trick, the technical wizard behind the original *Child of the Universe* soundtrack, for his valuable insights and recollections in this renovation process.

NOTE: The audio restoration software used on this project included Izotope, Algorithmix, WAVES, and DC-ART. As usual, in situations like this, there is no single tool that can do everything one may need. However, software in the coming decade or so will likely be capable of analyzing and repairing historical archive projects completely autonomously...and in less time than it takes to get a pizza delivered.

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## Star of Bethlehem (con't.)

(Söding, 2013: 189-208 and 45-79). The Jewish messiah, of course, must be the descendant of the ancient King David, which is why, the birth of Jesus of Nazareth takes place in Bethlehem.

There are often questions and discussions around the historical accuracy of the story, like the reports of King Herod's brutality, of the child murder, and all the stories of Jesus' childhood (Söding, 2013: 79-131). This is almost impossible to decipher due to the lack of facts and data; Nothing is preserved from Jesus's life in official documents except for the last few months. The rest of the story is based on oral history mixed with a lot of propaganda that is copied from Caesar Augustus. Augustus was the one who depicted himself as the "bringer of peace" (*pax augustae*), as the son of a god (*divi filius*), the rescuer of the people (thought Cicero commented that he does not want to be rescued by him), and the one who launches a golden age (*saeculum aureum*).

Matthew seems to have deliberately copied this propaganda of Caesar Augustus to his messiah. Augustus used the amalgamation of Venus and Jupiter in his propaganda, which was a practical fit for the required star in the apparition of the Jewish messiah. This way, Matthew had no difficulty in reminding his audience of this impressive observation some decades later—regardless of whether it really matched the date of Jesus' birth.

### CONCLUSION

Repeating the results of the sections above, we should argue that the commonly told story of Jupiter and Saturn does not serve as a satisfying explanation for the Star of Bethlehem.

Neither the constellation of Pisces nor planet Saturn fit Babylonian omens, and the extant contemporary concept of divination. We should not advertise this story in planetarium shows.

Concerning the reported transients in Chinese chronicles:

A nova in Aquila in 4 BCE is not excluded, but highly unlikely.

The transient is 5 BCE was likely a comet. Still, a transient in Capricorn – no matter whether it was a nova or a comet – could also perfectly match the interests of Caesar Augustus.

The conjunctions of Jupiter and Venus appear to be an attractive explanation to the "Star of Bethlehem," as this is reminiscent of popular propaganda used some decades before the story was told. With regards to i) visibility and ii) concepts of divination in Babylon, there is no conflict. It leaves all possibilities open and does not disprove anything.

The conjunction of Venus and Jupiter suits Caesar Augustus' propaganda perfectly.

Therefore, a planetarium Christmas show should (I) display what a nova in Aquila looks like and, although there is no convincing candidate star for a naked-eye nova, explain the nature of these eruptions, and (II) demonstrate the conjunction of Jupiter and Venus as an extraordinary example of an impressive observation. Additionally, (III) some photographs of Great comets could be shown while we explain that the typical depiction seen in churches goes back to the renaissance painter, Giotto.

The result of all this should be a planetarium show that beautifully demonstrates how the described phenomena would have looked. This way, we make use of the immersive qualities of this medium. However, the take-home message should be that announcing a new age matched the zeitgeist. Due to the lack of historical documents, it is impossible to reconstruct the date of birth for Jesus. The star is basically a symbol, and the propaganda of Augustus serves to connect possible real events in common memory to the story. All these components made for a fruitful foundation for Matthew to tell his story.

Thus, the popular planetarium question can now be answered:

Was the star of Bethlehem "real" or was it an invention of Matthew to sell his story? Yes, there were really interesting

apparitions – otherwise he would have lost the interest of his audience. Here, there might have been a common memory to resemble. However, if there really was a transient in the sky when Jesus was born, this is a question of belief that we likely will never be able to answer for sure, neither as astronomers nor historians.

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When we talk about expanding the use of our domes and immersive outlets, much discussion often centers on the types of content available. Of course, the tradition in the dome began with astronomy education, but over the past decades, our community has also encouraged art and music content, live concerts, and other activities that take full advantage of the immersive environment. There are dozens of fulldome shows available now that feature animations and music, which venue managers can present along with their more traditional astronomy and space-science presentations. Certainly, IMERSA has encouraged much of this expansion into other types of content in the domed environment.

However, another idea about expansion in the immersive world is fueling widespread discussion—the idea of inclusivity as it reflects on the people who are putting content onto domes and headsets. How can we increase the representation of producers who are people of color, women, and members of the LGBTQ+ community? We feel strongly that we need to encourage a broad range of voices in our communities. With this in mind, IMERSA hosted a stellar

panel for its July 25th IMERSA Day event called “Inclusive Immersive Media: How can we make immersive technologies more equitable?”

Ryan Wyatt, IMERSA Board Member and Senior Director of Morrison Planetarium at the California Academy of Sciences, assembled and led four accomplished panelists through a thoughtful exploration of inclusivity in immersive production. The panelists represented the entertainment and research communities, and each offered their own unique perspective on the topic.

Santiago Echeverry, a Colombian American New Media Artist and associate professor in the Film, Animation, and New Media Department at the University of Tampa, joined the panel to share his thoughts about broadening the “space” under the dome for queer and Latin American filmmakers. His career has focused largely on sharing perceptions through the use of interactive technology and low-fidelity reconstructions of images and environments. He has explored immersive techniques (such as in 360° and VR) to place audiences inside these environments. He has also sought to bring empathy and understanding of marginalized groups within the

larger LGBTQ+ community.

“After the massacre at the Pulse Nightclub on June 12th in 2016, I realized that I needed to start telling the stories of the people that I will see every single day,” he said. “So I started working with go-go dancers. I started working with porno actors.

I started working with drag queens. I started working with the exhibitionists and started dealing with these everyday people. Not only capturing their selves but also capturing the spaces. These spaces were essential for me.”

Maureen Fan, CEO and co-founder of Baobab Studios, brought her perspective as a woman working in the entertainment industry. She served as Vice President of Games at Zynga, and before that, she worked on the team that produced Pixar’s film *Toy Story 3*. Maureen shared her experiences as an Emmy-award winning filmmaker creating inclusive stories. She thinks there’s a message here for creators of immersive VR and fulldome content. “We believe that entertainment media has a way of transforming perspectives in a way that no other [media] can,” she said. “It’s our responsibility to put diverse perspectives in front and behind the camera. So, for a lot of these pieces, we’ve had specifically women and minorities.”

Fan says that she cares about diversity because she is a member of a minority group. “It’s important to me,” she said, discussing the appeal her work had to people within the industry. She noted that many of the celebrities involved volunteered to work on Baobab’s projects for little or no pay. “They still did it because they really believed in the messages that we were sharing,” she said. “They were really excited about storytelling and trying out a new medium, and creativity within that medium. But also, because a lot of the projects we’ve done have specifically had a theme of diversity, and these are things that they specifically care about.”

Writer and researcher Anna Gedal brought a different perspective to the team as she discussed her current research into the ethics of technology. She focused particularly on the cultural attitudes of colonialism displayed in early 20th-century immersive amusement park rides, and the lessons we can apply to make our current productions more equitable in terms



Panelists (l-r, top) Santiago Echeverry and Maureen Fan; (l-r, bottom), Anna Gedal, and Juan Carlos Peinado. Courtesy IMERSA.org

of societal attitudes. “In the early 1900s, millions experienced ‘20,000 Leagues Under the Sea,’” she said of an immersive experience that predates a similar Disney ride. At Coney Island’s 1903 version, however, riders could spend 25 cents to “travel” to Alaska, where they were exposed to arctic chill using the cutting-edge technology of refrigeration while observing native people accompanied by snow dogs. “So, though many visitors experienced the ride simply as a visceral thrill, it was designed as an embodied imperial fantasy,” she said. “The audience took on the role of colonizer. This consciously-crafted mass pedagogical tool profoundly impacted Americans’ views on race.”

Gedal pointed out that these experiments in immersion underscore that “elaborate travel simulations and interactive full-body experiences are not new technology,” and we can glean important lessons from this history. “I believe our current iterations [that] you see through headsets and digital layers inherit the legacies of these early experiences. And these legacy issues are complicated and painful, which is partially why many industries choose to ignore them and celebrate immersive technologies as natural empathy machines. But the truth is, we know better. No technology is neutral and it is critical for contemporary creators’ institutions and studios to adopt the historical, contextualized approach to cultural creation.”

Gedal also presented a set of critical questions that she hopes will push content creators to confront legacy ways of thinking and their own ingrained cultural biases when

doing productions. “Perhaps the most pertinent question is ‘who is really benefiting from this experience?’ Also, ‘what knowledge is being shared through the experience? How is that knowledge communicated?’”

Juan Carlos Peinado, an enrolled member of the Mandan, Hidatsan, and Arikara nations, taught new media at the Institute of American Indian Arts (IAIA) in Santa Fe, New Mexico and created the IAIA Digital Dome that focused on ways producers and students can enhance storytelling and continue tradition. He created the documentary film *Waterbuster* in 2006, which examined how dam building in the U.S. Midwest affected tribal homelands and traditions.

Peinado pointed out that, in our current time of societal change, ideas from other cultural backgrounds need to be carried forward in sensitive and sensible ways, particularly in our immersive environments. This was one of the reasons why he worked to build an immersive theater and production space at IAIA—to give voice to the traditions and stories of people who aren’t always heard in the mainstream. He also points out that such spaces also open up ways of communication to the majority. “It isn’t always the job of the lesser-heard voice to teach the majority,” he said. In the current environment, he points out that people need to have sympathy and empathy for each other and there are simple ways to accomplish that through human interaction. “Just sit down and have dinner with me. We don’t have to have a long discussion, but live with my family, watch me for a minute,” he said. “I should not have to be in a position

where I have to teach you, you need to come to me and learn.”

In the end, Peinado summarized the message the panelists hoped to convey through the 90-minute event. “We as human beings, we evolve every day. Whether as individuals or whether in the context of a society,” he said. “The word ‘culture’ is very misused and overused. But we evolve - very day, every decade, every century. What we were trying to do with all this technology that we were building at the Institute was trying to say, this is not about preservation, this is not about conservation. This is about evolution, whether you’re gay, or however you identify yourself. We are constantly evolving as human beings. And if this technology can help us evolve as human beings, then you know what? We did our job!”

### Engaging in More than One Way

The IMERSA exploration of immersive expansion actually began late this past spring with a fascinating look at how we can use VR and the dome—sometimes separately, sometimes together—to open up spaces for our audiences to interact and explore. On April 30th, host Carolyn Collins Petersen brought together two software design teams and an educator group to explore immersive production and education. Eighty participants took part in what was heralded as the first-ever “simulcast” of an IMERSA Day meetup in both Zoom and VR. It focused on the central question: what do you do if you don’t have a dome to work in?

While this question became ever important during the shutdowns of



(Right) Toshiyuke Takahei, creator of the Amateras software package for full-dome producers. (Far right) A screenshot of the Amateras software package for show producers. Japanese version shown; it is also available in English. Courtesy Toshiyuke Takahei.

the pandemic last year, not having a dome is an ongoing challenge for many a content creator and educator. So, we asked three innovators who are working with flat-screen solutions and show production, as well as one group involved in VR, to weigh in on the question. The first was Toshiyuke Takahei, from Orihalcon Technologies, Inc. in Japan. He opened the presentations with a look at his Amateras Dome Player ([orihalcon.co.jp/amateras/domeplayer/en](http://orihalcon.co.jp/amateras/domeplayer/en)), which is already familiar to many fulldome folks as a dome player. Amateras allows users to play back fulldome content on their domes quite easily. However, it can also function as a production tool, which allows creators to work on their content during times when they can't get access to a dome.

The second “third” of this IMERSA Day was a wild exploration of the VR content platform ENGAGE as an experiential education platform. The exploration was headed by Aaron McEuen of Starlight Productions ([starlight-prod.com](http://starlight-prod.com)) and Tony Butterfield of Fishtank Software. Attendees with VR headsets

could move directly into the platform and follow along as Aaron, Tony, and Chris Madsen of Engagevr.io took us on a tour of Mars and other 3D spaces. Attendees logged in via Zoom were able to watch the Engage action as it was ported to Zoom via OBS. The point was to show that educational outreach can be done in multiple platforms, but especially in VR where the demonstration was brilliantly put together.

Rounding out the event were Ruth Coalson and Phillipa Day of Festoon Software ([festoonsoftware.com](http://festoonsoftware.com)). Ruth and Phillipa showed off their production software that crosses boundaries between immersive production, HD large-format productions, and VR content creation. Their presentation unveiled a very useful tool for producers who don't always have access to domes as they create new shows. It eliminates the need for the physical dome and for teams to be working in the same place. They can cooperate remotely, make content to fit the requirements of different immersive venues quickly

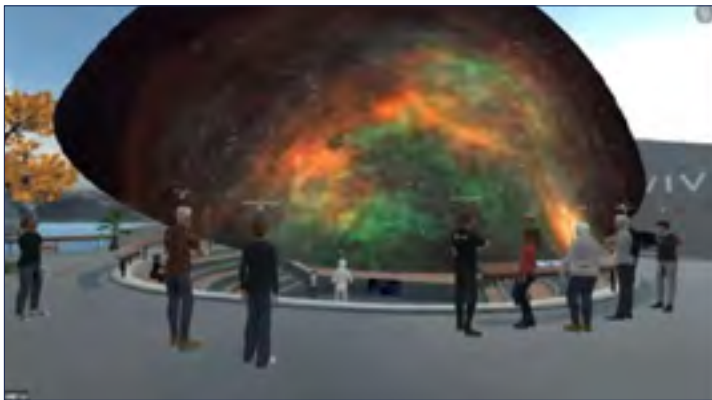
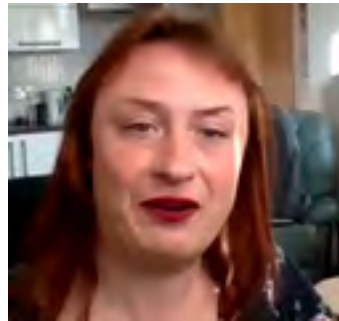
and more easily, and review it in a virtual environment at any time.

All three demonstrations opened up new avenues for producers and knowledge communicators to accomplish their work, and we at IMERSA were grateful to the presenters for their ingenuity and inventiveness.

### Immersive Connections to Hyperlocal Data

This summer's August IMERSA Day seeks to strengthen the experience over the data we present in our domes and other immersive experiences by integrating the idea of agency. That is, the influence we humans exert in space alone, and most significantly, when behaving the same way yet not spatially or temporally together with others. This is the kind of influence which we can only experience through data visualization. Whereas immersive experiences in planetarium domes often teleport audiences from Earth to the outer universe, this ultimate flight is enabled via scientific visualizations that dynamically scale space and time. How

*(Continued on pg. 64)*



(Top left) Aaron McEuen, CEO of Starlight Productions. Courtesy Aaron McEuen. (Top right) Tony Butterfield of Fishtank Software. Both Tony and Aaron are exploring the Engagevr.io platform as an educational tool to link domes and VR headsets. Courtesy Tony Butterfield. (Above) A VR Environment.

(Top left) Phillipa Day, co-founder of Festoon Software. Courtesy, Phillipa Day. (Top right) Ruth Coalson, co-founder of Festoon Software. Courtesy Ruth Coalson. (Above) A screen shot of the Festoon app, which allows producers to create content for a variety of immersive venues. Courtesy Festoon.com

# EXOPLANETS

*Discovering New Worlds*

SCRIPTWRITER AND NARRATOR  
CAROLYN COLLINS PETERSEN

PRODUCER  
MARK C. PETERSEN

SOUNDTRACK MUSIC  
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# UNDER THE CLASSDOME

## BEYOND THE STARS – OUR FAVORITE EXTENSIONS OF THE PLANETARIUM – PART 2



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I need a bumper sticker that says “Glad the pandemic is ending? Thank a SCIENTIST!” While this has been a very long year and a half, it could have been so much worse without the hard work of countless scientists.

Things changed rapidly at my school as the year ended in June. Good vaccination rates in our area led to plummeting infection rates and most of the kids came back to school before the year was over. We actually had concerts in the auditorium and my stage crew was incredibly busy. Time will tell how long it will take to get the kids out of their malaise and working hard again. I was also able to reduce the spacing and get more kids in my planetarium. Perhaps some of you saw my celebratory tape ball on Dome Dialogues.<sup>1</sup>



In this edition, our cadre of ClassDome teachers share two more ideas about activities that aren’t “straight up” planetarium fare. Lisa Swaney has some fascinating lesson ideas about using the dome as a model. I developed an activity with a colleague about silence wherein we use the room that is all about seeing to emphasize the importance of listening. We hope that your planetarium is returning to normal and that these ideas are something you can use or adapt.

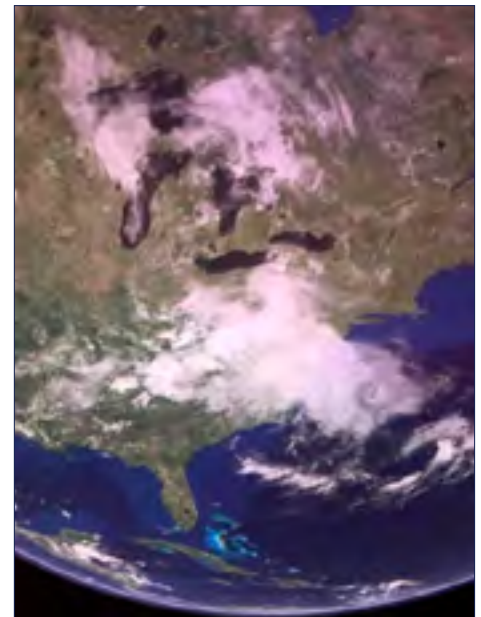
<sup>1</sup> My stage crew always makes a ball out of all the tape that we have to tear up at the end of a production. The larger the post-show tape ball, the better the show! Since I could open more seats in the planetarium, I celebrated by making my own post-pandemic planetarium tape ball.

### Lisa Swaney - Modeling in the domesky

Before I left the classroom role behind for this new exciting way to educate, I recall sitting in a handful of professional development sessions discussing what a model is, what is the difference between the construction of a model versus the process of modeling, and how can models help make predictions regarding phenomena? These discussions arose because there are a lot of misconceptions about what a model truly is and how they should or shouldn’t be used. Ironically, I have found my dome so useful as a model that I am literally ecstatic when I can use it to explain concepts other than just the night sky. Obviously, talking about the night sky is wonderful too, but I appreciate the variety that modeling has afforded to my dome presentations.

By definition: Scientific modeling is a scientific activity, the aim of which is to make a particular part or feature of the world easier to understand, define, quantify, visualize, or simulate

(Below) A visualized observatory. (Upper right) The coastline. (Middle right) The globe. (Lower right) The globe inverted. Images by L. Swaney.



by referencing it to existing and usually commonly accepted knowledge.

Modeling has become an important aspect for a variety of my star talks. Highlighted below are a few simple instances where I use the perks of my dome-shaped classroom to my advantage as an educational tool.

One of my favorite uses of the dome is to convert the planetarium dome into an observatory setting. It allows me to explain in very simple terms the difference between a planetarium and an observatory, all while using the doors of the observatory to open up to the night sky in preparation for the rest of the star talk. It also gives me the opportunity to ask students about observatories they have visited and highlight a special observatory in Wisconsin, Yerkes Observatory. Yerkes Observatory houses the World's Largest Refracting Telescope and is only about an hour away from our facility.

After lifting off in a rocket from our exact planetarium location, students and I discuss the different geographic features we see around and throughout Wisconsin. As we continue to pull away from Earth, we can further discuss the features that make up the United States and North America. These pictures provide a 2-D model, where questions are asked, and answers are being evaluated.

As I continue to dive into this educational platform, modeling will continue to be an important part of the educational practices I use within my talks and presentations. These models allow a more active learning platform with a student-centered connection.

### Mark Percy - Silence Lab

"I had an idea; can we try it in the dome?" is a frequent question from my colleague Kim Preshoff. She dreams things up and I figure out how to make them happen. Perhaps you remember our giant protractor? Well, Kim came up with another cool idea for her Environmental Science classes this past winter. She found this VR video about noise pollution: <https://sanctuariesofsilence.com/>. It is about 8 minutes long, and it immerses the viewer in some natural and artificial



Sanctuaries of Silence poster. Image courtesy of the Global Oneness Project

soundscapes. But how could this become a full-fledged planetarium lab?

First, we contacted the producers to obtain permission to use it. They happily agreed in exchange for some photos of the kids interacting with it. Playing VR video on the dome was something I have heard of but had not tried before. Wrapping the video onto a virtual sphere was actually pretty easy in my system. Converting it from H.265 to H.264 compression was not. I had to get a newer version of Adobe After Effects and try several different render settings before I could get it to play smoothly.

An interesting challenge was tilting my virtual sphere so that the audience could see things below or above the camera at different points in the video. If you watch it, you'll see Gordon lying on the ground as he discusses his first true listening experience. The scene transforms as a storm gathers above the treetops. VR viewers can look up and down at will, but our group planetarium experience means that we all have to look together. I experimented and made a list of cues to tilt our virtual viewing sphere up and down at the appropriate times.

My third challenge was transforming the audio. VR videos use a 4-track

format called "ambisonics." I got it to play through my system, but if anybody out there knows how to re-map it to surround sound, please let me know! OK, so now I have the VR video ready for prime time in the dome. However, the video is only 8 minutes long. How could we flesh this out and get the kids involved on a personal level?

We opened the lab session with some "food for thought" questions. What is the loudest and quietest place you have ever been? Can you remember a time when sound made an impression on you? What are the dangers of not listening to each other? There were a number of responses that were very moving. Someone remembered the sound of a car crash. Another student vividly recalled their fear during their very first fire drill. One student told of listening to the flatlining heart monitor as their grandfather died. I told the kids about the Meat Loaf concert that I attended in college. Even though I used ear plugs, I had to leave because the vibrations were making my shoulders and knees ache. We had their hearts in the lesson now.

I tend toward the left-brained side and wanted the kids to understand some of the physics of sound and sound measurement. I organized some images to show them the difference between transverse and compression waves, how the decibel scale works, and a video of an explosion in which refraction from the shock wave is clearly visible. As I introduced these images, we talked about hearing damage, my own unfortunate case of tinnitus and the loudest sounds ever such as Krakatoa's 1883 explosion. I demonstrated how I protect my hearing with an app that measures sound pressure.

The VR video would be presented next. This appeals to the right brain and the soul as Gordon discusses noise pollution and his work to document its effects. We discussed a couple quotes from Gordon as well as the students' answers to questions about how sound has affected them personally. The kids offered examples from a garbage truck waking them up, to a car crash, to hearing their new sibling cry for the first time, and even when someone's dog was hit by a car. Those short discussions really made the exercise personal for everyone.

*(Continued on pg. 40)*

# INTERNATIONAL NEWS

## Dear fellow planetarians...

In the past months, many planetariums have finally been able to reopen to the public, at least partly, after many months of shutdown due to the Covid-19 pandemic. These have been hard times, and for many institutions it will take a long time to get back to normal. This makes it even more inspiring to see, below, that new planetarium shows are still being produced and premiered and entire new facilities are being constructed, e.g., in Finland and Mexico.

For this section I'm indebted to contributions from John Hare, Bart Benjamin, Andrew Kerr, Ignacio Castro, Kai Santavuori, Loris Ramponi, Alexis Delivorias, and Zina Zsitkova.

Let's start this tour around the World in southeast USA.

### SOUTHEASTERN PLANETARIUM ASSOCIATION

The past 16 months have presented unprecedented challenges to the planetarium community. Once upon a time, news of an institution closing or scaling back operations became a headline for the local news. Now, take those circumstances and apply them to a worldwide community of institutions that have always been faced with struggles to survive. Many didn't or will need to face the future with fewer staff and fewer dollars just to keep the doors open. Local schools, the general public, and a host of vendors who specialize in planetarium related services and equipment have suffered along with everyone else.

We seem to be on the mend, but the recovery may take years to return to the status quo of the pre-pandemic days. Conferences that are often planned four or more years in advance were especially hard hit. SEPA conference dates for the next several years have all been impacted by the pandemic.

The original 2021 conference host, Bays Mountain, Tennessee made an executive decision at the last possible minute to postpone the 6-region, mega-

conference scheduled for June of this year. The postponement was supported by the 6 US regions involved: SEPA, MAPS, and WAC (4 regions). Instead, a virtual conference for SEPA members only took place on the 30th and 31st of July. The virtual conference included the usual presentation of papers and talks, vendor presentations, group discussions, the annual business meeting, and socializing to the extent possible using the internet.

Another casualty of the Pandemic is the 2022 SEPA conference. Originally scheduled for the Hallstrom Planetarium in Fort Pierce, Florida in June of 2022, director Jon Bell was told by his administration that the conference could not be held as originally planned.

Various other sites have been invited to host an event in 2022. What normally takes years to plan presents a difficult task on such short notice. At the time of this writing, nobody had yet stepped forward. Until a conference host is found, you can expect short deadlines for all conference related activities.

The 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](http://sepadomes.org) or contact IPS Advisory Council representative John Hare at [johnhare@earthlink.net](mailto:johnhare@earthlink.net).

### GREAT LAKES PLANETARIUM ASSOCIATION Illinois

On 12 May, the Adler Planetarium in Chicago celebrated its 91st birthday! While it remains closed to the public for the immediate future, they are hosting private events and investigated some pop-up museum experiences for the summer. They are also taking advantage of the closure to replace their exterior roof. Most recently replaced in 1940, the old lead-lined copper outer dome is



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(From top down) The Adler's original roof under construction, fall of 1929. Adler's first roof replacement, June 13th, 1940. The condition of the domed roof before the second replacement began, April 10th, 2021. Scaffolding going up around the dome, April 21st, 2021. The slightly different than normal view of the Chicago skyline, May 6th, 2021. All courtesy of Adler Planetarium.

overdue for removal and is being replaced with a new copper and zinc dome. The dome work ran through the summer, and they will also replace the horizontal/flat roof in late summer and fall.

The Cernan Earth and Space Center at Triton College in River Grove continues to offer virtual field trips. The staff hosted an in-person Rocket Camp for up to twelve middle school students during the first week in July.

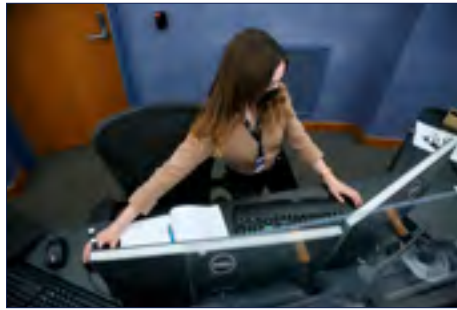
The ISU Planetarium in Normal remains closed to the public due to the COVID-19 pandemic. However, they continue to share astronomy and general science programs and activities on their website, Facebook page, and YouTube Channel.

Parkland College in Champaign hopes to bring staff back to campus by the end of summer. Hopefully, this means that the Staerkel Planetarium will have shows in the dome again starting in the fall. The James B. Kaler Science Lecture Series just completed its first year of lectures through Zoom. The planetarium has mounted the Hubble Space Telescope 30th anniversary banner, and they look forward to offering events to celebrate Hubble's accomplishments. The planetarium debuted its first show entirely in Spanish on May 7th.

Peoria's Dome Planetarium's digital upgrade is now complete! The team from E&S installed six new laser phosphor projectors. The planetarium reopened about the time that the Peoria Riverfront Museum opened its big summer exhibition, T. Rex: The Ultimate Predator. The staff resumed laser light shows this summer, and they hope conditions will allow them to return to their evening date night style programming this fall.

## Indiana

A new intern has joined the team at the Evansville Museum of Arts, History & Science. Carlisle Wishard, a graduate student working toward her Ph.D. in planetary sciences at Purdue University, will be presenting live shows and working on projects in the Museum's Koch Immersive Theater and Planetarium.



Evansville's new intern, Carlisle Wishard, presents live shows and works on projects within the Museum's Koch Immersive Theater and Planetarium. Both courtesy of Kock Planetarium.

Ball State University's Brown Planetarium in Muncie had over 1,000 students and teachers visit virtually during the pandemic. Even with the virtual visits' success, they excitedly welcomed small school groups back into the dome in May. They re-opened to the public in June with a new registration process that ensures physical distancing and a safe environment for their guests. Brown Planetarium director Dayna Thompson continues to create monthly episodes about variable stars alongside the American Association of Variable Star Observers. Going into summer, Ball State University concluded holding university classes in the dome. It was a learning experience and an excellent way to utilize the dome to truly enhance astronomy and geography courses.

## Ohio

Tiffany Stone Wolbrecht reports that the Ward Beecher Planetarium at Youngstown State University remains closed to the public and private groups but is operating as a classroom for the university. They are working on health and safety plans for reopening for a "soft" reopening in the summer to limited private groups before reopening to the public in September. In the meantime, they are wrapping up their virtual public show season with a Facebook live event sharing star

stories from across the world. They are also offering virtual field trips that kept them busy this spring.

The Appold Planetarium at Lourdes University in Sylvania has been closed to in-person visitors for the last year. To stay in touch with their audience, director Laura Megeath started the Dome from Home Club. Laura has also been doing free virtual field trips for area schools.

The Yahn Planetarium at Penn State Behrend in Erie is still closed. However, Director Jim Gavio continues to offer astronomy classes to Behrend students in-person as well as virtual field trips to outside groups.

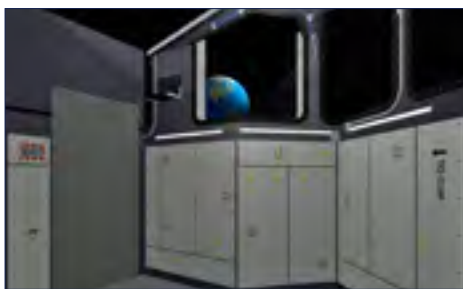
Lake Erie Nature & Science Center in Bay Village has been doing live programs for small groups since August 2020. Planetarium director Katy Downing has resurrected almost all of her previous live programming. In May, Katy got back one of her part-time presenters, which brings the presenting staff up to two. The planetarium offers 12 shows a week.

## Wisconsin / Minnesota

The lobby remodel projects should be completed at the Horwitz-DeRemer Planetarium in Waukesha, Wisconsin. Slated projects are a wallpaper accent wall, installation of soundproofing panels around the dome half wall and behind the dome and converting the vestibule area into a mock-up of the ISS cupola area. They were also offering public shows throughout the summer.

Minnesota Water Stories premiered in the Bell Museum's Whitney and Elizabeth MacMillan Planetarium in St. Paul, Minnesota this summer. This live, interactive production explores state water challenges, current research, and opportunities to help improve water quality by examining Minnesota's three largest water basins.

The Manfred Olson Planetarium at UW-Milwaukee produced Dodging Doom in July in honor of NASA's new planetary defense mission DART (Double Asteroid Redirection Test) on its way to near-Earth asteroid Didymos, where it will attempt to alter the trajectory of the asteroid's moonlet. This



The Horwitz-DeRemer Planetarium's lobby remodeling project will convert the vestibule area into a mock-up of the ISS cupola area. All courtesy of Horwitz-DeRemer Planetarium.

experiment will teach us how we can protect our planet if a dangerous object was bound for impact. At the time of writing, Shooting Stars and Meteor Showers is scheduled for screening in early August and will get the public ready for the Perseid meteor shower.

The Soref Planetarium in the Milwaukee Public Museum has finished a new original production, Stargazers of Africa, to go with its new exhibit on Nelson Mandela. They also made a fun, virtual mini show called The Ultimate Dependent Relationship! Earth & Sun. Next up: finish A to Z Astronomy!

## PACIFIC PLANETARIUM ASSOCIATION

On Friday June 25th, 2021, there was a gathering of PPA old-timers to share memories and stories. The session was recorded and can be found on the PPA Youtube channel ([www.youtube.com/](http://www.youtube.com/)

[channel/UC-pfVOHnkvAV\\_fdnKLdqzWA/videos](https://channel/UC-pfVOHnkvAV_fdnKLdqzWA/videos)) under this video link: [www.youtube.com/watch?v=t33co1bRTZQ](http://www.youtube.com/watch?v=t33co1bRTZQ).

- 1a. the first article in the guide, recently published in The New Republic, on the politics
- b. the explanatory article and videos by investigator Mick West
- c. the blog entries by noted skeptic Robert Sheaffer.

A one-page summary catalog of all the resource guides by Andrew Fraknoi is now available at: [bit.ly/fraknoiguides](http://bit.ly/fraknoiguides). Included are guides on interdisciplinary approaches to astronomy (music, science fiction, plays, etc.), guides for teaching astronomy (best short videos, image sources, humor, etc.) and guides on diversity (Black lives in astronomy, contributions of women, astronomy of many cultures).

The Silicon Valley Astronomy Lectures, professionally recorded, non-technical, public talks by noted astronomers, has just finished their 21st year on YouTube. The series now has 3.7 million views. Recent talks include:

Nobel Laureate John Mather discussing cosmic evolution and what the upcoming James Webb Space Telescope will be able to tell us

Janna Levin of Columbia guiding us to appreciate conditions near a black hole

Adam Frank of the University of Rochester explaining new ways to determine “techno-signatures” from advanced civilizations around stars

Elinor Gates of the Lick Observatory comparing the observatory's response to the current pandemic to what happened in 1918

Caltech's Mike Brown discussing the search for a Planet 9 in our solar system

Tom Shutt of Stanford discussing ongoing experiments to hunt for dark matter.

All the talks in the series can be viewed free at: [youtube.com/svastronomylectures](http://youtube.com/svastronomylectures).

## ASSOCIATION OF MEXICAN PLANETARIUMS

AMPAC vice president Eduardo Hernández comments: “that during the pandemic, as we all know, planetariums

had to adapt the way they used to operate and how they do so in a virtual way, reaching out to more people on diverse themes although without its main resource, the planetarium as an immersive space.”

Such is the case for the Luis E. Erro Planetarium in Mexico City, the Quintana Roo Planetarium Net, and the Torreon Planetarium, among others, having managed to capture public attention through their virtual lectures and telescope observations, science workshops and related activities.

Construction of planetariums hasn't stopped; 3 planetariums are currently being built: one in the city of Toluca, another in Ecateped (both in the State of Mexico) and one in Coyoacan, Mexico City. The planetarium in Toluca will be part of a science-cultural park, near the Cosmovital: a large botanical garden in the middle of the city. The planetarium in Ecatepec will operate an 8K system.

The Torreon planetarium will be opening two more observatories, adding to the four already operating with the largest telescopes in Mexico and open to the public. This is a Project to help prepare the people for the 2024 solar eclipse, which will be best observed near the city.

## NORDIC PLANEIARIUM ASSOCIATION

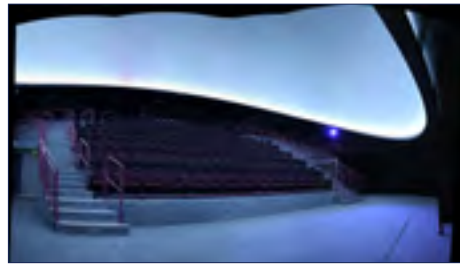
The affiliation will meet for its biennial conference, a little unusually, in Lübeck, Germany. After this long break of in-person meetings, we all long for real conferences and for enjoying our social connections in the physical planetarium world. NPA is very happy to invite you to a ‘real’ conference ‘after the pandemic’. As for Lübeck, there is a long history of exchange between the city of Lübeck and the countries of the NPA region. As the official conference host, the Lübeck Observatory (in German: Sternwarte Lübeck) is happy to welcome the NPA members in collaboration with the Sternkammer (the world's first school planetarium opened in 1931 at the former Klosterhofschule in Lübeck), now modernized with a digital full-dome system.

The conference is for Nordic planetarium staff, technicians, science centers, observatories, students, mediators and teachers in astronomy and science, and universities and organizations, and of course the NPA hopes to see many good friends from around the world. For further information please visit [www.npa2021.sternwarte-luebeck.de](http://www.npa2021.sternwarte-luebeck.de).

### Finland

Finland's seventh planetarium is planned to open in autumn of 2021, the Kakslauttanen Arctic Resort Planetarium located in northern Finland, and is the largest in Finland. The planning of the planetarium began in late 2016. The designer and consultant of the planetarium was Kai Santavuori, and Sweco Finland was responsible for the structural design. The planetarium was completed in the autumn of 2020 but will open in 2021 due to the Coronavirus pandemic. Technical information: Spitz NanoSeam, 18-meter dome with 145 seats that have

been manufactured by Skeie from Norway, Digistar 6 from E&S with 5 Sony VPL GTZ 280 projectors. Dome tilt is 22,2°. E-mail: [planetarium@kakslauttanen.fi](mailto:planetarium@kakslauttanen.fi), webpage: [www.kakslauttanen.fi](http://www.kakslauttanen.fi).



Interior of the new planetarium in Kakslauttanen, Finland. Courtesy of Kai Santavuori.

### SOCIETY OF GERMAN SPEAKING PLANETARIA

Though the maximum occultation was only about 20% in Northern Germany, the annular solar eclipse on 10 June, would have been – clear skies provided – a major event for planetariums and observatories in Germany, Austria and Switzerland. With

the COVID-19 situation still uncertain, some institutions still closed, and the COVID-19 regulations being very different everywhere, the GDP decided to put together a livestream for the event.

After the huge success of the livestream for the landing of Perseverance on Mars in February, a now well-established team set up the livestream. Project management, technology, the YouTube platform, and moderation were provided by the Stiftung Planetarium Berlin. Animations were supplied by the Verkehrshaus Luzern in Switzerland with moderation also streaming from the LWL-Planetarium in Münster.

Since this was an event that could be seen by everyone with his or her very own eyes (well protected by a solar filter or solar eclipse glasses of course!) the team included observatories from Germany and Switzerland to stream their live telescope views of the eclipse – under the organization of the VdS (Vereinigung der Sternfreunde, an astronomy club).

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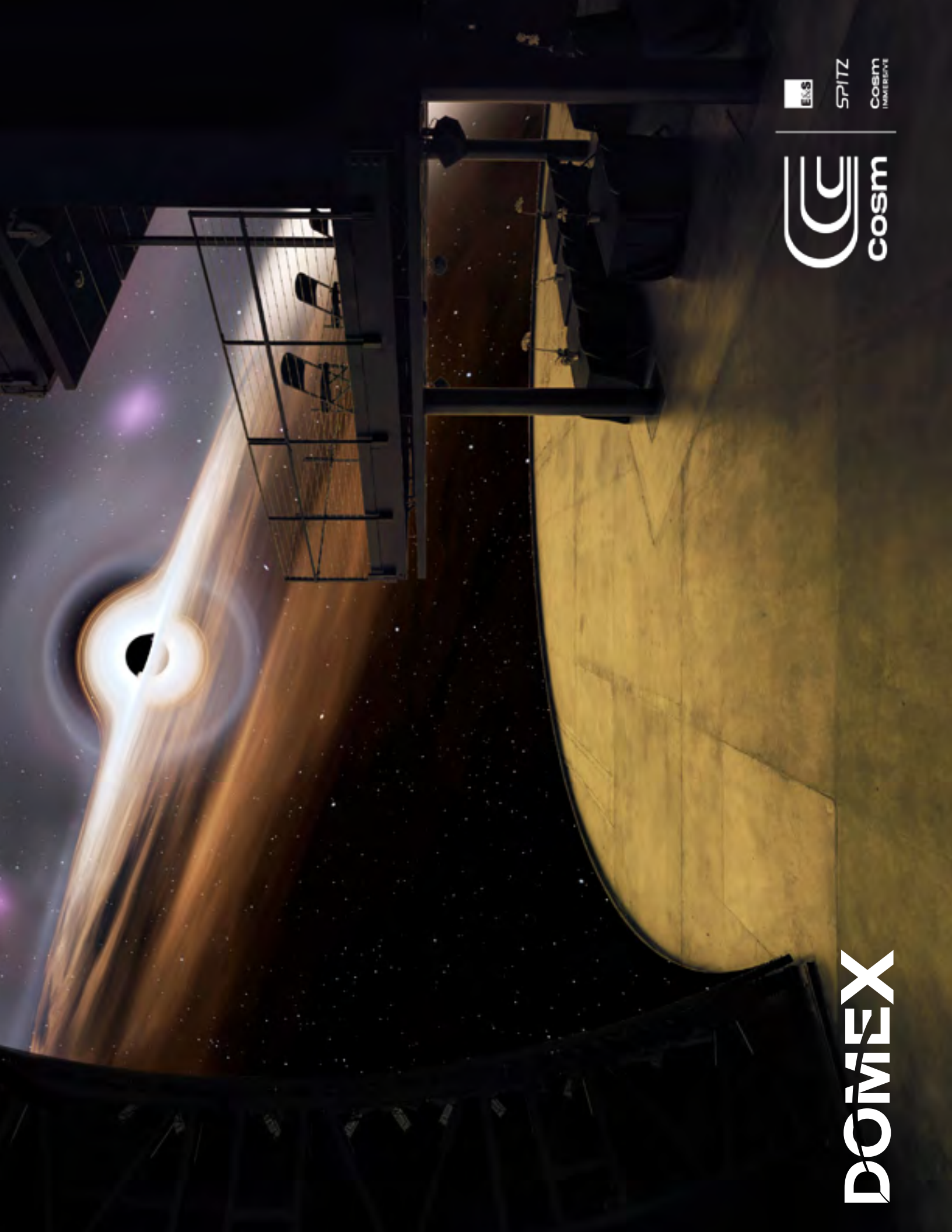
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A photo stream from the internet was provided by Daniel Fischer ([skyweek.wordpress.com](https://www.skyweek.wordpress.com)). The communications team of the Stiftung Planetarium Berlin, together with the Planetarium Erkrath and the Planetarium Bremen took care of the Youtube chat and many incoming audience questions during the stream.

Because the Solar eclipse took place during school hours, the VdS and the teams of the planetarium of Halle, the Stiftung Planetarium Berlin and the Science Dome in Heilbronn not only provided press releases and graphic material, but also educational materials and some solar eclipse glasses for schools.

The stream lasting about two hours (Die Sonnenfinsternis am 10. Juni 2021: [youtu.be/NIQLVzygw0](https://youtu.be/NIQLVzygw0)) combined live views from telescopes, explanations, video animations and interviews with various experts from the Leibniz Institute for Solar Physics (KIS), the Max Planck Institute for Solar System Research, The Leibniz Institute for Astrophysics Potsdam and the Förderverein of the Archenhold Observatory (an astronomy club).

Despite the fact that this Solar Eclipse was not a “major” one in Germany (between 6% occultation in Munich and 20% in Flensburg) the media impact was considerable and the announcement found its way even to nationwide published media. Being broadcasted around midday, i.e. during school and working hours, the livestream achieved a peak audience of 9,132 and 136,500 views as of 23rd June 2021 on Youtube alone. More than 3,600 messages in the chat meant hard work for the team behind the scenes.

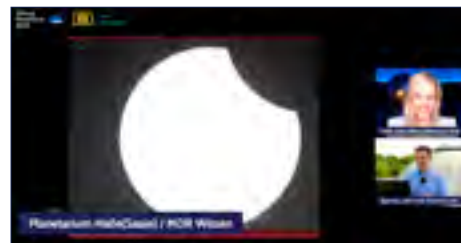
From the GDP's point of view, the continuing success of these events implies that livestreams for important astronomical or spaceflight events meet an interest from a large audience – and the benefits for the planetariums and observatories in terms of perception and public relations are well worth the huge effort it takes to organize such an event with a large number of partners. Moreover, it is a way to continue reaching the audiences, even in non-pandemic times.

## Bavaria

Since December 2019, the map of planetariums in Germany has been

a white spot poorer. Axel Bartelt, President of the Government of the Upper Palatinate, opened the new planetarium in the municipality of Ursensollen near Amberg in Bavaria in the presence of high-ranking representatives from politics, education and science. On an area of approx. 200 m<sup>2</sup>, the building houses an observatory, the planetarium, a lounge and lecture room as well as a spacious reception area. It was built by the municipality of Ursensollen on the active initiative of its star-loving mayor Franz Mädler with the help of subsidies from the state of Bavaria and the European Union.

In the construction of the building in wood frame construction, mainly sustainable materials were used. An air heat pump in combination with heat recovery ensures the necessary air conditioning. The solar power system above the green roofs supports the regenerative character of the system. The planetarium is equipped with technology from Sky-Skan and designed for 30 visitors. Two 2-channel LED projectors project the images and films controlled with the Dark Matter software in 2D or 3D to the dome. It has a diameter of 6.6 m and is tilted by 15°. Seamlessly joined, perforated aluminum ensures a uniform representation without overlap at the connecting points of the dome plates. Perforation reduces the scattered radiation in the dome and



Program announcement on the Youtube channel of the Stiftung Planetarium Berlin. Screen shot from stream Solar eclipse. Both courtesy of GDP.

thus improves the contrast, especially in full-dome films.

In the observatory, five columns are available to accommodate the telescopes of the Sternfreunde Amberg-Ursensollen, the tenant and operator of the facility. Two columns stand at ground level and allow barrier-free use of the telescope. The 6.5 x 6.5 m<sup>2</sup> large rolling roof of the observatory can be retracted, so that visitors can view the stars in addition to the telescopes.

The first highlight when entering the building is the back lit panorama of the Milky Way of the ESA satellite GAIA. With a size of 1.5 x 7.6 m<sup>2</sup>, the 1.7 billion mapped stars are illuminated effectively.

After a short tour of the building at the opening, Mayor Franz Mädler welcomed participants to the planetarium. In his speech, he emphasized the good cooperation of the mostly regional construction companies for a project whose special challenges they did not have any experience available. He also thanked the government agencies involved for the support and promotion of the project by the Country of Bavaria and the EU.

As a tenant and operator of the planetarium and the observatory, the



Outside view of the planetarium and observatory. Press photo of the planetarium interior and program. Both courtesy of Peter Martner, pmfoto.

Sternfreunde Amberg-Ursensollen e.V., in the person of its chairman Prof. Dr. Matthias Mändl, was already consulted in the preparation but also in the construction phase and was thus able to have a significant influence on the technical design of the facility. Mändl thanked those present on behalf of the association and demonstrated its enormous potential and impressive 3D display possibilities at the subsequent demonstration of the planetarium.

With the opening, the planetarium went goes into regular operation, i.e. fulldome shows with interactive star guidance initially offered every Friday and Sunday. In clear nights visitors also have the opportunity to admire stars and selected celestial objects live during the opening hours through the telescopes in the observatory. Further information about the planetarium and the Ursensollen Observatory can be found at [www.planetarium-ursensollen.de](http://www.planetarium-ursensollen.de).

## ITALIAN ASSOCIATION OF PLANETARIA

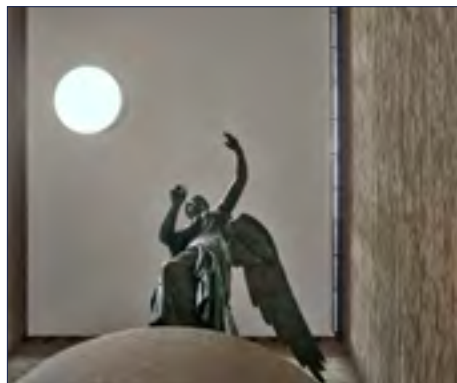
The winner of the PLANit 2021 Award (9th edition), a fulldome contest promoted by PLANit and open to anyone, is the fulldome show *Astronomical Atlas of the Divine Comedy* produced by Nicola Bonomo and Gian Nicola Cabizza. The film, targeted to high-grade school groups, shows how the planetarium can be a privileged place where literature and astronomy meet. Adding value to this production is Dante's 700-year anniversary, which makes such a theme relevant and interesting among planetariums in Italy.

Every year, PLANit's board selects the best fulldome show among those submitted (the deadline of the PLANit Prize is usually in March), the producer receives a monetary prize of 500 €, and it is then made available to all PLANit members. To date, nine video productions were awarded and distributed to Italian planetariums over the years. PLANit invites IPS Affiliates to organize similar contests in their countries and to share winners' productions with their own community.

The winner of the 2021 Lara Albanese Award was the Rheyta Astrofili

Association of Ravenna. The project *Il cielo sopra di noi*, presented by Paolo Morini, was awarded because of the way it was developed and laid out. In fact, the PLANit board positively evaluated both its interactivity and creativity: the active engagement of school groups, and the use of astronomical observations even during the pandemic (although in safe ways), was considered crucial in the designation of the award. Furthermore, the proposal matched the spirit of PLANit's beloved colleague, Lara Albanese, after whom the award is named.

The activities of PLANit includes the yearly Meeting of Italian Planetariums (online April 23rd) and the yearly National Day to Fight Light Pollution (next edition October 9th, 2021). The keynote speakers of the National Day to Fight Light Pollution include the following: Professor Massimo Tarenghi (ESO astronomer emeritus), Walter Riva (Righi Observatory and Planetarium), and Marina Costa (Cassiopea Project) who described 40 different ways of imagining the Milky Way with myths and legends. The title of Andrea Frigo's speech (Planetarium of Amelia) was *What world do we want to live in?* The planetariums as catalysts of a new sensitivity towards creation. Arianna Ricchiuti (EJR-Quartz for ESA, SISSA) and Fabio Pagan (SISSA) explained the role of Italian planetariums in disseminating research on life in the



All the Moons of the Museums. In the image the artificial "Moon" conceived and created for the new exhibition about the Vittoria Alata bronze statue, archeological area in the city center of Brescia. Photo by Alessandra Chemollo, one of the images of the exhibition *Mirabili radici. Il sito Unesco di Brescia nelle fotografie di Alessandra Comollo*. Courtesy of Brescia Musei.

Universe. Luca Ciprari (Planetarium Alto Adige) talked about the Photometry of Asteroids project, while Simonetta Ercoli (APS StarLight ... a planetarium between the fingers) reported of Dante's *Commedia* told in eight days. Alessandra Zanazzi (INAF Arcetri Astrophysical Observatory) described the Astrotourism project. Carlo Ottolini (*Storie a Domiciclo*) demonstrated how to look at the stars and listen to stories, or rather his experiences in astronomical-themed theater. Gian Nicola Cabizza (Siligo Planetarium) explained how he managed to build a digital planetarium with less than 4,000 €. Vittorio Mascellani (Planetarium of Modena), who boasts a long history as a teacher, told us about it in the "Atelier of the stars". Finally, Molisella Lattanzi (Nemesis Planetarium) describes how she deepened the techniques of virtual reality and augmented reality. Planetarium vendors also contributed.

Another important event is the International Day of Planetariums, whose tradition began in Italy in 1991. According to the proposal of Björn Voss, the March date will be postponed to May 7th, 2024 to coincide with the date of the first planetarium (see also the anniversary of the Centennial, 2023).

Italian planetariums were also involved in special events of the Asteroid Day on June 30th. PLANit promoted the project *Planitalia*, a giant Solar System whose Sun is located in Padova and whose planetary orbits touch the cities where a selection of Italian planetariums are located.

Last, but not least, All the Moons at the Museum took place, an event that is proposed every year in relation to the anniversary of Apollo 11. The project promotes collaborations between arts and science in both museums and planetariums, looking for examples of either painting or other artworks that are inspired by the Moon.

## EUROPEAN/MEDITERRANEAN PLANETARIUM ASSOCIATION Greece

At last! On Friday July 2nd, the Eugenides Planetarium that has remained closed due to the Covid-

(Continued on pg. 42)



Tom Callen  
Vaxholm, Sweden  
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# TALES FROM DOME UNDER SUPERHERO...ASTRONAUT...PLANETARIAN...FIREFIGHTER?

We in the planetarium profession are sometimes called upon to wear other hats. Sometimes what we're asked to do has absolutely no relationship with the time spent popularizing astronomy and other subjects in our domes. It can even happen the other way around; how many times have you heard about the school librarian, or physical education teacher, being drafted to run "that mechanical thing that shows the night sky on the ceiling"?

If you ask a child what they want to be when they grow up, depending on their age, you can get all sorts of fanciful answers: rock star, astronaut, doctor, policeman, nurse, teacher, veterinarian, superhero, etc. Chances are good that there might even be a "firefighter" or two as well, but certainly not "planetarian." While a grade schooler, I didn't have a clue as to what a planetarium was, let alone who might work in one, but by my senior year in high school I certainly did. I set a course to becoming someone who worked there by pursuing two degrees in Planetarium Education. What I had not counted on was that I was going to get "backdrafted" into a potential firefighter's role.

As many of you know, the Smithsonian Institution's museums in Washington, D.C., are big buildings with correspondingly large staffs that work in them. In order to evacuate these buildings in a timely and efficient way, individual departments within these various bureaus have someone who's known as a Personnel Movement Officer, or PMO. In the event of a fire, each is responsible for ensuring that their fellow staffers in the departmental office area have left the building and gathered in neat orderly rows, also by departments, on the National Mall outside.

If you are thinking that this only goes for fires, you also have to consider that this is Washington, D.C., and those national museums draw their fair share of bomb threats, amongst other forms of protest, every year. I worked at the National Air and Space Museum for

almost 13 years, so got to see my fair share of such lunacy. To wit, every 6th of August, Hiroshima Day, which marks the dropping of the first atomic bomb on a populated city, we became a target for protesters.

The simplest form taken was usually a crowd gathering on the Mall side of the building holding up placards proclaiming us a "war museum" or "purveyors of death," whereas all we were doing was preserving some military planes, plus some other historical artifacts, for posterity. One year there was even a person dressed as the "Grim Reaper," complete with black robe, cowl, rubber skull mask and skeleton-hand gloves, who showed up on the steps of the Mall side of the building. He stood there all day holding a large sign reading "DEATH MUSEUM" with one hand, while pointing up at the building with the other. I know it was all day, since my office windows on the top floor of the Museum looked directly down on him.

As you can imagine, building security on such an occasion was always on high alert, as there were others who were more aggressive. How so? This took the form of protesters trying to sneak into the building with concealed buckets of red paint, or in the worst scenario, pig's blood. Their target? The rockets on display in the large space-related gallery at the east end of the building. I know of at least one occasion when they managed to accomplish their goal; throw paint on the very tall rockets that were displayed in a large guard-railed opening in the floor that went down a whole level underneath. Even though their tails and rocket nozzles were that much lower, they still towered skywards over the main gallery floor.

Apparently, these groups never did their homework, or were intent on only throwing paint on a rocket - any rocket. Those displayed that got hit with the paint were scientific research rockets and not military in nature. If they had done a little preparation, they would

have realized that they were within literal spitting distance of a German V2 rocket on the floor of the gallery and a German V1 "buzzbomb" that could have been easily accessed from an overhead balcony railing. If one were looking for weapons, you couldn't get more "military" than those two, which were examples of the types that were used to attack London, southeast England and, later, parts of Belgium, claiming the lives of thousands of civilians.

I got tapped to be the PMO for the Albert Einstein Planetarium's office area, which also meant that I, after making sure the staff had evacuated and gone down our emergency stairs, had to take a swing through the planetarium theater to make sure that it too was empty of both public and support staff (the "button pushers"), before leaving the building.

To help ensure that all of the PMOs were on the same page when it came to procedures and were in coordination with the Smithsonian Guards, we were all issued a thick, 3-ring binder full of the rules and regulations, as well as a dark red construction hardhat with the letters "PMO" emblazoned across the front.

Procedures were different for a fire versus a bomb threat. Simply put, the evacuation rule for fires was "all office doors closed with lights off." Closed doors lead to less oxygen to feed a fire and if there were any signs of a fire in a particular office, it would be visible when a fireman checked it. For bombs, it was the exact opposite; "doors open and lights on," which facilitated a room-to-room search for anything odd that didn't belong in a particular space. For a bomb search, the PMOs were expected to tag along, since they supposedly knew their office areas better than the first responders did. I wrote about this in a previous "Tales from Dome Under" column: "On His President's Secret Service."

I served in this capacity for the planetarium office for about eight years, and while we had regularly scheduled



Four happy graduates from the Cosmonova Omnimax® theater/Digistar® planetarium staff following their course at the Firefighter's Training Academy of the Stockholm Fire Department. From left to right theater technicians Håkan (he wasn't with us very long, so I have, unfortunately, forgotten his last name), Torgny Bång, Olle Linder, and myself; Astronomer/Program Producer Tom Callen. What you can't tell from this picture is that our borrowed Academy coveralls are saturated with smoke and we all reek, almost like we've been inside a small concrete house partly filled with burning bales of hay.

fire drills and a few false alarms, (both fire and bomb threats) nothing serious ever happened.

Moving to Stockholm in September 1991 to become a full-time staff member at Sweden's largest museum and participate in the building of their new Omnimax® theater/Digistar® planetarium, meant that I no longer had to be a PMO since there was nothing like that function in the new building. Many years later (circa 2002), we were expected to take and pass a fire safety proficiency course, which was offered by the Firefighter's Training Academy of the Stockholm Fire Department.

All of the Museum's various departments had their turn and eventually it came time for the theater staff, and other members of the Public Department we were a part of, to do our training. I was up to my ears in the middle of producing a major school show, so I didn't feel I had the time to drop everything, but this day-long course was mandatory.

We arrived at the Firefighter's Training Academy facility, which was in the middle of a forest in the middle of

nowhere outside the capital city. Much of the first part of the day was spent on classroom theory; fire prevention, fire safety, what kinds of equipment, like fire extinguishers, were available for non-firefighters at home and in the office place, etc. It was the second part in the afternoon when things started to heat up.

There are four things that stick out in my memory from this latter part of the day: two demonstrations and two "hands-on" (for lack of a better word) experiences.

Everyone has probably heard of the dangers of throwing water on a grease fire taking place on a kitchen stove. One of the firefighters demonstrated what would happen if done incorrectly by throwing water on such a fire in a simulated kitchen. The most impressive part was how the grease fire literally exploded and blew missiles of flame everywhere when hit by the splashing water; something not soon forgotten. This was followed by a demonstration of how to handle it properly (smothering it by putting a lid on the pan).

The second demonstration consisted of them lighting a simulated room in a house on fire to show how fast a fire could spread from item to item; curtains to sofa to coffee table to overstuffed chair, etc. It couldn't have been more than a few minutes and even without the use of a combustible accelerant like gasoline, the whole room was ablaze.

Then came the two "hands-on" experiences. We had already been warned by other staffers back at the Museum, who had already completed the course, about the grand finale, so there was a bit of unspoken apprehension going forward.

Frankly, the first was just as attention-grabbing as what we knew awaited us later on. We were led to a large open area by the trainers. In its middle was what looked like a large, shallow wading pool that was about five meters in diameter and 40cm deep. To make its purpose even more unclear, it was about three-quarters full of water, so there was a band of concrete around the top inside where the water had not reached. If we had been a little more cognizant, perhaps the hint of a rainbow-colored slick on the water's surface would have offered up a clue as to what it was used for. The large supply of fire extinguishers sitting nearby would have provided a second, though one couldn't miss those.

One of the trainers poured a quantity of gasoline on the surface of the water and then used a plumber's propane torch to set it on fire. Within a few seconds the surface of the water was on fire, with the flames coming off it almost a meter in height. Impressive fire, but now what? There were a few nervous titters amongst the Museum staffers about roasting hot dogs.

Another instructor grabbed a fire extinguisher and, after showing us how to check to see if it was charged (via its built-in gauge) and how to work the release valve so that it would spray fire retardant out the large nozzle at the end of the extinguisher's hose, he proceeded to turn his back on the fire.

This seemed to be the wrong way to face if you wanted to put out the fire, but then he crouched down and

began to walk backwards toward the wading pool, with the nozzle of the fire extinguisher, held at his side, pointed behind him. In order to keep from getting overcome by the heat if you were facing the fire, it was better to back up to the blaze and then direct the fire retardant at the burning base. He got up just before the wall of the wading pool, stopped, and (back still turned away) began to spray in short blasts; the fire was out in under a minute.

And now, we were told, each one of us was going to do the same thing.

Having just watched this scenario as performed by a professional firefighter, the first thing that went through my head was, 'What if you back up too much, trip over the low wall of the wading pool and go head-over-heels into the water? Which, by the way, is on fire.' "Not to worry," said one of the trainers, "It's never happened before."

With that reassurance, we lined up to take our individual turns and, fortunately, we managed to keep the Fire Training Academy's safety record intact and no one went for a swim. This only left the grand finale, the piece de la resistance, of the day. And, having been forewarned by others at the Museum, we knew what we were in for.

If someone brought you up to a small 3 to 4-story building that appeared to be made of concrete, contained multiple rooms and a few small holes that might be windows, you might be unimpressed. If, however, you were told that you were going to be put into said building, a fire would be set inside and then you had to find your way out again through the resulting smoke, it would certainly change your feelings about the place.

Like a school of baby ducklings, we filed inside behind our trainers and gathered in a room at the far end of a series of rooms. The bales of hay that were stacked in rows against the wall were hard to miss. Once we were all inside, it was explained to us that, after an overview of what was going to happen, we would be retreating into the previous room to begin.

Actually, it was pretty simple; they were going to light the bales and the little house would fill up with smoke. We were to keep low to the floor to

mitigate the effects of smoke inhalation and, after passing through several more rooms, find our way out the door at the opposite end of the building.

Several things go through one's mind when you hear such a thing, like Did I really sign a release absolving the Fire Training Academy of any responsibility of an accident?

Exercise explained, we moved into the previous room, sat on the floor, and the trainers set the bales of hay on fire in the room we were just in. They then joined us as we all began the wait for the place to fill with smoke. What made it interesting was that we had to allow time for enough smoke to accumulate, though if anyone felt panicky, they could bail out a little sooner. Otherwise, you could stay as long as you thought you could stand it, or until the trainers said it was definitely time to get out.

Did I mention that they were all wearing full-facial oxygen masks and had their own personal supplies of O<sub>2</sub>? They did; we didn't.

I am pleased to say that no one in our Museum group panicked and left the smoke-filled room earlier than was suggested and everyone made it back to the front door without passing out and having to be dragged from the building.

Following this last bit of smokery, we were all assembled back in the classroom building and, having passed the course, given a very fancy Certificate of Graduation from the Firefighter's Training Academy of the Stockholm Fire Department. It came in a heavy dark glossy paper folder with their logo embossed on the front.

It certainly was an interesting way to spend a day with one's colleagues in a setting that was far from the day-to-day norm of working in a prominent museum. Such experiences tend to bring you closer together as a group; it remained a topic of conversation for a week or so during our Museum-mandated afternoon coffee breaks.

I still have my Certificate of Graduation; I come across it from time to time when I am going through stuff, though I can't say exactly where it is at the moment. I should probably locate it; one never knows when they might be asked to put out a fire in a wading pool.

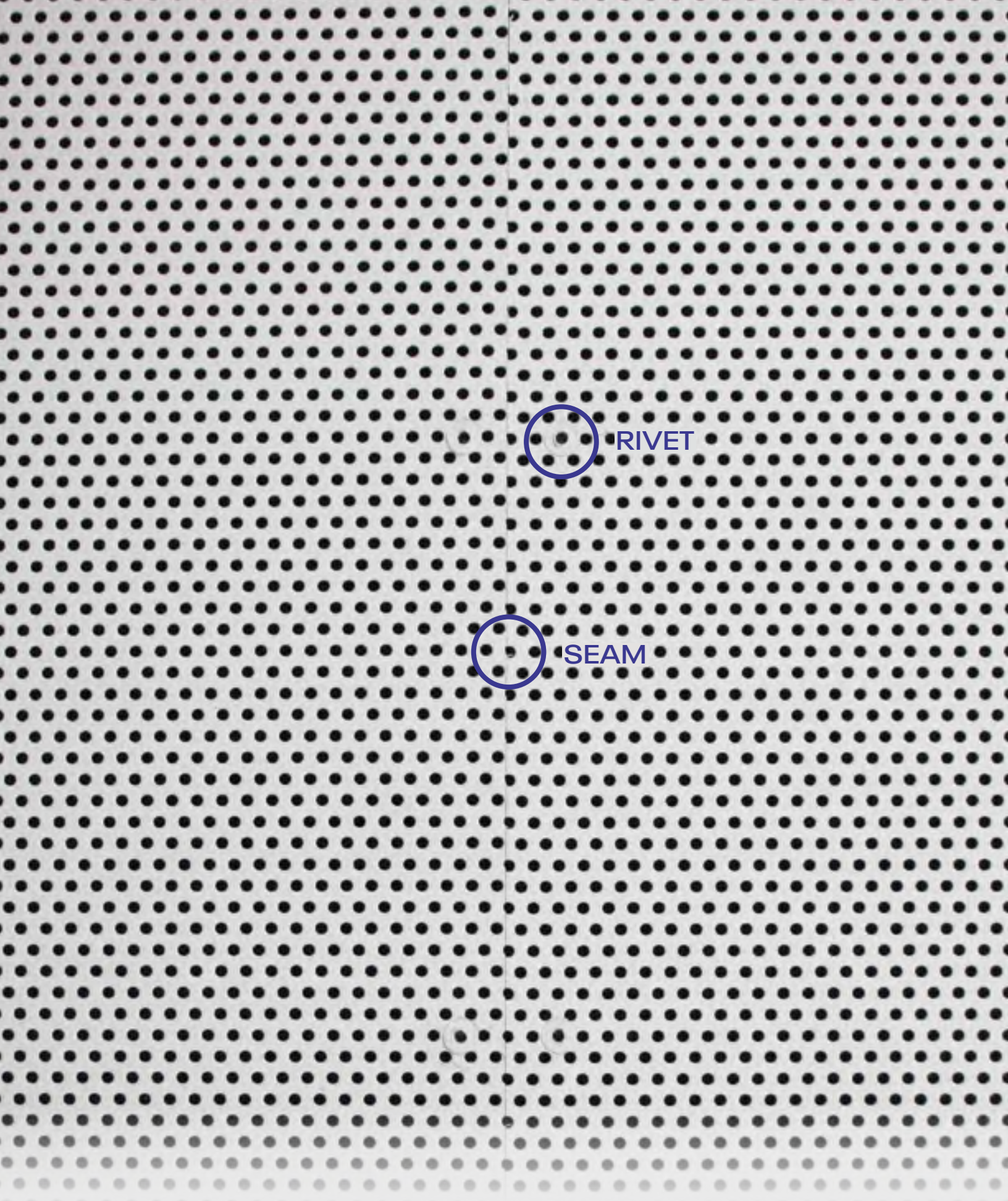
## Under the Clasdome (con't.)

After the video and discussion, I used student volunteers for a demonstration that they would repeat at home. My planetarium is definitely quieter than the rest of the school, but how quiet was it and how quiet could it be? Using our phones, we measured the ambient noise at about 43 dB. The HVAC fans are most noticeable. I turned those off and we measured again: 35 dB. The students then noticed the video projectors. Turning them off got us down to about 30 dB. One by one, I turned off the star projector console with its cooling fans, and then the sound system that makes a very slight digital background noise. Now we were at 23 dB. We sat and absorbed the silence, and then discussed how nobody noticed all those noises before because we are so used to living in a sea of background noise. It was a lot like when my visitors get fully dark adapted under my Spitz A5 sky. Most folks are unaware of how light polluted their environment is until they experience the planetarium's ultra-darkness.

We sent the student home with a mission. First, they were given a list of appliances and asked them to measure the sound pressure at 2 meters away (we're all about 2 meters/6 feet this year, right?). Next, they were asked to do the "sound pressure limbo" and see how quiet they could make their home environment by turning off the appliances. As usual, the kids' answers were fascinating. We asked them to come up with three other loud things to measure besides the listed appliances. We got a blender at 90 dB, a sawmill at 130 dB, and one kid must dry their hair with a jet engine because they said it was 150 dB. We figure that was a mistake or made up...lol.

## Summary

Will there be a part 3 to this series? I hope so. I know the rest of the teachers in this group have some great things going on. Perhaps you do, too, and would like to join the ClassDome cadre! Please feel free to contact me at mpercy@williamsvillek12.org if you have some lessons that you teach in your dome that you would be willing to share. In the meantime, I need to go hug a scientist.



RIVET

SEAM

## International News (con't.)

19 pandemic since March 2020 (with only two brief opening spells in September and October), has once again opened its doors to the public. According to the rules imposed by the Greek health authorities, the Athens-based Eugenides Planetarium will operate at 50% capacity and will only accept persons that are either fully vaccinated against the virus or have been tested negative. Needless to say, wearing masks and keeping a minimum safe distance is also obligatory. For July, there were various full-dome planetarium shows and giant screen films on the schedule for all ages, including in-house productions *The Red Planet* (2019) and *The Centre of the Cosmos: from the geocentric system to the expansion of the Universe* (2018). In August, as it is customary, the Eugenides Planetarium will remain closed to the public.

In autumn of 2021, the Eugenides Planetarium aims to finally premiere *The Story of Earth*, its latest planetarium production. The premiere was originally scheduled to take place in March of 2020 but was repeatedly delayed due to the unprecedented effects of the pandemic. The show focuses on the formation and evolution of Earth, highlighting the geological processes that cause earthquakes and volcanic eruptions, including a presentation of the theory of tectonic plates, and explaining of why Mars and Venus are so hostile to life today. It is worth mentioning that this is the first time the Eugenides Planetarium incorporates full-dome, live action, video of an actor/presenter in its shows. The show is accompanied by a fully illustrated 60-page guidebook that expands on the main theme of the show, and by a much shorter and easier-to-read booklet aimed for the younger children. Both books are freely available to all in pdf form on the planetarium's website.

The Eugenides Planetarium's online communication with the public continues through its Facebook page, with numerous articles, quizzes, short videos etc. on astronomy, astrophysics, and space exploration. In July, the Eugenides Planetarium premiered its podcast *The Evolution of Giant Stars*, the

second to feature Dennis Simopoulos. Also in July, the Eugenides Planetarium premiered *The Life and Death of Stars*, the third episode of *Space Series*, a sequence of short videos on various astronomy topics.

### Croatia

For the second time since it opened for the public, the Rijeka Astronomical Centre closed to the public from Thursday April 1st to Thursday May 6th, 2021, due to the COVID-19 pandemic. In that time, the Centre worked on new programs for its digital planetarium and stayed in touch with the public with various online activities through its Facebook page.

Even though the Rijeka Astronomical Centre was closed during that time, the Russian cosmonaut Sergey Ryazansky toured its premises, including the digital planetarium and the Valentina Tereshkova exhibition, on April 18th, the 60th anniversary of Yuri Gagarin's flight into space, and laid flowers by Gagarin's bust.



Cosmonaut Sergey Nikolayevich Ryazansky visiting the Rijeka Astronomical Centre for the 60th anniversary of Yuri Gagarin's flight. Courtesy of Rijeka sport Ltd.

According to the relevant instructions of the Croatian Civil Protection Headquarters, the capacity of the planetarium fluctuated from 50 seats to 16 and later to 25 and 50 again (for organized groups). Nevertheless, on Wednesday June 30th, the observatory of the Centre reopened for the first time since the outbreak of the pandemic offering the opportunity for small groups to enjoy the night sky. Despite the situation, interest for the RAC programs was quite good. Because of this, the evening planetarium program

was enriched with two new programs for adults, *Starry Sky*, *Our Treasure* and *Space Neighbourhood* on light pollution and the *Artemis* program.

May, June, and the beginning of July saw the restoration of past activities, including planetarium birthday parties, and Saturday and Thursday evenings for children with different live planetarium programs and two new workshops titled *The Sun in your Pocket* and *Young Astronaut* (for a maximum of 10 participants, age 5-11). On the summer solstice, the RAC held the second part of *Days of Francophony* in collaboration with the French Alliance in Rijeka. The event included live planetarium screenings, poetry, and French songs dedicated to the summer sky, as well as the interactive exhibition *France eMotion*.

At the time of writing, the Rijeka Astronomical Centre is preparing two new events that will include live programs, as well as lectures, quizzes, hidden treasures, a public forum, and stargazing at the observatory. The first is *Moon Night* and will celebrate the anniversary of the Apollo 11 mission. The second is *Mars Party* and will celebrate the first anniversary of the Mars Perseverance Rover launch. In August, the RAC plans to offer yet another two events, dedicated to the Perseid meteor shower and the Jupiter opposition: *Prepare, beware, Perseids!* and *Jupiter Party*.

### RUSSIAN PLANETARIUM ASSOCIATION

On June 15th, the Association of Planetariums received a grant from the President of the Russian Federation. The grant was awarded for the creation of an educational program for planetariums, *The Sun and the Life of the Earth*. Sergei Yazev is the scriptwriter and scientific supervisor of the project. He has compiled a method guide to help teachers or lecturers in the planetarium. Under the terms of the grant, the planetarium's partners held charity sessions as part of the celebration of the International Day of the Sun, which were attended by 3,356 people. The film was shown at

the Festival of Full-dome Films 2021 in Yaroslavl and was recognized as the best educational film.

On April 21st, the All-Russian ZOOM-conference called 60 Years in Space took place with international participation., where plans and forecasts for the next decade were made. Its participants were lecturers, leaders of planetariums, popularizers of cosmonautics, and cosmonaut Oleg Artemiev.

On June 23rd, a ZOOM-seminar was held called The Problem of Dark Matter. Its participants were planetarium lecturers from Russia, Belarus, and Kazakhstan. The presenter was Anatoly Zasov, doctor of physical and mathematical sciences, professor of the Department of Astrophysics and Stellar Astronomy of the Physics Faculty of Moscow University. This seminar, named after S.V. Shirokov (1961-2010), marked the beginning of the work of the online school of planetarium lecturers. Stanislav Shirokov is known among the popularizers of astronomy in Russia as a specialist of the highest level. His many years of creative activity were associated with the Moscow Planetarium. He created lectures and audiovisual astronomical programs that were incredibly popular with audiences and are still considered the pinnacle of creativity and skill by planetarium lecturers. The goals of the school are the professional growth of planetarium lecturers, the exchange of their work experiences, and raising of the scientific



V. Shirokov. Courtesy of L. Panina.

and methodological level of educational planetarium activities.

### Yaroslavl

The V International Week of Planetariums took place in the Planetarium from June 16th through June 19th. It included a full-dome film festival, Reflection of the Universe, and a conference titled Planetarium of the XXI century. Competitive screenings of the new and most spectacular full-dome films, as well as bright and meaningful reports, were held. The international jury noted the growth in the amount of full-dome content produced by Russian planetariums; 14 programs became laureates and 8 of them are Russian. The International Week of Planetariums will be held in Yaroslavl next in June 2023, the year of the 60th anniversary of Valentina Tereshkova's flight and the centenary of the invention of an optical-mechanical planetarium device.



(Top) Awards to the winners of the Full-dome Festival 2021 in Yaroslavl. (Middle) Director of the Big Planetarium of Novosibirsk, T. Belousova accepts the award. (Bottom) Participants of the 2021 Conference Yaroslavl. All courtesy of A. Popov.

### Kaluga

The Planetarium of the State Tsiolkovsky Museum of the History of Cosmonautics opened its astronomical

observatory on May 19th this year. Its construction was carried out as part of the second stage of the museum, which began to receive visitors a month earlier. The observatory is designed for excursions and observations of the Sun, Moon, planets, and other objects on the celestial sphere, including artificial satellites. The dome has an "AllSky" design with remote control, air handling system, and weather station. The observatory equipment includes a:

- Refractor-telescope (main instrument): aperture 250 mm, focal length - 2.2 m
- Solar refractor-telescope: 95 mm aperture, focal length 580 mm, equipped with an H-alfa filter
- Reflector-telescope: aperture 430 mm, focal length - 2.88 m, equipped with a CMOS CCD camera with an astronomical filter turret
- Set of digital receivers for photographic recording and broadcasting a streaming video signal
- Mounting system with automatic guidance to objects and the ability to track artificial earth satellites

### Lytkarino

The inauguration of the new digital planetarium took place on May 21st. The new facility, created by the Lytkarino Museum of Local Lore and History in partnership with the Lytkarino Optical Glass Factory, is part of the Interactive Optical Center Lytkarino. The planetarium was created with charitable funds and the support of the Shvabe Optical Holding and prominent Lytkarino entrepreneurs. The Interactive Optical Center "Lytkarino", created as part of a partnership project, is a unique center in the Moscow region for children's career guidance, education, culture, and leisure. Today, it includes a museum of optical glass, a children's observatory, an interactive optical laboratory called the Journey of Light in Optical Labyrinths, a thematic area on microscopy, and a planetarium.



# MOBILE NEWS NETWORK

## Planetarium Builders and Enthusiasts



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So much has happened in the last few weeks, the time has flown by! I see on Facebook that many planetariums are gradually starting to open. It is especially difficult to reopen mobile domes and for the director to get back in shape. I remember that even after a short vacation the equipment felt heavier, and my voice was not as strong. I wish you all luck as you try to navigate that and the uptick in Covid cases. I know many of you have pivoted to different work to keep making a living. I hope you get back to what you really love again soon! Hiroshi Futami seems to be able to keep his mobile dome in action despite Covid and is even advertising for new staff to begin in September!

### PLANETARIUM BUILDERS AND ENTHUSIASTS:

Others fulfill their passion by building their own planetarium at home!!! In my last column I told you about the Facebook group 'Planetarium Builders and Enthusiasts.' I am following James Hicks, the administrator of this group, as he constructs his own planetarium. It is important because we can learn about low-cost dome and projector options from people like him. He explained, "I started this as a place to document my own project. I am building a small Planetarium from scratch, on a fixed income in the Senior's trailer park where I live. Star Projector and everything. Actually, I am building two projectors. My first is based on Spitz but with an RSA Cosmodysee aesthetic, and I have been working with Paul Bourke who helped me mapped 8700 +/- stars from The Hipparcos catalog onto a truncated Icosahedron. This next projector will be the plate and lens style pioneered by Zeiss. I'll also have full dome video in a year or so as I find used projectors I can refurbish."

On June 15th, James was one quarter of the way done with the dome and a third to a half of the way done with the Pinhole projector, while still researching the plate projector.

I think it would be interesting for you to follow his progress, trials, and tribulations because some of you are also trying to build low cost solutions! The African Planetarium Association is especially involved in this right now. If you are on Facebook, you have probably seen the latest bamboo and fabric geodesic dome that Susan and Daniel Owen have built!

James is using a different approach. He writes, "I am fortunate to be able to afford Sonostar PVC hubs. I am using the "MegaHub," which accepts either 1 inch or one and a half inch" Sch 40 PVC. I picked these for a smoother dome. Mine will be 16.25 feet in Diameter. I think I am doing something innovative with the skin. I was going to use Canvas and cover it with elastomeric. However, soft coverings, no matter how well made (and I used to make sails), always have soft spots and ripples near the bottom. I decided I couldn't live with that. So I decided to use cardboard with elastomeric. You can buy different size sheets of different grades. I am getting the one eight inch 'C' Corrugation #32. It's rated for 32#lbs crush force per square inch. So I am going to glue two of these panels together with the corrugation crossing, cut the triangles to fit the geodesic frame, join them with fiber reinforced paper box tape, and then the elastomeric with polyester roof cloth goes over that. It should be very smooth, sturdy and aesthetically pleasing in the end. Hopefully, this plan will work! One thing about this approach, if successful, is that if a panel is damaged it can be easily replaced. Repairing a hole in canvas, vinyl or Dacron is difficult without taking the cover off to get it under a sewing machine."

On June 28th, he posted this picture and wrote, "This work is over a week old now. The floor is now cut out and beginning to look like something interesting. I just 'bit the bullet' to buy the wood for the short riser wall. Got the pieces mostly cut out before it got hot. The excessive heat has pretty

much paralyzed my work for now, so I'll probably be back to working on the pinhole projector this week."

On July 12th, he reported that he had gotten the wall installed. And the next day he had finished cutting the struts and was excited to see if the first ring fit as he wanted it too. He exclaimed, "It did! Whew! It is designed to just hang over the edge. In this way, once I have the skin on, there will be a bit of flashing on the lower edge of the dome, so rain doesn't run down the siding too much."

On July 17th, he was fitting the geodesic to the wall. He got the first section up and fine tuned the placement before continuing. By July 19th, he reported, "The geodesic structure is complete. More fine adjustments to the wall still to do and soon the skin will be installed. One step closer to a Planetarium!"



(From top). The floor platform is complete.; The first section of the dome structure is up; The geodesic structure is complete! Images: All photos courtesy of James Hicks

I will continue to follow James as he completes the dome and moves on with the projection systems. He is making good progress toward his dream!

## THE ASSOCIATION OF ITALIAN PLANETARI (PLANIT):

Loris Ramponi recently wrote to me about another interview he conducted. He explained, "An unpublished tale that connects to the constellations was born under the dark and star-filled skies of Calabria (Southern Italy). It is one of the curiosities that can be discovered on the Facebook pages of Planit, the Association of Italian Planetariums. There you will find interviews as part of the "Voices from the Dome" series. This original, celestial story was told during an interview with Professor Angela Misiano of the Planetarium of Reggio Calabria

<https://www.facebook.com/watch/?v=864592524143306> The text of the story was published in installments on the Facebook pages and is also available in an audio version, through a two-voice dialogue."

The Facebook post <https://www.facebook.com/photo?fbid=4369957356359625&set=gm.4048659141898094> begins,

"Do you know the legend of the beautiful Callisto and her son who were turned into bears? And that of the Big Dipper, or of the seven oxen from which the word north is derived? What you may know best is the story of the 'Big Dipper' which is linked to the conquest of the West. The seven stars of the most famous constellation were imagined by American colonists as a large ladle, the ones used to quench their thirst, taking water from the barrels carried on wagons during the long journey to the Western territories.

Now forget all these things and follow us to Calabria. From the dark and star-filled skies of the region at the south end of Italy comes a story that is completely different from the previous ones. We invite you to add it to those you describe under your fixed and traveling domes. We propose it to you through a two-voice dialogue."

*The story dialogue is below. The first voice is the storyteller (Loris who is the host of a weekly radio show) and the second (in bold) is*

*Donatella Valgonio who manages (conducts the program) and works for the radio station of the local Brescia newspaper.*

### Dialogue:

"Once, a young student met an elderly Calabrian breeder. They were under a wonderful starry sky, full of stars, as happens in the clear nights of a new moon in the areas of Calabria without light pollution. The girl pointed out the seven main stars of Ursa Major to the breeder.

**Did the elder know the stories of the constellations, such as that of the beautiful Callisto who was transformed into a bear?**

That was what the student wanted to know, but she was surprised by a very curious answer.

**Was the breeder an astronomy enthusiast? Had he learned to familiarize himself with the firmament thanks to that wonderful sky?**

The old man said, answering the question in Calabrian dialect, "You mean Callisto?" I'm sorry not to be telling you that original story, because maybe that story would be more attractive.

**It doesn't matter, I'm still curious to hear how this story continues.**

"But Callisto is a cow thief!" said the breeder.

**But what robbery was he talking about?**

In his eyes, those seven stars had nothing to do with the mythologies we know. Forget the ancient Greeks, the nymph Callisto, loved by Jupiter, and her son Arcade. Also put aside Juno, a jealous wife, who turns mother and child into bears. The breeder did

not want to hear about these things and repeated to the girl that in that group of stars one could not see Callisto, but two oxen on the run.

**It is not a wonder that a farmer prefers to imagine cows instead of bears. So when he looks at the stars he dreams of a herd much larger than the one he owns.**

The farmer did not want to multiply the animals on his farm, he was instead worried about cattle thieves. Those two stars, which for the ancient Romans represented the rear wheels of a chariot, in his eyes were oxen on the run.

**He was talking about the two stars that help us find Polaris?**

Yes, exactly. They are called the "pointers" because the line that unites them leads us to the star that always remains motionless in the sky. They are those indicated with the letters alpha and beta in the atlases of the sky. The ancients called them Dubhe and Merak.



(Above) Painting by Sebastiano Ricci, Diana and Callisto, 1712-1716, Courtesy of Gallerie dell'Accademia, Venice. (Below) The Ursa Major with the characters of the breeder's story. Il garzone (the boy); La lampada (the lamp); Alumera-La moglie del contadino (light-the farmer's wife); I due ladri (two thieves); I due buoi (two oxen). Courtesy of Gian Nicola Cabizza.



Planetarium of Reggio Calabria. Courtesy of Planetarium Pythagoras Reggio Calabria

They represent the back and sides of the bear, as the etymological meaning of their names of Arabic origin reveal.

**In short, for the Calabrian breeder these stars have the appearance of two oxen. But they are not the ones for whom the ancient Romans pulled a chariot. These are running away!**

In addition, the breeder imagined that the delta and gamma stars, respectively Megrez and Phekda of the Ursa Major, were the thieves who chase the oxen on the run.

**So there are four protagonists of the story imagined by the Calabrian breeder: the perpetrators of the theft joined by the pair of oxen.**

The list of characters is not finished. The star Alioth, or epsilon, the first of the tail, represents the master of the oxen. The last of the queue, Alkaid, is his boy, the farmer's assistant.

**Did the farmer not notice that there is another star in the center of the**

**Ursa Major's tail?**

That star is not alone, it is in good company. At that point in the constellation, we see a famous pair of stars. They are called Mizar and Alcor. The latter is the weakest. But they are close only in appearance.

**Because it is so faint that not everyone can see it, Alcor was used as a visual acuity test in the past.**

The breeder had coined a very particular nickname for the two stars in the center of the Bear's tail. He called this couple "alumera" in local dialect.

**"Alumera." Why?**

The word light is hidden in this name. In these two stars, the farmer saw his wife who becomes a light holding a lamp.

**Ah yes, because the theft of the oxen had taken place in the middle of the night.**

Our breeder has excellent eyesight if he can observe this famous couple in the night sky.

**This story is really curious. Did the student who met the breeder tell you about it?**

I discovered it thanks to her teacher, Professor Angela Misiano, who is well known for her many years of national commitment to teaching and dissemination of astronomy.

She is the founder and manager of the Planetarium Pythagoras in the Metropolitan City of Reggio Calabria.

**On what occasion did she introduce you to the story of the Calabrian breeder who looked at the stars?**

When I interviewed her as part of the initiative entitled 'Voices from the domes.' In fact, I have collected several testimonies and memories of planetarians, popularizers and astronomers. They described how their scientific and public activities are carried out, including anecdotes and curiosities. For example, Professor Misiano tells some of the moments of the breeder's history in Calabrian dialect.

**Have you wondered how such a particular story was born? I had never heard of it. Who knows if the breeder had invented it?**

Theft from farms, especially in the southern regions, was widespread. In Sardinia, for example, each municipality had an office in charge of the abigeato. It is a legal term which indicates the theft of livestock.

**This explanation shows us that celestial stories are not born with your head in the stars, but with your feet firmly on the ground! And there are many of these stories. It is nice to listen to them and tell them under the celestial vault, even more so in dark places where the absence of lights makes us discover the Milky Way and a multitude of stars."**



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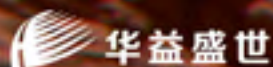
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# LIP SERVICE

## FACE TO FACE



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Exterior of the Carnegie Science Center. Credit: Carnegie Science Center.



The newly renovated Buhl Planetarium at the Carnegie Science Center. Credit: Becky Thurner.

As I write this in late July, we have just opened registration for LIPS 2021. I am so excited to be able to meet in person again! LIPS 2021 will be hosted by the Buhl Planetarium at the Carnegie Science Center (CSC) in Pittsburgh, Pennsylvania.

This past year—plus of pandemic restrictions has been a reminder of WHY interaction is so important. I am tremendously grateful that the coronavirus hit during a time when we at least have tools that permit us to connect virtually. Without Zoom, Google Meet, Teams, etc., the isolation would have been much harder on me, and many others. We held a successful e-LIPS in 2020, but still, I cannot wait to all be in the same room again this September.

As the Canadian psychologist Paul Bloom has said, “Humans are social beings, and we are happier, and better, when connected to others.” LIPS 2021 will provide a much-needed opportunity to reconnect, to share what we’ve learned and experienced since LIPS 2019, and to simply enjoy each other’s company.

Speaking of enjoying each other’s company, we’ll kick off LIPS 2021 with an evening social event on Tuesday, September 21st at the CSC. LIPS will be the first in-person, system-agnostic

planetarium conference to take place in the USA in nearly two years, so we’ll have a lot of catching up to do.

Following the evening event, we will then have the standard three full days of LIPS from Wednesday through Friday, September 22nd – 24th. Those days will include:

- Opportunities for attendees to do live programs for the public.
- Daily free time for LIPS attendees to explore the CSC, including attending stage science programs.
- Workshop with indigenous storytellers from the Pittsburgh area.
- Workshops and sessions led by LIPS attendees.
- Participating in Buhl Planetarium-led presentations for the public.
- Sneak peeks at Buhl programs in development
- Sponsor presentations focused on interactive programming—thank you to Mark Webb of GOTO, Inc. for once again acting as our sponsor liaison!
- Professional recordings of all sessions by CSC. These recordings

will be shared freely with the planetarium community.

I’m looking forward to everything, of course, but especially for the chance to see LIPS attendees in action doing public shows. We did this for the first time at LIPS 2019, hosted by the Cradle of Aviation in Garden City, New York. It received rave reviews from LIPS attendees, so we’re hoping to make it a consistent LIPS activity. I know I personally got many new ideas from watching these presentations.

As a science center alumna, I am also looking forward to exploring the CSC. We hope to include one hour of free time each day Wednesday through Friday. That exploration time will benefit our Pacific Planetarium—the 6.1m fixed dome that Digitalis operates and where we hosted the first ever LIPS in 2011. The Pacific Planetarium has a small, hands-on exhibit area, and I am always looking for new ideas to supplement it.

Stay tuned for the next column for a full recap with photos from LIPS 2021!

As I’ve mused on humans’ need for connection, I’ve tried to think deeply about what LIPS currently offers the community as well as what it needs to offer in the future. As I say every



One of the exhibits near the Buhl Planetarium features an earlier projection instrument. Credit: Carnegie Science Center.



The writer Dorothy Parker. Credit: Bernard Botturi; license CC BY-SA 4.0.

year during our “Future of LIPS” conversation, there is always room for improvement. LIPS has evolved over the years, adapting to the needs and interests of its core constituents; we will never stop refining LIPS, or it will lose its relevance. We’ve made some mistakes along the way, but we have learned from those mistakes.

It strikes me that one of the unifying characteristics of LIPS attendees is curiosity. As the writer Dorothy Parker commented, “The cure for boredom is curiosity. There is no cure for curiosity.” I know that I don’t want to be cured, and I suspect the LIPS community would say the same.

Curiosity leads me to ask, “Why is the audience in my dome today? What is most interesting to them about this topic? What can THEY teach ME while they’re here?” Sometimes they teach me simply that the dome environment is awe-inspiring, and that I need to stop and remember to enjoy the wonder. This is a lesson that I tend to forget.

It is too soon to spell out all of the impacts the pandemic restrictions will have on my next public shows, which are currently planned for Astronomy

*(Continued on pg. 64)*



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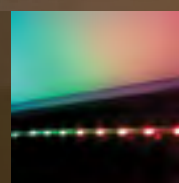
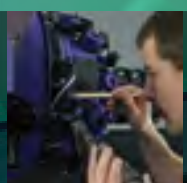
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# A DIFFERENT POINT OF VIEW

## A Little Bit of Everything



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The thing about being an “amateur planetarian” is that one need not follow the standard norms that you professionals do. I must admit that I was a bit smug in thinking that offering “planetarium ale” would be the perfect offering, and what I believed to be a cut above what you pros could offer. Also, importing it from California by the keg added a certain amount of class to the operation. Imagine my chagrin when I found that the Adler was doing the same thing, offering “Space Beer” brewed specially for the Adler and its guests.

Certainly, they must be the only one....no there are others, a lot of others, and not only planetariums but observatories as well. The Worthy Garden Club Hopservatory has set up a telescope to teach “big and unwieldy concepts.” I wonder if that makes focusing any easier, or should we just sit back and let the computer do it?

A new amateur dome is under construction by James Hicks. It will be a 16.25-foot diameter dome in his back yard. The size was set to keep the sq. ft. under 200 and thus avoid the need for a building permit. If interested, you can follow along on his progress at “Planetarium Builders and Enthusiasts” on Facebook. <https://www.facebook.com/groups/169761594256661>



Photo by: James Hicks.

If I happen to be home around sunset, I always look out to see if there is a worthwhile view to digitally capture. I never do sunrises because I’m retired and never intend to get up that early

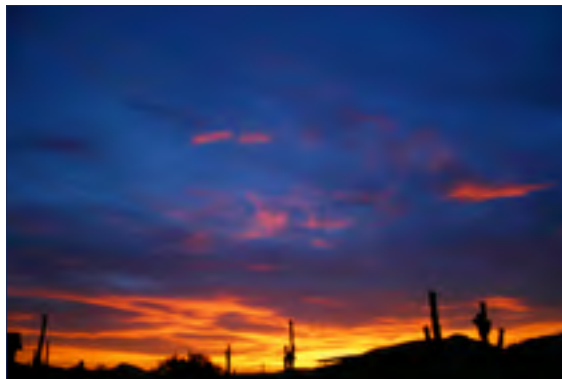


Photo by: Ron Walker.

ever again. Anyway, with the Sun so far to the north, I tend to walk to my northern property line to get a picture without all of the infrastructure wires hanging in view. If I see a sunset worthy



Photo by: Ron Walker.

of a few megabytes, I will take the shot.

From this perspective, my view of my little complex always makes me hum “Thus Spake Zarathustra”.

### KEITH’S CAPTURED QUIPS ~ CHAPTER SIXTEEN

“Some of the stuff you taught me I didn’t know. But when you taught me, I knew it.”

“Thank you for showing us the planetarium. It is very big.” (We only have a 40-foot dome)

“I learned that the galaxy is bigger than I thought.”

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

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

### 10 YEARS AGO, SEPTEMBER (2011):

Gary Tomlinson penned a rather interesting article entitled, “Keeping Astronomy in Science Education.” Way back in 1898, a group called “The Committee of Ten” decided that astronomy was no longer required as a subject in US schools and it was dropped. Without many planetariums

back then I guess it didn’t affect us much. It wasn’t until Sputnik and the space race that things changed. This did affect us a lot and thanks to Mr. Spitz, planetariums popped up all over the place. Then, in 1995, the National Science Education Standards came out and once again deemed astronomy not as worthy to teach as other branches of science. He went on and developed a K through 12 curriculum.

### 25 YEARS AGO (1996):

“Preschool Program Evaluation” by Francis C. Bidy looks at some of the old planetarium programs that have been used for years to see if they are still useful. Unless the information presented is no longer viable, it will be used and new to each new grade as they come through. Stu Chapman developed a lesson on Kepler’s third law of planetary motion still viable today.

I could comment on Richard McColman’s article on “Stop Wasting That Kodalith!” but why bother? Unless you have some stashed away in a secret place, all we can do is shed a tear for, what was, one of the most fun....or perhaps we don’t want to remember the pain.

It might be well worth reviewing Roger W. Dignard’s article called “Projection Pit Lighting Case Study” that discusses different ways to illuminate the dome if you have a central projection pit.

(Continued on pg. 64)



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# BOOK REVIEWS

## New in the World of Lit



**ASTROTOURISM, STAR GAZERS, ECLIPSE CHASERS, and the DARK SKY MOVEMENT, Michael Marlin, Copyright Business Expert Press, LLC, 2021, 222 East 46th Street, New York, NY 10007, ISBN-13:978-1-63742-067-6 (e-book)**

*Reviewed by: Bruce L. Dietrich, Wyomissing, Pennsylvania, USA*

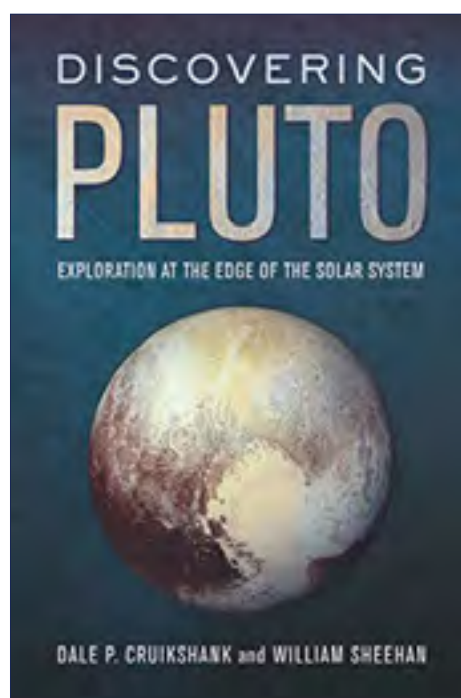
Astrotourism is a fluid journey which travelers partake in to experience celestial and space occurrences from an earthly perspective. Since several of our IPS members have been professionally involved with these journeys for more than half a century, many of the fine ideas offered here are not new to them. The fresh perspectives, however, and a new biographical context, are welcome.

During the past few months alone, the AAAS has announced an adventure to the Galapagos Islands to view the Lunar Eclipse of May 2022. One of our founding members, Ted Pedas, was eulogized for arranging such voyages since 1970.

Several of us have travelled to all the continents for our research. In our shared quest for contrast-

yielding “friendly skies,” this powerful book has some fresh ideas and much encouragement. This book promotes the general growth of astrotourism and provides structure for planning, including the thoughtful use of basic astronomical equipment.

One can only imagine our future, fueled by the quantum internet and actual space travel, soon to be available to inquiring minds.



**Pluto, by Dale P. Cruikshank and William Sheehan, University of Arizona Press, © 2018, 475 pp.**

*Reviewed by Steve Tidey, Shoeburyness, Essex, England.*

This will be an easy book review, so here goes. The book is great. Buy it.

There, that was easy. What's next, April? What was that? You want more detail? Oh, OK.

One of the two notable authors, Dale Cruikshank, was a co-discoverer by spectroscopy of methane on Pluto's surface in 1976 and is a co-investigator on the New Horizons probe to Pluto

and the Kuiper Belt. They clearly set out to make this the definitive book on everything Pluto-related, up to and including the science that came back from the New Horizons probe which passed the minor planet in 2015. And they have succeeded, mightily.

It has been researched to within an inch of its life, as I am sure that I could hear the pips squeaking a few times. The style is that of a textbook, and it is aimed at astronomy nerds like you and me who have more than a passing knowledge of things celestial. So not necessarily for the classroom, but there are plenty of nuggets of information that can be slotted easily into classroom or dome presentations.

Many of us are familiar with the background of how Pluto was discovered, but the authors have the room here to go into a significant amount of historical detail to delight the reader. Percival Lowell, of course, is the main character in this scientific drama, so we learn much about his obsession with finding Planet X. He was so determined to restore his good name in astronomy circles after the debacle of the non-existence of his Martian canals, to the point where it made him very ill. I had not realized that Lowell's drawings of Venus also showed linear markings, as he believed he was seeing the surface through breaks in the cloud cover, or that on his honeymoon in London he had ascended in a balloon to draw the crisscross paths in Hyde Park for comparison.

Not finding the ninth planet was the biggest disappointment of his career. Without getting into the fine detail here of his observational methodology when searching for the elusive planet (the book lays it out very skillfully), the authors' summation of his decades of effort is that it was doomed to fail from the beginning. He was using historical observations of the positions of Neptune and Uranus whose accuracy was questionable for such a search for Planet X, which meant he was looking in the



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wrong part of the sky. In addition, he had made too many other false assumptions about Pluto's orbital characteristics, leading him to go down mathematical cul-de-sacs. Even though Pluto was discovered close to a point predicted by Lowell, the authors show why this was a mathematical coincidence.

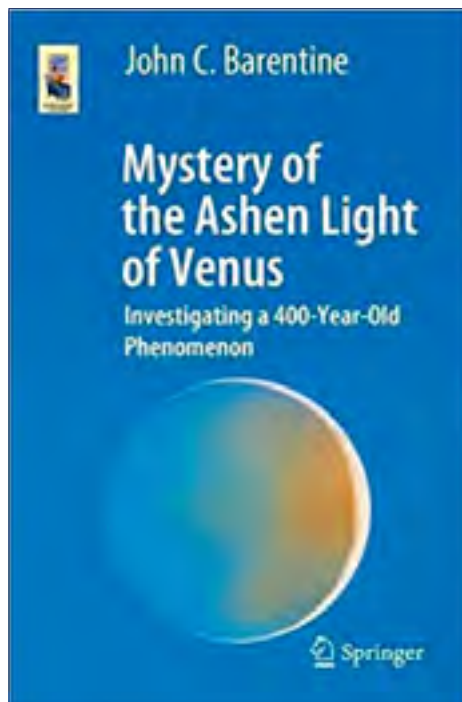
We learn that Lowell's widow had sole control over his estate after his death, and as she spent about US\$1,000,000 on lawyer fees, there were no new funds to carry on the Planet X search for at least a decade. And besides, many professional astronomers shied away from planetary astronomy during this time because the Martian canal controversy had, in their eyes, forever blighted the field and left it a laughingstock.

Clyde Tombaugh, of course, built upon some of Lowell's more reliable observations to eventually discover Pluto, but I was not aware that for decades afterwards he harbored doubts about its genuine claim to be a planet. I also learned that Tombaugh went on to spend a further 7,000 hours sitting at his blink comparator device, examining 30 million more star-like images looking for another planet beyond Pluto. He dined out on his discovery for the rest of his career, and would often tell people, "I was the world's first Plutocrat." But he later became very frustrated that all the media coverage of him was focused on Pluto, and few people bothered to mention valuable work he did observing Mars, which, surprise, surprise, turned out to be his favorite planet. Well, I never.

Coming up to date with the New Horizons probe (which carries Tombaugh's ashes) we learn that it encountered only one speck of interplanetary dust during the encounter with Pluto, all four major moons probably have a common origin from an impacting body on Pluto, and how different forms of ice reveal much about a planet and its history. The authors close with what, at their time of writing, was a look ahead to New Horizons' encounter with a Kuiper Belt object a few years later. We have since had that flyby of the amazing double-lobed body, 486958 Arrokoth.

All in all, this should be on your office bookshelf as an ideal resource to answer questions that the public still have about Pluto, as their interest in this fascinating

body has increased since its untimely and controversial demotion in 2010.



**Mystery of the Ashen Light of Venus: Investigating a 400-Year-Old Phenomenon, by John C. Barentine, Ph.D.**

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

Several months ago, I was asked to write several paragraphs on the "Ashen Light." I really wish I had had this book then.

What exactly is the Ashen Light? This is light coming from the planet Venus that has been observed for hundreds of years by both professional astronomers and seasoned amateurs. But not by every observer. And not all at the same time or phase in Venus's orbit.

Also, it doesn't seem to always have the same physical appearance. Finally, it has never been photographed. What is happening?

The author takes great pains to prove to the reader that this phenomenon does seem to be real.

He quotes researchers who have spent years attempting to not only observe but understand what could be happening at Venus. Too many observers have acknowledged its presence through the centuries to dismiss the unique lighting that they have seen and documented.

And many have tried to explain this Ashen Light, either by exact scientific explanations and testing, such as by means of the planet's interactions with coronal mass ejections, or (admittedly off the wall), bonfires on the surface to acknowledge new leaders. But, although there have been many confirmations of the Ashen Light, there hasn't been any true agreement as to its physical appearance.

In an attempt to understand the complexity of the sightings, the author went so far as to contact an expert in vision science, who, as an example, could conceive of the possibility of the observer's brain "filling in" information where it might not really exist, such as the "duck-rabbit" scenario.

In retrospect, the author could have had the reader wonder whether the Ashen Light is simply a play on the observer's senses, such as the Martian canals or the inner planet Vulcan. But he didn't.

Is there, then, a possibility that the Ashen Light could be just as "real" as those? Or is it a true, but elusive, phenomenon? Keep an open mind when you read this book, and, if you are a Venus observer, come to your own conclusion. You may be surprised.

## IN MEMORIUM



Eddy Pirotte, retired director of the planetarium at Cozmix, Volkssterrenwacht Beisbroek (the public observatory) in Brugge, Belgium, passed away on 18

June 2021, surrounded by his loved ones.

He was born 29 September, 1955 in Hasselt. A geography teacher earlier in life, Eddy started his planetarium career at the Europlanetarium in Genk-Belgium in the late 1980 before joining the Cozmix planetarium team at Beisbroek-Bruges in 1997. He was an active member of IPS and passionate about the planetarium field.

He is survived by his wife, Martine Boels; his children, Marald Mortier and Laura-Johanna Cluytens, and Mauger Mortier and Jade Tanghe; and beloved grandchildren, along with brothers, sisters, and cousins.

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# SEEKING WHAT WORKS

## DEBUNKING EDUCATION MYTHS



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Education research is as prone to misconceptions and false narratives as astronomy. Everyone has personal experience of thinking and learning; perhaps that is why myths that 'sound right' are so easily accepted. Fortunately, academic researchers have gathered enough experimental data to help us sort at least some of these myths from reality.

There are a few well-worn education myths that are especially persistent, despite having been debunked by psychologists some years ago. Here are my Top Three Education Myths.

### MYTH 1: People learn best in their preferred Learning Style

A learning style is a way of receiving information for learning. Lists of learning styles vary, but usually include visual, auditory and kinesthetic.

This myth, from the 1990s, suggests that people learn best when material is provided through their preferred learning style. If you believe this, you might think that teachers must present information in every different style to avoid leaving any learner behind. Or (worse), that children should be grouped by preferred style and given different activities.

In reality, everyone learns through multiple learning styles. Although most people claim a preferred learning style, studies have repeatedly shown that presenting material in the learner's favored style does not improve learning outcomes (Pashler, 2018).

The Learning Styles myth is very prominent, partly because it is pushed by companies selling associated training and resources. This is part of the broader pseudo-scientific 'personality test' industry (Chen, 2018) - effectively a modern form of astrology.

**Don't:** Feel compelled to use learning styles that don't suit the material.

**Do:** Use a natural mix of styles, choosing the style(s) most appropriate for each individual concept.

### MYTH 2: The type of learning activity determines how much is remembered

This fantastically sticky edu-myth has been tracked all the way back to the 1850s (Letrud, 2018). At some point, it was merged with an unrelated academic diagram to create a meme which has successfully wheedled its way into teacher training programs and other, apparently authoritative, contexts. It is usually presented with fake academic references.

The myth is presented as a pyramid diagram (as in Figure 1). Each level is labelled with a way of learning (e.g. lecture, discussion). Each of these is given a percentage claiming to show how much of the taught material will be remembered. The diagram is often mis-attributed to Edgar Dale.

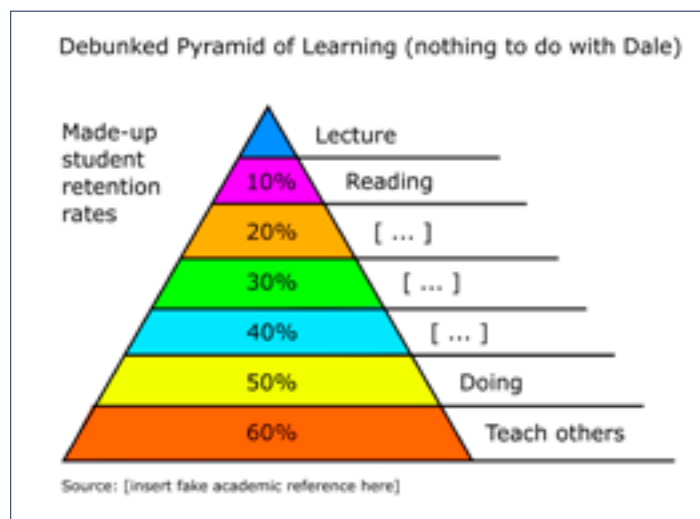


Figure 1: Myth 2 is often presented as the "Pyramid of Learning". Credit: author.

Red flags should immediately be raised by the fact that each percentage is a multiple of 10%. Experimental data is never so tidy! Recent retention studies trying to test its claims have shown no basis for the numbers at all. In addition to the made-up figures, this model contradicts current understanding of how learning occurs. It's difficult even to study this topic, as retention varies so much between individuals, contexts, and through time.

**Don't:** Be put off using activity types that are undervalued by this false and misleading diagram.

**Do:** Use a mixture of activities that are best suited to the topic and to the prior knowledge of the learners.

### MYTH 3: Learners are good judges of their own learning

Planetarians are often asked to provide information that would require a longitudinal research study using sophisticated psychological/sociological methods. Have you ever asked your audience something like, "how much did you learn?" I have - many times! But unfortunately, people are terrible judges of their own learning.

Reasons for errors of judgement include:

1. They have become very familiar with the material but have not learned how to recall it.
2. Practicing recall made them aware they can't remember everything they expected to. This made them feel they learned less well than they otherwise would have reported.
3. They struggled, or were confused, during the activity and so think they did badly. (In fact these feelings can be markers of effective learning.)
4. They believe they understood it all, because they did not get the chance to identify their misunderstandings.

There is a lovely study related to the first two items in this list. Learners were

(Continued on pg. 60)



# BLACK HOLE

FIRST PICTURE



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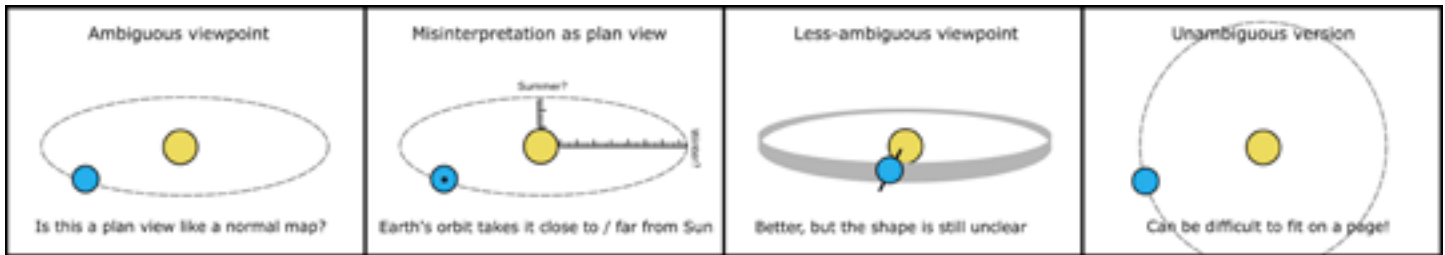
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# DANGER: MISCONCEPTION AHEAD!



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## BEAT THE SEASONS

Many popular misconceptions are born from misguided links to familiar, well-understood concepts. A good example is the misconception that summer is warmer because we are closer to the Sun. This misconception can be linked to past experiences of huddling closer to a heat source to catch more of its warmth. The misconception feels very natural and there is no immediately obvious evidence that might contradict it.

As discussed in previous columns, learners will interpret new information through the lens of their misunderstanding. They give more attention to evidence that agrees with their prior beliefs, and less to aspects that disagree. Unfortunately, they are likely to have encountered astronomy diagrams that have accidentally reinforced their mistaken beliefs.

It is especially important to consider the prior beliefs of your audience, and to be aware of the points at which you may be challenging these. Here are three mistaken models that your learners might be bringing into the dome:

### What's my Angle?

The solar system is often shown as if viewed from a tilted angle. This saves space on the page but is an unexpected viewpoint for anyone expecting a map. Without clear explanation, it is no surprise that some people might expect the view to be a plan view, seen from 'above'.

Consider Figure 1. If the first panel was interpreted as a plan view, the Earth would be different distances from the Sun at different times of year (as in the second panel). This would fit with

the misconception that we are all closer in summer. It would also mean we experience two summers per orbit, but human brains automatically give less attention to things that do not fit with prior beliefs, so this may well be ignored.

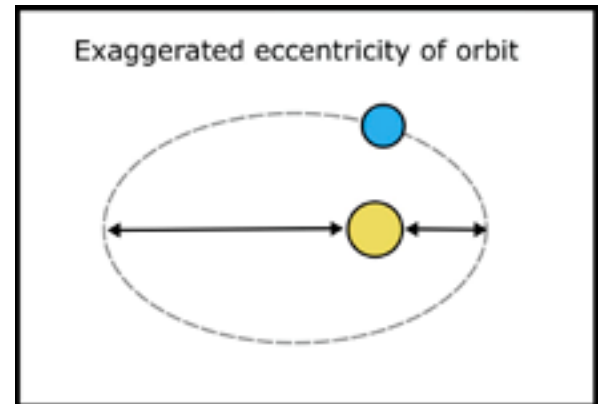
The planetarium's ability to show planetary orbits from moving viewpoints is great for helping learners to commit an accurate 3D model to memory. Drawing attention to the orbit's shape may help those who believe it to be more elliptical.

Rotating to a tilted viewpoint and mentioning that this is how orbits are often shown in books may help people align their prior experience with what they are seeing. "Oh, my book isn't wrong, it's just showing it on a tilt," rather than, "She might say that but I know differently from my book".

### Elliptical over-exaggeration

The Earth's orbit is, of course, not exactly circular, but explaining this to learners who have misconceptions about the seasons can cause confusion. This is especially true where diagrams exaggerate the eccentricity in order to show how the Sun is positioned at one focus of the orbit.

If the diagram in Figure 2 was taken as showing true shape of Earth's orbit, then this would fit with a 'Summer is closer' explanation for the seasons, showing just one summer and one winter each orbit. It still can't be correct, as Northern summer coincides with Southern winter. Despite this, it



(Top) Figure 1: Ambiguous diagrams can support misconceived ideas. (Above) Figure 2: Exaggerated scales can create mental models that reinforce misconceptions. Images: Jenny Shipway

is very likely to be accepted because it supports the prior misconception that the Sun is closer in summer.

Care should be taken whenever talking about the deviation of the Earth's orbit from a circle for this reason, ensuring that this information is not being taken as evidence to support a misconceived seasons model.

### Lean In

Perhaps the learner knows that the Earth's orbit is near-circular and that when one hemisphere of Earth has summer, the other has winter. They also know that seasons are caused by the 'tilt'. Is this enough to banish the misconception that 'summer is closer'? Not quite.

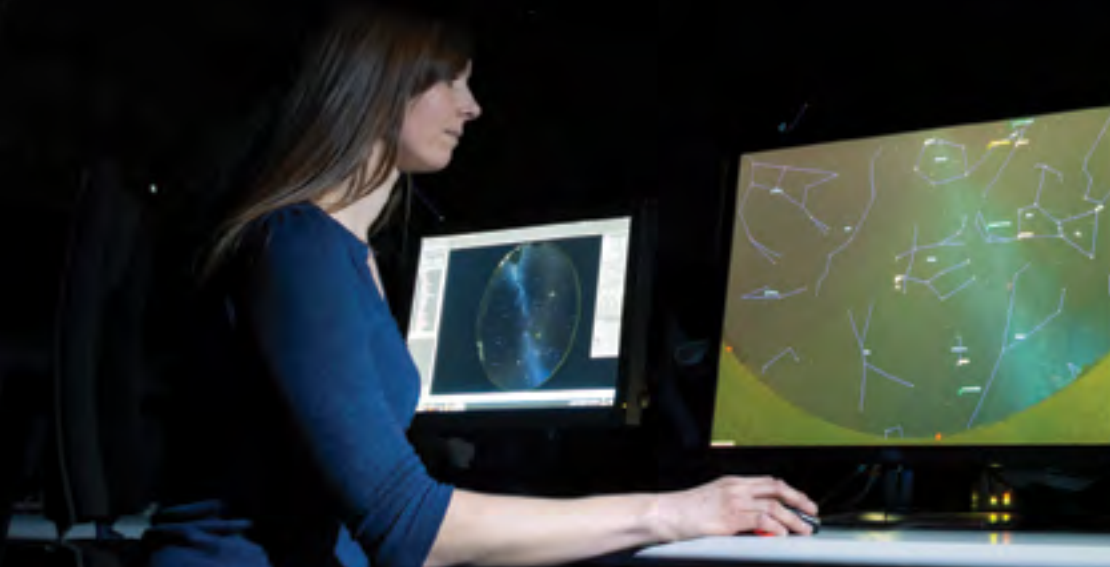
Recalling memories of standing near a bonfire, it's not unreasonable to think of the summer hemisphere as leaning in towards the warmth, and the winter hemisphere as leaning away to cool off. Diagrams showing the Earth and Sun very close together could support this model.

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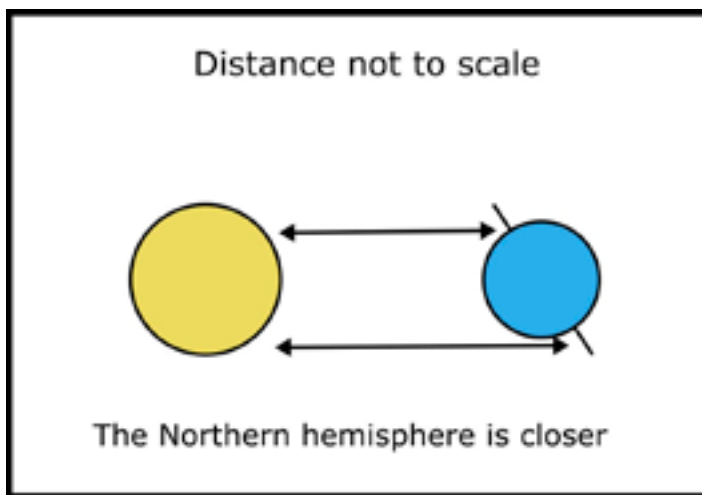


Figure 3: Using different scales for size and distance can encourage the learner to make misguided links to their own experiences. Image: Jenny Shipway

Of course, it is not possible to show the Sun and Earth in detail at true scale in the dome. They are so far apart! Presenters choose different ways to tackle this – usually by either expanding the scale of both until they are visible or having the Sun out of sight while

### Seeking What Works (con't.)

asked how well they thought they would do in a test, and this was compared to their subsequent performance. One group of learners had re-read the test material repeatedly. The other group had read it just once, using the rest of the time to practice recalling it. Which group do you think was most confident? Which group do you think did best on the test? (Roediger & Karpicke, 2006)

This myth also helps feed Myth 1 (Learning Styles); students may report that they are more confident about material learned in their preferred style, despite showing no benefit in testing (Knoll, 2017).

**Don't:** Adapt your practice in response to self-reported assessments of learning.

**Do:** Ask learners to demonstrate, recall, or use new learnings. You could ask them to predict and point to where an object should be, or to identify something in the dome. Or, give them quick, low-stakes quizzes designed to catch misconceptions. Be sure to involve everyone, not just those confident enough to put their hands up.

looking at the Earth.

If you are going to change the scale of the Sun and/or Earth, I always recommend starting at true scale. Explain you are going to expand the objects, and then when you are finished, return them back to true scale again. Make a point of noticing how tiny they are in reality

compared to the distances.

### The Reason for the Seasons

Seasons is a really tricky topic to teach, even to someone without misconceptions, and it can't be

rushed. Take time to check at every step whether all the learners have mastered the understanding they will need to progress. Accept that it can't be mastered during a single planetarium show; your task is to build on prior learning experiences and to give a firm foundation for future learning experiences.

Finally, remember that misconceptions can pop up in zombie form long after you thought they were gone, so keep checking! Encourage the learners to use their new, correct, models in as many different and useful ways as possible. This will boost the correct model's status and make it more likely that this is called upon in the future, rather than the misconception.

### SIMPLE FIXES

Education myths are often attractive because they offer a simple approach. But education is a complex activity, and so it is always worth being cautious of anything that looks like a quick fix. That said, if you do want a single, simple phrase to help guide your practice, you could do a lot worse than choosing Daniel Willingham's "Memory is the Residue of Thought."

This phrase reminds us that, however we choose to present a topic, the most important steps to learning will happen within the learner's mind. The more the learner thinks about or uses a concept, the more likely they are to remember it. So, consider: are you encouraging your audience to turn the new information around in their mind, to use it in new ways, and to link it to their prior knowledge? Or, is it just going in one ear and out the other?

Save wasted time and energy by casting off debunked educational myths and allow yourself to focus your energies on more-effective strategies to help your audience learn.

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NARRATED BY RICHARD DORMER

# BIRTH OF PLANET EARTH



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# TECHNICALLY SPEAKING...

## A NEW POINT OF VIEW

Glenn Smith  
 Managing Director  
 Sky-Skan Europe  
 Munich, Germany  
 smith@skyskan.com

Greetings to planetarians world-wide! The torch has been passed and I will now carry on the tradition of trying to shed light on the more technical aspects of our industry. Technologies used in planetariums have gone through an amazing evolution over the past twenty to thirty years. Some advancements have been adopted and have brought our systems and presentations to new levels of quality and performance, and others not so much!

I have just returned from the Fulldome Festival Brno in the Czech Republic, where the latest productions and uses for our domed canvas were shared in person! Being the first live conference in over eighteen months, it was great to see, chat, and interact with colleagues from all over the world again! Many, unfortunately, could not make it due to local regulations but we still managed to have about a hundred individuals convene to watch four packed days of fulldome content and works in progress. Let's hope things keep improving and we can count on more such meetings soon.

Moving on to more technical matters, it wasn't so long ago that many of us were wrestling dozens of slide and special effects projectors in order to spice up our presentations. The first video projectors that allowed the background to be adjusted to a deep black brought our special effects to life, and slewing video projectors inspired us to dream of covering the dome with moving images.

After a few years of philosophizing over whether planetariums were becoming cinemas or not, most of us today have accepted fulldome video and computer-driven visualization as the norm. Even the word "planetarium" has taken on a new meaning, where not only astronomy and the cosmos can be presented in full immersion, but any range of science topics. And why not a bit of entertainment, too?

It is not only fulldome video that has grown in depth and resolution since its emergence in the late 90s. Years ago, almost every planetarium had a different type of sound system, with the most common similarity being the traditional and authoritative "voice of God" at the zenith. We've evolved to 24 channel, steerable systems that use joysticks to route audio around the dome. Lamp-based projectors have evolved to solid state sources like LED and laser. Lamp changes, and the constant struggle to keep the projection channels balanced, are slowly fading to memory.

Now, active display domes made entirely of LEDs are beginning to appear and, with them, a whole new set of challenges. The contrast barrier has been broken, and it is exciting to see the first glimpses of the future of dome theaters. Prices will be inhibitive for most for the foreseeable future, just as it was when fulldome projection technologies first emerged, but I think no one can deny that we are looking at what will

eventually be the standard for all new planetariums.

LEDs are everywhere today. We have amazing colorful LED cove lighting, LED monitors in our consoles, and LEDs that allow for wonderful, aesthetic, indirect lighting for planetarium interiors and the surrounding spaces. LED light sources have also brought our cherished opto-mechanical planetarium projectors into the 21st century with crisp, bright, white light that faithfully represents the true color of the stars without all the heat previously generated by incandescent or xenon arc-lamps. As a result, the star projectors have been reduced in size and become less intrusive to the planetarium interior. However, I think we all, along with the public, still have a nostalgic feeling for the traditional giant "ant," or as the Germans say, "Knochen" (bone), that used to tower above us in the center of the theater.

In the coming issues of The Planetarian, I look forward to answering questions, and to discussing what various aspects and features of our technologies should be appreciated or considered for use in planetarium or fulldome theater settings. Please feel free to send me a message with your comments or questions to smith@skyskan.com, mentioning "Technically Speaking" in the subject line, and I'll do my best to answer them along with shedding some light on the details of how all these technologies work.

## PARTYcles

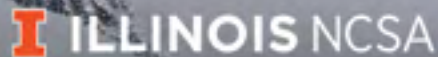
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Alex Cherman

# ATLAS

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## Immersive Matters (con't.)

do planetariums connect audiences to phenomena at the much smaller, human scale?

Led by IMERSA board member Julieta Aguilera, an exceptional panel of experts will address this and other increasingly relevant questions. Past-president of IPS and science visualizer Mark SubbaRao (now at NASA's Goddard Space Flight Center) has been eagerly advancing scientific visualization in planetariums. Jason Leigh, who directs the Laboratory for Advanced Visualizations and applications (LAVA) at the University of Hawai'i at Mānoa, has been working in the development of immersive tools to enhance cross-disciplinary collaboration. Jeff Kirschner has introduced data collection, classification, and analysis to the public in order to drive change in their own communities via the Litterati app. Finally, Tanya Berger-Wolf is a computational ecologist whose Wildbook project utilizes citizen science to better understand how living beings connect to their environments. IMERSA Advisor Ka Chun Yu, who has been involved with astronomy and education

research throughout his career, will start the panel by presenting a brief overview on the WorldViews Network, a project designed to develop best practices when using immersive virtual environments for ecological literacy. This panel aims to take immersive experiences to the next level in time and space as we seek to foster a stronger connection to our home planet through our domes and immersive experiences.

### Virtual IMERSA Days to Continue

Since the experiment with online IMERSA Days has been so successful (our attendance for all the events has averaged over a hundred participants for each one) the IMERSA board has decided to continue them every two months for the foreseeable future. With the uncertainty inherent in successive waves of COVID-19 variants, it's possible that our community members will be facing shutdowns or, at the very least, curtailed operations, for some time to come.

These online sessions have been a great way of bringing our widespread community members together. The

events are free to IMERSA members, and available at a low \$20.00 per session to non-members. Recordings of these events are available to paid attendees and members for a short time afterwards. We announce our events at IMERSA.org, as well as provide detailed information about how people can join our organization.

We remain hopeful that 2022 will bring a resumption of "in person" events, and to that end, we will have more news soon about an event to take place in Montreal a year from October. Stay tuned!

In the meantime, IMERSA is producing workshops and educational sessions for the upcoming Dome Fest West film festival taking place in Los Angeles October 8-10. More details are available at <https://www.domefestwest.com>.

Thanks to Julieta Aguilera, Michael Daut, Dan Neafus, and Ryan Wyatt for their contributions to this column.

## A Different Point of View (con't.)

### 45 YEARS AGO (1976):

In his article "Science Fiction Literature and the Planetarium", Mr. Jack A. Dunn suggests that, by its very nature, a planetarium is a science fiction experience. He has produced a script, "Spectrum: The Science Fiction Universe." His script "Spectrum" is in the "Script Bank." (Do we still have a "Script Bank?") I need to check on this, as it sounds like something I would want to do.

While I doubt anyone will have a use for this, W. A. Deutschman's article "An Integrated Circuit Variable Speed Motor Controller" can still be useful today. Imagine a chair centrally located in the plethora of computer monitors that literally surround today's operations cockpit. Wouldn't the final touch to reaching nirvana be a joystick that could spin you from monitor to monitor?

## LIP Service (con't.)



The Fiske Planetarium at the University of Colorado in Boulder, LIPS 2022 host. Image from: <https://www.colorado.edu/fiske/>

Day in October. However, I am already looking forward to filling up those 28 seats and exploring the universe. We can do—and in fact have done—virtual Pacific Planetarium programs with much larger audiences, but there's nothing like having everyone under the dome together.

I wrap up with a look farther into the future: LIPS 2022. We plan to hold LIPS 2022 at the Fiske Planetarium at the

University of Colorado in Boulder. Exact dates are still to be determined, but it will most likely be in July.

You may recall that the Fiske was going to host LIPS 2020, and we all know why that didn't happen... 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. I thank the Fiske for their willingness to wait until 2022 to host LIPS!

As always, I end this column with reminders about the LIPS Google Group and Live Interactive Planetarium Symposium Facebook group. Contact me ([karrie@DigitalisEducation.com](mailto:karrie@DigitalisEducation.com)) if you need information about joining either group, or if you just want to share ideas.

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# INTERNATIONAL PLANETARIUM'S CALENDAR

COMPILED BY: LORIS RAMPONI

## 2021

- **3-4 September.** British Association of Planetaria (BAP), Annual Conference, virtual. Contact: [nina.cameron@glasgowsciencecentre.org](mailto:nina.cameron@glasgowsciencecentre.org) [www.planetaria.org.uk](http://www.planetaria.org.uk)
- **21 September.** LIPS Conference (Live Interactive Planetarium Symposium), virtual. Contact: Karrie Berglund, [karrie@digitaliseducation.com](mailto:karrie@digitaliseducation.com); <https://www.lipsymposium.org/registration>
- **4-8 October.** Digistar Users Group Conference, DUG 2021, Salt Lake City, Utah, USA. Select sessions are available virtually. Contact: [digistar@yahoo.com](mailto:digistar@yahoo.com); <http://digistardomes.org/>
- **5-7 October.** Association of Science-Technology Centers (ASTC) Annual Conference, virtual. <https://www.entsoc.org/event-calendar/association-science-and-technology-centers-annual-conference>
- **8-10 October.** Dome Fest West, Los Angeles, <https://www.domefestwest.com/>
- **8-10 October.** FullDome Festival, Jena, <https://fulldome-festival.de/>
- **8-10 October.** Fulldome UK, Plymouth, <https://www.fulldome.org.uk/>
- **9-10 October.** Dome Under Festival, Melbourne, <https://museumsvictoria.com.au/scienceworks/whats-on/dome-under-festival/> All Festivals will join for the "Best of Earth"
- **November 1.** "Catch a Star" contest for students, organized by European Association for Astronomy Education (EAAE) and the European Southern Observatory (ESO). Will start on November 1, 2021. The deadline to send the projects is February 28, 2022. The final conference and the award ceremony will be on March 20, 2022. Contact: Hristo Stoev, [stoevi@gmail.com](mailto:stoevi@gmail.com); <https://eaae-astronomy.org/catch-a-star/welcome-to-catch-a-star-2022>
- **10-13 November.** Great Lakes Planetarium Association, Annual Conference, Kalamazoo, Michigan, USA. Contact: Mike Smail, [msmail@](mailto:msmail@adlerplanetarium.org)

[adlerplanetarium.org](mailto:adlerplanetarium.org); <https://glpa.org/2021>

- **26, 27, 28 November.** Association of French Speaking Planetariums (APLF), Annual Conference, virtual. Contact: Milène Wendling, [milene.wendling@unistra.fr](mailto:milene.wendling@unistra.fr); [www.aplf-planetariums.org](http://www.aplf-planetariums.org)
- **17-19 December.** Workshop of small digital planetariums, Marseille, France. Contact: [lionel.ruiz@live.fr](mailto: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](http://www.ips-planetarium.org/?page=WeekinUS)
- **31 December.** Deadline of the prize "Page of stars" organized by IPS Portable Planetarium Committee in collaboration with Serafino Zani Astronomical Observatory. Contact: Susan Reynolds Button, [sbuttonq2c@gmail.com](mailto:sbuttonq2c@gmail.com); <http://www.ips-planetarium.org/?page=pagesofstars>

## 2022

- **January.** 40° 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](http://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](mailto:segreteria@planetari.org); [www.planetari.org](http://www.planetari.org)
- **April.** Italian Association of Planetaria (PLANit), National Conference, dates and site coming soon. Contact: [segreteria@planetari.org](mailto:segreteria@planetari.org)
- **23-25 April.** Gesellschaft Deutschsprachiger Planetarien e.V., (GDP), Annual Conference

of the Society of German-Speaking Planetaria, Heilbronn. Contact: [bjoern.voss@lwl.org](mailto:bjoern.voss@lwl.org); [www.gdp-planetarium.org](http://www.gdp-planetarium.org)

- **18 May.** International Museums Day, <http://icom.museum>
- **2-4 June.** European Network Science Centres & Museums (ECSITE), Annual Conference, Heilbronn, Germany. [ecsite.eu/activities-and-services/ecsite-events/conferences/2022-ecsite-conference](http://ecsite.eu/activities-and-services/ecsite-events/conferences/2022-ecsite-conference)
- **20-22 June.** International Planetarium Society Conference, Saint Petersburg, Russia. Contact: Evgeny Goodov, [ceo@planetarium.one](mailto:ceo@planetarium.one); <https://en.planetarium.one/ips>; <https://www.ips2022.com/>
- **30 June.** Asteroid Day.
- **31 December.** Deadline for the contest "A week in United States." For information and application requirements go to: [www.ips-planetarium.org/?page=WeekinUS](http://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](mailto:AdamThanz@kingsporttn.gov)

## 2024

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

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# LAST LIGHT

## THE BEST THANK YOU NOTES



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I am retiring from a long and satisfying career at the end of this year and am going through old (paper) files. Thank-you notes from students are always fun to read:

“Thank you so much for the tars. The wierd part was when I felt like I was sick. I realy enjoyed the stars and the silly Coyote!”

“Thank you for the lesone and I liked the silly coyote doing silly things. And my favorite part was when the coyoe was floting on the and it fell out of the water.”

“Thank you for the super pantairum. I like stars. The movie flet like I was sick and it flet like I was moving around. I enjoyed the constellation.”

“Thank you for the lesson on coyote and it wus the grate time and it was supe day on the Earth Moon and sun.”

“Thank you for the super stars in the top “Earth Moon, and Sun.” and my favorite part is wen the funny coyote was doing a funny thinking have a good week.”

“Thank you for showing us about constellations and thank you for showing us sun moon & earth. I felt like was outside on the grass.”

“Thank you for leting us watch the stars and the moom and the Earth and the sun thank you for leting us watching all of that good by.”

“Thank you for leting us see the snaks and the stars I was funny and inporten I love wen we saw the cobra.” (We have some live snakes on exhibit at the Science Center, but no cobra...)

“I love your move it was to funny when that funny coyte ride the moon like a cowboy I had a graet time thank you.”

“Thank you for the awesome lesson in the planearium and I liked the stars and the crazy coyote and I enjoy the lesson.”

“We loved your show I didn’t know that the sun is biger then the moon. thank you for avrething.”

“Thank you for the planetarium we enjoyed the show espeshaly me. I loved the stars and the Moon and he Solar systems thank you so much. I love stars.”

“Thank you for the show. I rely enjoyed it. But the part that I liked best were the snakes. It was an honor getting to see so much stars.”

“Thank you for the Show and All the Cool Suff you hade. In the planetarium it was so cool.”

“Thank you for showing us that funny show and the show where it talked about the stars and the solar systems and the moon. I love the planetarium and thank you for helping us lern and I lerned that the sun is full of gas.”

“Thank you for the show I hop you enjoyed the novie because I did and again thank you for invot us to FernBank but I enjoyed that you showed us about the moon and stars.”

“...I am enjoyed the show I was happe to go Planetarium that is the Best every”

“I LOVED the planetarium! The chickens where squaky! That was the best fild tripe.”

“I like the show beaeacuse it was cool and fun bceaaese the movie was fun because the show was so cool and fun.”

“Thank’s for all the fun. We enjoy the show. Your realistic animals wear cool sum animals creep me out! But you are sooo nice so that’s why we all right a not.”

“We had the best! At the planetarium we saw lizzards, and snakes, chickens, and roosters. We loved it. Thanks. We had a good time!” (and apparently attended a planetarium lesson too...)

“I learned that the sun is a star. and The sun is the hottest.”

“You are so nice. I love your job. I learned that the moon is small and the sun is big. I like the stars that look like pictures. Heart heart heart heart heart”

“Thank you for the tour. It was very fun! I learned that the planet Pluto, was or called it the dwarf planet. I will come again one day and have fun.”

“I liked that part when everyone thot a planet was a star and you said it was not a star.”

“I learn that the other halfe of the Earth night and other and the day the halfe of the Earth and the day.”

I learned that Pluto is a star. And I also learned that the moon spins around the Earth. I also learned that Jupiter is the biggest planet Thank you for teaching us.” (uh-oh.)

“I loved when you showed us the constellations in the movie room tat was amazing. One more thing I learned so much that I want to go again.”

“I like the part when you needed to look up and look at the stars it was beautiful.”

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