Reach for the stars... and beyond.

ZEISS powerdome IV

True Hybrid with brilliant stars and perfect renderings from a single source

ZEISS powerdome IV brings many new features to your star theater: an integrated planetarium for earthbound and extraterrestrial astronomy with seamless transitions between optical and digital star fields (True Hybrid) | The universe from Earth via the solar system and Milky Way galaxy to the very edge of the observable space | Stereo projection | 8k performance | 10 bit color depth for smooth gradients | HEVC codec for efficient video renderings free of artifacts | All constellation figures, individually and in groups without any mutual overlapping | Telescope function for deep-sky imagery applying Astronomy Visualization Metadata | Complete image set of all Messier objects | Customizable polar lights, comets with gas and dust tails, and shooting stars with a great variety of parameters for location, brightness, colors and appearance | Simulation of day and night with dusk and dawn coloring of sky and panorama images | Customizable weather effects such as clouds, rain, fog, snow, rainbow, halos, air and light pollution effects | Digital rights management to secure your productions | Remote service for quick help, and much more from the only company serving planetariums for nearly a century.

www.zeiss.com/planetariums
Executive Editor
Sharon Shanks
484 Canterbury Ln
Boardman, Ohio 44512 USA
+1330-781-9341
sharon.shanks@gmail.com

Webmaster
Alan Gould
Lawrence Hall of Science Planetarium
University of California
Berkeley CA 94720-5200 USA
adgould@comcast.net

Advertising Coordinator
Dale Smith
(See Publications Committee on page 3)

Membership
Individual: $65 one year; $100 two years
Institutional: $250 first year; $125 annual renewal
Library Subscriptions: $50 one year; $90 two years
All amounts in US currency
Direct membership requests and changes of address to the Treasurer/Membership Chairman

Printed Back Issues of Planetarian
IPS Back Publications Repository
maintained by the Treasurer/Membership Chair
(See contact information on next page)

Final Deadlines
March: January 21
June: April 21
September: July 21
December: October 21

Associate Editors
Book Reviews April S. Whitt
Calendar Loris Ramponi
Cartoons Alexandre Cherman, Chuck Rau
Classroom Education Jack Northrup
Data to Dome Mark Sulba Rao
Design Operations Tim Barry
Different Point of View Ron Walker
Education Committee Jeanne Bishop
Fulldome Matters Carolyn Collins Petersen
International Lars Petersen
Last Light April S. Whitt
Live Interactive Karrie Berglund
Mobile News Susan Reynolds Button
Sound Advice Jeff Bowen

On the Cover:
The spectacular Star-roof at the ESO Supernova Planetarium in Munich. Read more about this newest *star* in the planetarium world starting on page 14. ESO/P. Horálek

International Planetarium Society home page: www.ips-planetarium.org
Planetarian home page: www.ips-planetarium.org/?page=plntn

www.facebook.com/InternationalPlanetariumSociety
twitter.com/IPS_Planetarium

Vol 47 No 2 - June 2018
Planetary

Articles
8 Vision 2020 Update: Transitioning to the Future Jon Elvert
9 Centennial of the Planetarium: We are looking for your ideas! Björn Voss
10 Portable planetariums celebrate International Day of Plantariums Susan Reynolds Button
12 The International Relations Committee announces "We have a winner!" Susan Reynolds Button
14 The ESO Supernova: A new star awakenings in Munich Carolyn Collins Petersen
22 From space to the stars: Ten years of arts and entertainment at The Vortex Dome-Los Angeles Ed Lantz
30 Antoine Darquier and the discovery of the Ring Nebula Jean-Michel Faidit
34 Visions of immersion 50 years in the past Jack Dunn
38 15 years of keeping track of the world’s planetariums Daniel Audeon
40 From Chichulub to Tunguska Esteban Sanders
42 The Dome’s Next Generation Maciej Ligowski
One Sky, Many Languages Chrysta Ghent, Peter Licona
How we do it: Power adapter for DSLR Camera Adam Thanz
72 Tales from Dome Under: On His President’s Secret Service Tom Callen
90 Tributes: Stephen Hawking, Gloria Villalobos

Columns
Book Reviews .................................................. 82
Calendar ...................................................... 91
A Different Point of View .................................. 86
Fulldome Matters ........................................... 48
From the Classdome ....................................... 56
In Front of the Console ................................. 4
International News ......................................... 60
Last Light ...................................................... 92
LIP Service ..................................................... 74
Mobile News ............................................... 84
Outside Space ............................................. 78
Partycycles .................................................... 57
President’s Message ...................................... 6
Seeking What Works ..................................... 52
Waxing New ............................................... 88

Index of Advertisers
American Museum of Natural History .......... 69
Ash Enterprises ............................................. 59
Astro-Tec Manufacturing .......................... 45
Audio Visual Imaginering ......................... 85
Bays Mountain Productions ...................... 44
California Academy of Sciences .............. 77
ChromaCove ............................................... 41
Clark Planetarium ....................................... 89
Creative Planet .......................................... 71
Digitalis Education Solutions .................. 7
Evans & Sutherland ................................. 5, 46-47
Fulldome Pro ............................................ 51
GOTO Inc..................................................... 41
Metaspace ................................................... 29
NSC Creative .............................................. 13
Ohira Tech .................................................. 27
RSACosmos ............................................... 28
Sciss .......................................................... 39, 63, 67
You Can Do Astronomy .............................. 80
ZEISS ......................................................... 88
Officers

President
Shawn Laatsch
Emera Astronomy Center
167 Rangeley Road
Orono, Maine 04469 USA
shawnlaatsch@gmail.com

Past President
Joanne Young
Audio Visual Imagingeering
6565 Hazeltine National Drive, Suite 2
Orlando, Florida 32822 USA
+1 407-859-8166
joanne@av-imagineering.com

Executive Secretary
Rachel Thompson
9373 Whitehurst Drive
Dallas, Texas 75243 USA
rachelsusanthompson@gmail.com

Treasurer
Ann Bragg
Anderson Hancock Planetarium
215 Fifth Street
Marietta, Ohio 45750 USA
+1 740-376-4589
annbragg@marietta.edu

Memberships fees also can be paid online on the IPS website

Affiliate Representatives

Association of Brazilian Planetariums (ABP)
Antonio Augusto Rabello
Foundation CEU University Study Center
Rua Emílio Dalla Dêa Filho, s/n.
Pontal 4
Campos Elíseos, Brotas, SP, Brazil
+55 14 3653-4466
+55 21 382-2192
www.fundacacaeo.org.br
riker44@gmail.com
www.planetarios.org.br
www.planetariosdorio.com.br

Association of Dutch-Speaking Planetariums (PLANed)
Jaap Vreeling
Nova informatie centrum
Science Park 904
1098 XH Amsterdam
+31 20 525 7480
+31 20 525 7484 fax
J.A.Vreeling@vu.nl
www.astronomie.nl

Association of French-Speaking Planetariums (APFL)
Milené Wendling
Université de Strasbourg
Jardin des Sciences
12 rue de l’Université
Strasbourg F-67000 France
+33 (0)3 68 85 05 32
+33 (0)3 68 85 04 88 fax
milene.wendling@unistra.fr
www.apfl-planetariums.org

Association of Mexican Planetariums (AMP)
Igancio Castro Pinal
Av. San Bernabe, 723, Casa 7
San Jeronimo Lidice, C.P. 10200
Mexico City, D.F. Mexico
+52 (55) 5500 0562
+52 (55) 5500 0583 fax
icastro@hotmail.com

Association of Spanish Planetariums (ASP)
Javier Armentia
Planetario de Pamplona
Sancho Ramirez, 2
E-31008 Pamplona Navarra Spain
+34 948 260 004
+34 948 260 056
+34 948 261 999 fax
javarm@pamplonario.org
www.pamplonario.org

Australasian Planetarium Society (APS)
Shane Hengst
Outreach Manager, University of New South Wales Physics
UNSW Australia
Sydney NSW 2052 Australia
+612 3958 6006 fax
s.hengst@unsw.edu.au
www.aps-planetarium.org

British Association of Planetaria (BAP)
Lee Pullen
The Curious
One Millennium Square, Bristol BS1 3D8
United Kingdom
+44 (0)117 9157 221
lee.pullen@theweathervirus.com
www.planetaria.org.uk

Canadian Association of Science Centres (CASC)
Frank Florian
TELUS World of Science
1211 142 Street NW
Edmonton, Alberta T5M 4A1
Canada
fflorian@tws.ca
www.canadiansciencecentres.ca

Chinese Planetarium Society (CPS)
Jin Zhu
Beijing Planetarium
No. 138 Xizhiwenwai Street
Beijing, 1000044
P.R. China
+86 10-5158-3311
+86 10-5158-3312 fax
jinzhu@bjp.org.cn

European/ Mediterranean Planetarium Association (EMP)
Manos Kitsonas
Eugenides Planetarium
387 Syngrou Avenue
17564 P. Faliro
Athens, Greece
+30 210 941 7372 fax
mak@eugenfound.gr

Great Lakes Planetarium Association (GLPA)
Mike Small
Theaters Manager
Adler Planetarium
1500 Lake Shore Drive
Chicago, Illinois 60612 USA
+1 312-294-0365
msmall@adlerplanetarium.org
www.glpa.org

GDP

Great Plains Planetarium Association (CPPA)
Jack L. Northrup
Dr. Martin Luther King, Jr. Planetarium
3720 Florence Boulevard
Omaha, Nebraska 68110 USA
jnorthrup@fbx.com

Holland Freedom Planetarium Society (HFPS)

Japanese Planetarium Association (JPA)
Loris Ramponi
National Archive of Planetaria c/o Centro Studi e Ricerche Serafini Zani via Bosca 24, C.P. 104
1 25066 Lumezzane (Brescia) Italy
+39 30 872 164
+39 30 872 543 fax
mergers88@gmail.com
osservatori@serafinizoni.it
www.planetaria.org

Korean Planetarium Association (KPA)

Middle Atlantic Planetarium Society (MAPS)

National Planetarium Association (NPA)

Northern Planetarium Association (NPA)

Oceanic Planetarium Association (OPA)

Pacific Planetarium Association (PPA)

Peruvian Planetarium Association (APA)

Russian Planetarium Association (RPA)

Society of the German-Speaking Planetariums (GDP)

Southeastern Planetarium Association (SEPA)

Southwestern Association of Planetariums (SWAP)

SWAP, Rocky Mountain Planetarium Association (RMPA)

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

IPS President Dave Weinrich
Welcome to the 2012 IPS Conference
Baton Rouge, Louisiana
**Something old, something new**

Something old, something new, something borrowed, something blue...wait a minute. That’s a wedding tradition, isn’t it? It must be that the royal wedding in Great Britain has me bedazzled.

But, to be honest, the June *Planetarian* has things that are old, things that are new, at least one thing that is borrowed and—well, the official IPS color is blue.

According to the tradition, something old represents continuity. On page 9, the something “old” is the planetarium projector itself, as the planetarium community begins preparation to celebrate the 100th anniversary of the “miracle at Jena” in 2023.

Other articles in this category: Jack Dunn’s memories of his mentor and the revolutionary “immersive” process he developed 50 years ago on page 34, and a look at Antoine Darguier and his discovery of the Ring Nebula, written by Jean-Michel Faidit, page 30.

Something “old” also could mean the reappearance of some old friends in this issue’s pages. Former Digital Frontiers editor Ed Lantz returns to update us about his adventures in Los Angeles and the newest “frontiers” of immersion starting on page 22; Adam Thanz is back with another helpful “How do we do it” column on page 58; and Tom Callen shares another fascinating story from his long history under the dome with “On His President’s Secret Service” on page 72.

Something new represents optimism for the future. This issue’s something new is, of course, the ESO Supernova Planetarium; what a wonderful representation of optimism. Carolyn Collins Petersen tells us all about it starting on page 14.

**The Next Generation**

Optimism for the future is also the theme of a new series of articles that starts this issue. I’ve called it The Dome’s Next Generation, and it will be written by or will feature the young and enthusiastic personalities shaping the future under the dome. Maciej Ligowski starts us off; see page 42.

Something borrowed represents happiness. That’s an easy one to point out: see page 88 and the Waxing New item about the La Porte, Texas, school planetarium. The cover image is “borrowed” from Texas School Business (with permission, of course). The image certainly made me happy with its clever use of constellation outlines to illustrate the innovative programs developed by Texas schools.

Something blue stands for purity, love, and fidelity.

And, apologies to the royal couple and British readers everywhere: there’s no sixpence in this issue’s shoe.

**A major “how did I do that?” moment**

During my break between issues, I thought I would attend Bowen Technovation’s workshop that was scheduled to be held immediately after the IMERSA conference in Columbus, Ohio, in February. I planned to do the 3-hour drive, spend the night with my daughter in Columbus, and then head to COSI (the Center of Science and Industry) for the workshop the next day. Which was a Wednesday.

My brain somehow decided that Wednesday was the day I was driving to Columbus, and it wasn’t until that evening, when I was checking Facebook, that I realized I had missed everything. At least I had a nice evening out with my daughter.

I had agreed to have a table with IPS information during the workshop, and also speak about IPS for five minutes at lunch. Instead, I was a no-show, which certainly didn’t represent our society very well.

Thankfully I had sent a PowerPoint to Jeff Bowen earlier and he used that to fill in for me. He also handed out the drawing prize of a free one-year IPS membership to winner Drew Foster from Rauch Planetarium at the University of Louisville in Kentucky.

**Meet Luciana Vega**

On page 83 you’ll find a rather unusual review. It’s for a doll. You have Jeanne Bishop (editor of *Seeking What Works*) to blame.

It all started when Jeanne mentioned to me in an email that American Girl had a new “Girl of the Year” doll out and she was astronomy themed. What a great idea for a story, I thought.

I emailed the media office at American Girl and instead of simply giving me permission to use one of their photos in this issue, which is all I wanted, they offered to send me the doll for review. Wow.

So, like a kid on Christmas, I watched the mail and a big box arrived. You can read my assessment of Luciana Vega and my enthusiasm for American Girl’s attention to detail and educational endeavors. What I didn’t have room for was the fact that I already knew about their quality, having purchased the Samantha doll for my daughter about 20 years ago. She also has one of their Bitty Baby dolls.

Both are now carefully packed away, awaiting a new generation to love and play with them.

Luciana, still in her box, will be donated to the next STEM-themed public outreach event to take place in Youngstown, and hopefully will be won by a young lady who will be encouraged to pursue science as a career because of her.

**Remembering Stephen Hawking**

Like many around the world, I was saddened by the death in March of physicist Stephen Hawking. Martin Ratcliffe of Sky-Skan is putting together a tribute to the great man for presentation at IPS2018 in Toulouse, and agreed to write the tribute to him for this issue.

There were a number of photos of Hawking to pick from, but I decided to use one rarely seen: that of him aboard the goZeroG plane. He looks so happy and excited in the photo, and I think he would rather have people remembering him this way, floating momentarily in zero gravity, than tied to his chair. Despite his handicap due to motor neuron disease, his world didn’t end, and neither did his enjoyment of it.

**Time to get dirty**

As always with the June issue, as soon as I am finished I head to my garden to do battle with the weeds. I am looking forward to dirt under my fingernails, mud on my knees, and some time soaking up free vitamin D from the sun.

Then, all too soon, it will be time to head to Toulouse, and I am also looking forward to seeing many of you again in person.

---

Sharon Shanks has been *Planetarian* editor since Vol. 35 No. 3 (September 2006). She retired in 2015 from the Ward Beecher Planetarium at Youngstown State University in Ohio, returning to her journalism roots after a pleasantly passionate career sharing the stars.

---

Sharon Shanks
484 Canterbury Lane
Boardman, Ohio 44512 USA
+1 330-783-9341
sharon.shanks@gmail.com
M.A.R.S
ONE THOUSAND ONE

The first men and women to fly to Mars are already alive and amongst us today. Tune in for the next 1001 days...

Live broadcast by Miles O'Brien
President’s Message

Are you ready for IPS2018?

Around the time you receive this issue of the Planetarian you should be packing and planning for our upcoming IPS conference is in Toulouse from July 1 to 5. It is hard to believe the conference is almost upon us! Have you finished your paper or panel presentation yet? If not, you might have a few days or hours left to do so! Please plan to have your paper written up and ready for submission at the conference so it is ready for inclusion in our proceedings.

Spring has been a busy time at my planetarium as we are in the throes of field trip season with multiple groups each day. It is great to see many young students come in and get excited about science and eager to explore their universe.

I’ve had visits also from a few high school students doing some career shadowing this year, which has been fun and very educational as well—for both me and the students too! One of the things I enjoy about being in a 10-meter dome at the University of Maine is the variety of students we see from our surrounding community and cities as far away as a two hour drive (one way).

In addition, of course, we see a number of university students from astronomy labs and a variety of other courses. From kindergarten to university student, it is always a unique opportunity to teach and learn under the dome.

In between I’ve been emailing with the IPS officers after meeting with them in Chicago in March. Our meeting allowed us to finalize a number of conference items with our host Marc Moutin, plan for the upcoming council meeting and Vision2020 session in Toulouse, and go over our large and varied officer “action item list” which keeps us on track with the numerous duties for the organization.

One of our main concerns at the March meeting was recruiting possible host bids for IPS2022. While I know it seems far away, the initial bids are to be presented at council and at the general assembly this year in Toulouse.

Highlight: V2020 report

Another major item of discussion was with Jon Elvert of the Vision2020 task force. Jon will be reporting out some of the items that took place in St. Louis during our most recent council meeting and the work on implementing a number of the strategic initiatives council voted on at the meeting there. Look for his report on page 8.

As I write this message, Mark Subbarao and I are on our way to the opening of a new digital planetarium in Chimalhuacán (a suburb of Mexico City) called Sumate a La Ciencia Planetario Digital, which opened on April 29. We have been invited to the inauguration of this new facility, which will provide programming to a number of people who have not had access to a planetarium before.

It has been quite inspiring to see new facilities like this one and others spring up in Mexico and other places around the globe, proof that our domes are unique, have staying power, and are the true virtual reality devices.

This message is a bit short, but I look forward to sharing more with you in person in Toulouse at IPS2018! Marc Moutin and his team have a wonderful conference planned, and it is sure to help you reach new heights, learn new things, and be inspired to do Planetarium Live: In and Outside the Dome!

Nominations are still open for IPS officer positions

As you are aware, 2018 is an election year for the IPS. Later this year we shall all be voting for the next president-elect, secretary, and treasurer who will hold those positions during 2019-20.

The president-elect will be president in 2021-22 and past president in 2023-24.

Nominations are still open for these positions. Nominations also will be taken from the floor at the General Meeting in Toulouse during IPS 2018, however the Elections Committee appreciates having nominations well in advance.

If you would like to nominate an IPS member for any of these positions, or are interested in standing, please let me know.

I am pleased to work with several dedicated Elections Committee members and if you would like any further information about these roles, we should be happy to help.

I look forward to hearing from you, and especially to seeing you at IPS 2018!

Martin George, Chair, IPS Elections Committee martingeorge3@hotmail.com
Tatsuyuki Arai, Tats.arai@nifty.com
Johan Gysenbergs, gysenbergs@skyskan.com
Dale Smith, dwsmith@bgsu.edu
Dave Weinrich, Dave.l.weinrich@gmail.com

IPS President Shawn Laatsch has worked at planetariums around the world and now calls the Emera Planetarium and Science Center at the University of Maine in Orono home.
Think Digitalis only sells portable planetariums?

Think again.

The Digitarium® Lambda Plus has been one of our most popular models since its launch late last year. Why?

- Single projector simplicity
- 2.4k diameter resolution
- Bright, vibrant, laser-phosphor projection
- Minimal operating costs and environmental footprint
- Incredible value

Serious value for serious educators.

Portable and fixed systems up to 4k diameter.

Digitalis®
EDUCATION SOLUTIONS, INC.

DigitalisEducation.com

Digitarium: The most popular digital planetarium on Earth.
At the council meeting in Toulouse later this month, Vision2020 will present a series of recommendations for transitioning from IPS’ current officer-affiliate governance structure to the new “compromise” model council drafted and agreed on at last year’s meeting in St. Louis.

The primary purpose of this governance realignment is to achieve a more equitable representation of membership worldwide and to make the governing board more flexible, accountable, active, and compatible with similar organizations.

Vision2020 was tasked to implement the mechanism for the transition, which we believe will result in a more responsible governance while still maintaining the integrity of the current regional affiliates. Our team’s recommendations for the transition process are summarized below. Of course, the devil is in the details, and these deliverables need to be vetted and approved by council in Toulouse.

Governance structure

The new governing model has nine board members, five officers, and an executive staff position. Every continent, excluding Antarctica, has board member representation: North America, Europe, and Asia have two members, while all other geographical regions have one. The current affiliate representatives, the standing and ad hoc committees, and an advisory group complete the new structure.

Board member selection

Board members are elected by IPS members in their geographical region. An elections committee will be made up of the affiliate presidents from each geographical region.

Board member candidates are nominated by IPS membership within each region and presented to the elections committee. Board members are term limited.

A detailed job description including desired qualities, expected duties, and qualifications has been drafted. The elections committee will vet each candidate.

Transition timeline

The new board is phased in over two years. All geographical regions elect one board member in the first year (2019), while the three largest regions, those having the majority of IPS membership, elect their second board member after the first year. This ensures an overlapping of members. Transition to the new structure is complete in 2020.

Affiliates

IPS Affiliates continue to represent their regional membership. Affiliates engage directly with their elected board members, then share information from their board member with their membership. Affiliate representatives could serve as board members.

Further considerations to be made before a restructuring can be fully implemented are:

- What changes to the Bylaws need to be made to implement the board model?
- Define the role of the executive staff position.
- How the new governance model relates to the Strategic Plan.
- Define how the board model evolves as the IPS evolves.

Again, the above transitional recommendations will be discussed in detail during the joint Vision2020-Council facilitated meeting later this month, and outcomes made by council will appear in the fall issue of Planetarian.

In addition to the governance restructuring task, V2020’s team continues to work on their individual goals directly related to IPS’ Strategic Plan. The accomplishments and next steps for these six goals, listed under the Vision2020 page on the IPS website, will be presented by team members in Toulouse.

Meanwhile, the team continues to work on ideas for supporting membership growth and financial sustainability. Two of the current proposals are:

- Offer monthly professional development webinars to members only
- Investigate the possibility of an IPS Foundation

Advisory group

Although Vision2020 works closely with IPS Offices, the team also relies on input from its Advisory Group, a group of ten individuals from various countries interested in assisting the IPS by providing non-binding strategic advice, such as the recommended governance structure transition. This informal group essentially brings their own unique knowledge and skills to help guide our team’s decision making. Members of the Advisory Group are listed under Vision2020’s page on IPS’ website. www.ips-planetarium.org/?page=vision2020
Dear fellow planetarians, artists, producers, and enthusiasts:

The first presentations using a planetarium projector took place in 1923.

In 2023, the 100th anniversary will be celebrated as a year-long, global series of events, targeting both the public and planetarians. Individual events will look back at the past 100 years, present what we have become, and highlight our plans for the future.

As a first step, we are collecting ideas on how to bring this anniversary to life, and which events and activities to hold during the centennial year. Below, we list some preliminary ideas. This is not a final plan, but merely a collection of thoughts meant to inspire you to contribute your ideas!

Central dates of the anniversary are:

- September 19, 1923, when the first Zeiss Mark 1 projector was fully operational for the first time, at the Zeiss factory in Jena, Germany. Even before this, first (partial) presentations with the Mark 1 took place at Zeiss in August 1923.
- October 21, 1923, when the Mark 1 was first presented in a closed session at Deutsches Museum in Munich, Germany.
- May 7, 1925, when the first planetarium at Deutsches Museum opened to the public.

The centennial could be held over a two-year period starting in August 2023 and closing in May 2025. Or, it could be a 12-month period from Mid-2023 to mid-2024. We are weighing the options, but both would offer a huge opportunity for all of us to present us and our planetariums to the world.

There will be a motto or theme attached to the centennial year. Two early suggestions are ‘The Future’ or “Us and the Universe.” We are looking for more ideas and for your suggestions.

Year of the planetarium

The highest aim could be to propose a UNESCO Year of the Planetarium. This avenue would be through a national government, as only nations can propose such theme years to UNESCO. The German government would be one obvious possibility, but we should pursue all viable alternatives as well.

A centennial meeting: A central event of the centennial should be a special gathering at one of the two historic sites Jena or Munich.

Global celebrations on a special date: While planetarians could come together and celebrate during such a special gathering or at the IPS2024 conference, a separate global celebration event should be held on a special date; e.g. on October 21, 2023.

This will be a global event with domes around the globe participating at the same time, or at least on the same day. A vision for this event is that it is “handed off” or passed along from one planetarium to another, each presenting an individual highlight, with everything streamed or domecast to every planetarium in the world.

The events to be streamed or domecast might include short talks (approximately 10 minutes) by famous science speakers, live-streamed views from space and from special places around the globe, and novel fulldome-visualized science highlights.

Public events throughout the centennial period

- A dedicated centennial planetarium show could be produced, revolving around the history of the planetarium and that of planetariums from 1923 until today.
- A fulldome short feature about the history of the planetarium could be produced.
- There could be a centennial fulldome festival, perhaps aligned with the IPS 2024.
- A series of 100 domecasts could be held on 100 days of the centennial period.
- IPS could seek the creation of fulldome art (e.g. short pieces) revolving either around the history of the planetarium, or the theme 100 years, or simply the theme 100. This could happen in cooperation with one or more fulldome festivals, and/or aligned with IMERSA.
- IPS could provide media (trailers, logos, icons, taglines, etc.) to “centennial brand” any planetarium activities throughout the centennial period.

Professional development events

- A special gathering should be held at the historic sites, and the IPS2024 conference should have a focus on the centennial (see above).
- IPS-like events all over the world (“Mini-IPS”).
- We will involve all stakeholders (International Astronomical Union, Communicating Astronomy with the Public, IMERSA, and more) and plan special activities with them.

Activities in the media

- We aim to publish a book about the planetarium and its history.
- We want to present the planetarium and its history in a TV production: a movie, or a documentary feature.
- And many further media activities.

For each item, we seek your ideas! We would like broad and general suggestions as well as detailed and specific recommendations. We are also looking for novel thoughts that go beyond of what we have laid out above. We are looking forward to your thoughts and ideas! Please visit our workshop at IPS 2018 in Toulouse, or contact us at: centennial@gdp-planetarium.org.

Björn Voss
LWL-Westphalian State Museum of Natural History
Münster, Germany
For the IPS Planetarium Centennial Task Force

Vol 47 No 2 - June 2018
Planetarian

1923-2023 Preparing to celebrate the Planetarium

A sketch from Walter Bauersfeld, the first idea of a machine to project the stars, is a fitting start to the journey to celebrate our field’s 100th birthday. Planetarian will feature historical remembrances each issue though the end of the centennial year. Image courtesy ZEISS.
Portable planetariums celebrate International Day of Planetariums

Each year, on the second Sunday in March, people around the world enjoy a day of stars, science, and fun when Planetariums open their doors for a world-wide celebration of domed theaters. The International Day Planetariums has four major goals:

• to inform the public about planetariums: what they are and why they exist;
• to educate the public about the problem of light pollution;
• to promote international exchanges and collaborations between planetariums of different countries;
• to highlight the important work of the International Planetarium Society.

In 2018 the International Planetarium Society created a one-year-only contest for the smallest domes in our IPS family, mobile planetariums, with these specific goals: to honor and encourage the excellent work of mobile planetarium educators; to promote IPS as a forum where mobile dome directors can learn from each other; and to reward innovative approaches to science education in portable planetariums.

Congratulations go to the four participants who sent documentation of their celebrations on the weekend of March 10-11; they all qualified for prizes!

The prizes were based on: submitted photos, audio or video files, and the text of their narrative on the entry form. Three special aspects also were considered: the most unusual or remote (underserved) location; children participating in a unique lesson inside and/or outside the dome; and partnering with one or more other planetariums.

Although there were few participants, these planetariums made an impact in very some diverse locations of the world and we can be proud of that. I am sure you will agree as you enjoy the pictures and read about these four IDP celebrations!

Guangxi Science and Technology Museum

The entry of the Guangxi Science and Technology Museum in China, submitted by Liu Jing, won the first place prize of $500, given to the planetarium that best met the spirit of the competition in location, uniqueness, and partnering.

They also won the Pleiades Prize of $100, a special recognition funded by several delegates at the October 2017 Pleiades National Conference in St. Louis and given for outstanding achievement in one of the categories and the best photographs.

The planetarium reported that the 2018 IDP-Guangxi Science and Technology Museum Event was held on March 11. Their ceremonies also involved the school, the neighboring community, and other museums of the city. The main theater and mobile dome planetariums presented Losing the Dark and regular planetarium programs.

The museum brought astronomy to the public through those shows, hands-on activities, observation activities, and children, who wrote their greetings and dreams on notes that were displayed on a “blessing wall” with hopes that they would come true.

Liu Jing enthusiastically wrote, “Guangxi is known as the Guangxi Zhuang Autonomous Region (Zhuang: Gvangjih Bouxcuegh Swcigih), located in South China … It plays an important role in the economic exchange between China and Southeast Asia. There are ethnic minorities such as Zhuang, Yao, Miao, Yi, Maonan, Hui, and Jing in Guangxi. The total population of ethnic minorities in this region ranks the top in the country.”

We were told that, with this in mind, young people of the Guangxi Zhuang Autonomous Region sang and danced in the traditional manner of their own ethnic minorities. International students from ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam) were also invited to participate in a variety of activities. Guangxi Science and Technology Museum, www.gxkjk.com.
Cosmos Planetarium

Cosmos Planetarium, Scotland, submitted by Steven Gray, won the second place prize of $300, which was given to the planetarium that was the best in two of the three categories.

Steven Gray reported that their event, “Coll & the Cosmos,” took place over both days of the weekend, 10-11 March, on the Isle of Coll, which is a small remote island community in the Inner Hebrides off the west coast of Scotland with a population of approximately 200.

Steven explained, “It takes 2 hours 30 minutes to drive from our home-base to the Scottish west coast town of Oban, where we catch the ferry. There is only one ferry per day to the island; it leaves very early in the morning and takes 3 hours to get there.

Coll was awarded dark status in 2013 by the International Dark-Sky Association (IDA) after an application was submitted to by a small group of islanders, the ‘Dark Sky Group,’ with the backing of the whole community.

Gray reported that “We have been running events of the island since 2014 working in partnership with Development Coll, a not-for-profit company with charity status. It exists to promote the sustainable development and regeneration of the Isle of Coll for the benefit of residents, visitors, groups and businesses.

“I decided to run our Spring Coll & the Cosmos on the weekend of 10-11 March to coincide with IDP. The plan was to include some extra activities for those on the course and something for the children who live on the island. There are 7 children who live there and attend the primary school (age between 4 and 11).”

We ended up being fully booked for the weekend with 9 members of the public travelling to the island for the course and we also had 11 carers on a respite break, 21 in total. I wasn’t able to collaborate with any other planetariums but I was able to collaborate with a local observing group Central Scotland Observers Group (CSOG). One member of CSOG came with us for the weekend, Kathleen Moore, a very an experienced amateur astronomer who did a fantastic extra talk on astrophotography. The numbers of attendees when seen in context for how small and remote the island is are amazing, we increased the population of the island by 10% for that weekend. Steven Gray, Cosmos Planetarium, LLP, sgray@cosmosplanetarium.co.uk, www.cosmosplanetarium.co.uk.

Planetario Adventura

Planetario Aventura in Costa Rica submitted by Marco Avalos received an Honorable Mention of an IPS 2-year membership (value: $100) for outstanding achievement in one of the categories.

They also won a robotic telescope tour of up to one continuous hour. Valued at $650, this prize was graciously donated by Emerald Planetariums, Bareket Observatory, in Israel. This prize includes an interactive video experience with the ability to pose questions and get answers. This prize was meant to go to a unique initiative with a mobile dome in a remote location (perhaps addressing an underserved population) and partnering with one or more other planetariums.

Planetario Aventura is the only portable dome in Costa Rica. It is a STARLAB that was recently upgrade from a standard projector, that served more than half a million people during the last 25 years in Costa Rica and Nicaragua, to a new digital projector. The company owners are chemists from the University of Costa Rica, and work together with the planetarium.

For their IDP celebration they partnered with Planetario de San José. Approximately 110 people attended. They targeted two specific audiences: students and families from nearby schools and amateur astronomers from Costa Rica. During the two days of the weekend, March 10-11, an estimated 110 people attended programs in the planetarium.

(Continues on next page)
Tenmado Mobile Planetarium

Tenmado Mobile Planetarium submitted by Hiroshi Futami also received an Honorable Mention of an IPS 2-year memberships (value: $100), for outstanding achievement in one of the categories.

Marco explained that they were presented with both student and general audience levels of their astronomy programs, as well as an artistic visual presentation specially made for the digital projector.

He said “Parents were very grateful that they were invited along with their children, since their generation didn’t have this kind of learning tools when they were young. They were even more surprised than their kids. They said they didn’t imagine the quality and awesomeness of the equipment and the program. They enjoyed both artistic and scientific aspects of our presentation, and they could experience and see the difference in both levels of the astronomy program: kids and general public.”

Marco Avalos, Planetario Aventura, info@planetarioaventura.com.

Tenmado Mobile Planetarium

Tenmado Mobile Planetarium is a Digital system used under a variety of dome sizes (4m, 5m, 6m, 7m) as each venue dictates. Hiroshi Futami reported that their IDP event was held on 10 March in an Elementary school gymnasium and he estimates that there were approximately 100 participants. Through a partnership with the PTA, parents and students enjoyed the planetarium together.

Hiroshi commented “In Japan, most people do not know IDP. We can introduce IDP to many people.” He also provided a delightful video demonstrating the excitement during one of the interactive lessons of the day.

Hiroshi Futami, futami@skylight-studio.jp; www.skylight-studio.jp.

Go to the web for more

To see more pictures from the four sites and read more about their programs, go to the IPS website page for IDP 2018 at www.ips-planetarium.org/page/IDP2018. There you also will be able to hear audio clips and enjoy the videos submitted.

Thank you to all four portable planetariums for participating in this year’s International Day of Planetariums! It was wonderful to feel and see your enthusiasm for promoting the international planetarium community as well as astronomy and art. We appreciate the time and effort you took to share your success with us.

We hope that these wonderful stories and joyous pictures will inspire many more planetariums to join us in celebrating on the International Day Planetariums every year on the second Sunday in March! For more information keep checking www.ips-planetarium.org/?page=IDP.

-Susan Reynolds Button

The International Relations Committee announces “We have a winner!”

Congratulations go out to Üllar Kivila, from Tartu, Estonia, director of the AHHAA Science Center Planetarium, who has won the 2018 “Week in the United States” competition sponsored by the IPS International Relations Committee.

He will be hosted by the planetarium at Minnesota State University-Moorhead.

Üllar started working in a planetarium as an explainer during his first year of university and says he “never regretted the choice, even if it meant long night hours spent on preparing shows while trying to keep up with my studies and normal life as well.”

He became interested in astronomy and physics in primary school and as he explained, “chose to study physics in university to gain a deeper understanding of the field in addition to my already existing hobby of amateur astronomy. I do not think my interest in astronomy is in any way different from the natural curiosity about the world surrounding us that every child possesses, but I do feel I haven’t lost it, as much as many other people sadly do as they grow up.”

He spent 4 years working part time as an explainer and show designer for the AHHAA Science Center planetarium (www.ahhaa.ee) and then began working full time as the planetarium director. The planetarium provides daily shows in four languages (Estonian, English, Latvian, and Russian) for diverse audiences.

“The pictures showcase the unique architectural solution of our planetarium that gives as about 3/4 of full sphere as projection area at the cost of fewer seats than typical domes of the same size (only 20 seats in 9.3 m dome),” he said. This compares, for example, to MSU-Moorhead’s 62 seats in 9.1 m.

Aside from sharing his own culture and traditions, Üllar will present a program called “Measuring the Cosmos with Sticks and Shadows” for his public presentations and “The Search for Extrasolar Planets” for students and teachers.

Sara Schultz, planetarium director at MSU-Moorhead, will be hosting Üllar in October this year. The planetarium opened in 1972 and was last renovated in 2011 and currently has a Elumenati digital system using SCISS Uniview.

Sara writes that she is happy that MSUM Planetarium has been chosen to be the host site for the 2018 IPS A Week in the United States.

“The planetarium staff is honored and excited at the opportunity to share knowledge and experience with Mr. Üllar Kivila of Estonia. They would like to thank IPS and GLPA for their generous support to make this a possibility.”

Üllar will spend the first week of October with the Moorehead planetarium staff, after which he will attend the Great Lakes Planetarium Association Conference in East Lansing, Michigan.

The Week in the United States is a professional development opportunity sponsored by IPS that began in 2017. Applications are sought from educators and/or astronomers who work with any of the various models of planetariums and who are comfortable making presentations in English.

Full details are available on the IPS Website at www.ips-planetarium.org/?page=WeekinUS. The deadline for the 2019 competition is 31 December.

-Susan Reynolds Button
THE MOST IMMERSIVE SHOW IN THE UNIVERSE.
SUITABLE FOR ALL DOMES AND VR HMDS.
NOW AVAILABLE IN 8K STEREOSCOPIC 3D 60FPS.
WEARESTARS360.COM
Overlay: This image combines data from four space telescopes to create a multi-wavelength view of all that remains of RCW 86, the oldest documented example of a supernova. Chinese astronomers witnessed the event in 185 A.D., documenting a mysterious “guest star” that remained in the sky for eight months. X-ray images from NASA’s Chandra X-ray Observatory and the European Space Agency’s XMM-Newton Observatory were combined to form the blue and green colors; infrared data from NASA’s Spitzer Space Telescope and WISE, Wide-Field Infrared Survey Explorer, shown in yellow and red, reveal dust radiating at a temperature of several hundred degrees below zero, warm by comparison to normal dust in our Milky Way galaxy. RCW 86 is approximately 8,000 light-years away. At about 85 light-years in diameter, it occupies a region of the sky in the southern constellation of Circinus that is slightly larger than the full moon. This image was compiled in October 2011. Image Credit: X-ray: NASA/CXC/SAO & ESA; Infared: NASA/JPL-Caltech/B. Williams (NCSU)

Right: Audiences at ESO Supernova enjoy the view of a sunrise over an exoplanet. Credit:ESO/P. Horálek
The ESO Supernova:
A new star awakens in Munich

By Carolyn Collins Petersen

There is a new star in the fulldome firmament called the ESO Supernova Planetarium & Visitor Centre. It is a shining example of fulldome technology and science outreach, located at the headquarters of the European Southern Observatory (ESO) in Garching, Germany.

(continues on next page)
The ESO Supernova opened to the public on April 28, 2018 and features free access to astronomy experiences showcasing ESO-specific research and technology. It is also a major participant in the Data to Dome initiative and is becoming a center for open-source materials, making its own shows and other content available to the planetarium community.

The facility is under the aegis of ESO’s department of education and public outreach, headed by Lars Lindberg Christensen, who coordinates all press and outreach activities in Europe and Chile. Various staff members are responsible for day-to-day operations. The overall ESO Supernova coordinator is Tania Johnston. The ESO educational coordinator is Wolfgang Vieser, who spends much of his time working with the children who visit the facility. They are joined by a team of scientists, astronomy visualizers, graphics designers, science communicators, marketing specialists, engineers and others from ESO who work with exhibitions, planetarium content and other aspects of the facility’s operations. “It’s not the most conventional structure,” said Christensen, by comparison to other planetarium and science center facilities.

ESO Supernova’s heritage
The creation of the ESO Supernova was a multi-year project, beginning with a dream of the late physicist Klaus Tschira. He was managing director of the Klaus Tschira Stiftung, a foundation dedicated to ongoing projects in science, mathematics, and computing. He was fascinated with astronomy and wanted to create an exciting place devoted to bringing astronomical discoveries to the public.

On behalf of his stiftung he and colleagues at the Heidelberg Institute for Theoretical Studies (HITS) brought the idea of a joint gift to the European Southern Observatory. In December 2013, ESO accepted the donation. Design began immediately, with construction commencing in February 2015. The HITS was instrumental in developing the exhibit...
its and interactives, and worked closely with the exhibit fabricators and ESO staff to install and integrate them.

It was the last project Tschira initiated before his death in 2015.

Designing a place of exploration

The ESO Supernova’s design, created by the architectural firm Bernhardt+Partner, is based on the idea of a binary star, with both members in a tight orbit. In the universe, such a configuration leads eventually to a Type Ia supernova, which gives off a brilliant flash of light. The Center’s name means that it, too, shines brightly. ESO hopes it will generate enthusiasm and passion for astronomy in the young and not-so-young alike.

Exhibits and a planetarium combine to present nearly 3,000 square meters of space, giving visitors ample opportunities to explore the cosmos at their leisure.

Exploring under the dome

The first “star” in the ESO Supernova is a fantastic new fulldome installation. The heart of this 109-seat theater is Evans & Sutherland’s (E&S) Digistar 6, feeding a five-channel Zeiss VELVET projection system, which delivers black backdrops and expanded colors through sharp, custom lenses. The 14-meter, 25-degree-tilt dome is the largest tilted dome in Germany, Austria, and Switzerland.

According to E&S’s president and chief operating officer Kirk Johnson, who attended the April opening ceremonies, the ESO Supernova’s facility is spectacular. His Salt Lake City-based team worked with Carl Zeiss AG, which supplied state-of-the-art Velvet projectors for the theater.

“It was great to work in cooperation with Zeiss on this prestigious theater,” said Johnson. “It’s always a bit of a dance when two companies that often compete find themselves in a partnership on a project, but the end result is that we were able to combine the best features of Digistar 6 with those of the Zeiss VELVET projectors.”

The installation of Digistar 6 allows the ESO Supernova theater to do real-time playback of astronomy content for both live presentations and pre-rendered material. It is also used to generate content for in-house productions.

ESO is the not first facility where customers have selected Digistar to drive Zeiss Velvet projectors. Both E&S and Zeiss have cooperated on installations in Wolfsburg, Germany and at both dome theaters in Berlin. While Digistar 6 is the prime package for daily operations in the ESO Supernova dome due to its ease of use, the facility team has also installed Powerdome and Uniview (both supplied by Zeiss), SpaceEngine (a universe simulator), World Wide Telescope, and a media server package. These are available for special events and other occasions.

Now that the building and its exhibits and dome are open to the public, visitors arriving between April and June 2018 can pick from eight planetarium shows to experience. These range from the award-winning The Secrets of Gravity animated film about Albert Einstein’s discoveries, to the giant-screen documentary adventure Hidden Universe.

(Continues on next page)
Educators and students from nearby schools can choose from two specially-designed presentations. The first is *A Tour of the Solar System* and the second is called *The Skies Above Us*.

**From the telescope to the dome**

In addition to using state-of-the-art digital planetarium software that allows ease of access to regular fulldome planetarium capabilities, ESO also worked with E&S to make Digistar the first launch platform for the joint ESO/IFS Data to Dome initiative. This was largely due to the availability of Digistar’s integrated cloud library infrastructure and user interface built into the system, according to Christensen. “E&S has given us and the community a huge amount of support getting Data to Dome launched,” he said, noting that its development is integral to ESO Supernova’s role in the community.

In a nutshell, the Data to Dome initiative was created to allow planetarium presenters around the world using a variety of digital planetarium systems to access a menu of astronomy news and available datasets. All the information is fed via internet connections, and include metadata information for ease of inclusion into the systems and presentations.

Before the advent of Data to Dome, planetarium presenters did not always have good access to images and data in real time. In addition, databases of astronomy information could not be used by planetarium systems without a lot of work. Data to Dome project members cooperated to apply the Astronomy Visualization Metadata Standard (the standard is called “Data2Dome,” or D2D and is described in the Data2Dome document referenced at the end of this article), which, along with other developments, makes it easier for digital planetarium systems to access astronomy information.

“I am really impressed with how quickly and easily we were able to implement the Data to Dome initiative and make it available to our users,” said E&S’s Johnson. “Nearly every day there are new contributions from the Data to Dome partners into Digistar, which is truly a game-changer for science education. Now the latest research and discoveries are available when our customers turn on their systems. It’s an almost unbelievable way to connect science research with planetarium audiences. We are pleased that the work E&S contributed paved the way for the data and research from ESO and other scientific organizations to spread quickly and easily throughout the planetarium community.”

The main Data to Dome partners continue to work together to further improve the project. The ultimate goal is to make sure that science announcements and data from ESO and other scientific and astronomical organizations is made available to users in an efficient and timely manner.

**Exploring the cosmos**

The second star in the ESO Supernova’s design is “The Void,” a unique and beautiful room on the ground floor that sports a domed “star-roof” containing a representa-
The ESO Supernova in Chile is a modern facility dedicated to the exploration of the stars of the southern hemisphere. Its walls are covered with a giant image of the Milky Way Galaxy, suitable for exploration. The image, taken by Seattle-based astrophotographer Nick Risinger, is the largest such visual in the world, and shows the sky as seen from the latitude of ESO’s Paranal Observatory.

Visitors begin their trip through this part of the building at the entrance to the ESO Supernova. They walk along a gently sloping 255-meter-long path that eventually takes them around the building from top to bottom. Along the way, they interact with exhibits. Highlights also include scale models of the planets, real astronomical artifacts, and a mock-up of the Atacama Desert—the home of ESO’s telescopes.

According to ESO’s Dr. Mathias Jäger, the physical environment of the center takes visitors on a cosmic journey through 13 different themes in a set of exhibits called The Living Universe. “We always had a concept in mind which takes the visitor on a journey through time and space. In the end we decided to create a journey from the Earth to the edge of the universe,” he said.

“The first theme starts in Munich and from there we move on to the Earth-moon-sun system, the solar system, stars, galaxies and cosmologies. This journey is interrupted by topics about ESO in general, its observatories in Chile, different techniques used in astronomy, and the ELT (Extremely Large Telescope). The length of different sections and the material we were able to put on display was strongly influenced by the challenging layout of the exhibition, which includes a ramp with a constantly changing width, ceilings of different heights, and large windows,” he added.

Highlights of The Living Universe include a mirror segment from the future ELT that visitors can examine. They can also touch a meteorite, and work with a hands-on station where they can build their own telescope. Athletically inclined visitors can even take a ride on a bicycle that travels at the speed of light!

This main exhibition was fabricated by Design und Mehr of Kostanz, Germany, and provides both interactive and virtual reality experiences to the visitors. The VR experiences, developed for the exhibition by Heidelberg Institute for Theoretical Top: Hanging over the central part of The Void is the spectacular star-roof, a set of glass panels set into a metal framework. The 30-ton installation’s triangular sections are arranged to artistically represent the constellations of the southern hemisphere.

Center: ESO Supernova visitors on a tour of the exhibition, led by Mathias Jäger. Bottom: Telescopes strategically located around The Void (in the center of the building) allow visitors to look at a wall-size image of the Milky Way. The Void is also used for special events held at the center. Credit: ESO/P. Horálek

(Continues on next page)
Studies, show different ESO observatories. The content is a mix of clips, a real 6-minute VR movie, and live real-time rendered content.

Throughout the exhibits and special areas of the building, visitors explore and examine real astronomical artifacts. They can conduct experiments to get an idea of what it means to be an astronomer, to work in science, and to discover the mysteries of the universe.

In addition to The Living Universe, a temporary exhibition called Our Place in Space presents a scientific and artistic look at where we are in space. It helps visitors imagine what our future will be and how space exploration has expanded people’s horizons beyond our planet. It is open until September 2, 2018.

All content throughout the building and in the planetarium theater is provided in both English and German and is completely free of charge in 2018.

Audiences have been flocking to the facility since its doors opened in April, according to Jäger. “As we had hoped, most of the activities right now are booked out, although there are still free tickets during the week.”

Christensen pointed out that audience numbers fit into what the center has predicted. “It seems realistic to hope to reach 100,000 visitors in the first full year of opening,” he said. If audience enthusiasm continues, it’s likely that the ESO Supernova will remain on visitor agendas for quite some time.

Educational and open source activities

The seminar rooms on the top floor of the ESO Supernova are aimed for use during special events such as lectures, workshops and conferences. This includes specially-created workshops for school students at all age levels. They cover such topics as understanding our home planet, studying and understanding astronomical clocks, doing astronomy across the electromagnetic spectrum, and seeing the invisible universe. In addition, staff have created special teacher training workshops to assist educators in preparing lessons for use in the classroom.

Beyond the facility, and in addition to the extensive work the ESO Supernova and its partners are doing on the Data to Dome project, the
institution’s philosophy is that its own productions should be open-source and available to theaters around the world. To that end, the team regularly posts its content for download. (The link is provided below.)

ESO Supernova’s first show, From Earth to the Universe (V2 is an improved and updated version) is available, along with a new one called Energetic Universe. They will release two additional full-length shows later in 2018: Europe to the Stars (about ESO) and The Sun, Our Living Star. These join a growing collection of 3D models, fulldome stills from ESO observatories, panoramas, fulldome clips from ESA/NASA Hubble Space Telescope, and a music archive.

In addition, a number of other free shows also are archived at ESO Supernova’s website. The VR content also will be released in the near future for use by the community.

For more information
More information about ESO Supernova and selected partners:
Carl Zeiss AG: www.zeiss.com/planetariums/int/home.html
Data2Dome Standard: www.data2dome.org/
ESO Supernova Website: supernova.eso.org
Evans & Sutherland: www.es.com
ESO Supernova free materials for planetarium facilities: supernova.eso.org/for-planetariums/
Heidelberg Institute for Theoretical Studies: www.h-its.org/en/
Klaus Tschira Stiftung: www.klaus-tschira-stiftung.de/

Special thanks to Dr. Mathias Jäger, Lars Christian Lindberg, Kirk Johnson, and Tania Johnston for their insights and background information about ESO Supernova.
The Vortex Dome at Los Angeles Center Studios. All photos provided by the author.
From space to the stars:
Ten years of arts and entertainment at The Vortex Dome-Los Angeles

I love planetariums. My first dome experience was at the Miami Space Transit Planetarium. It changed my perception of the cosmos and stimulated my imagination with possibilities for virtual theatrical experiences.

As a teenager I wrote a science fiction short story about performers in the future who projected their consciousness directly onto large holographic domes. The performers elevated into the theater surrounded by a console with quartz crystal sensors and took audiences on cosmic journeys to other worlds—both real and imagined—using instrumentation that projected their mind onto the dome. Performers disciplined their minds to achieve crystal clear focus. If they wavered, the audience could become ill. When in tune, the audience experienced a sense of awe so great that people’s lives were often transformed by the experience.

I directed my education and career into electrical engineering, knowing that technology was the future of art, entertainment, and wellbeing.

Planetarium engineer

After 7 years working as an aerospace engineer at Harris Corporation, I radically shifted my career in 1990 to work as chief engineer at Astronaut Memorial Planetarium at Eastern Florida State College in Cocoa, Florida.

Working under Director Mike Hutton, my team created the first hybrid planetarium by synchronizing a Digistar and a Minolta Infinium star projector which we demonstrated at IPS in 1994 in our newly opened 21m dome.

I next accepted a position at Spitz, Inc. (now E&S Spitz) where we pioneered the fulldome format and built a dozen early digital dome theaters in the late 1990's and early 2000's, including Papalote Museo in Mexico City, the Library of Alexandria planetarium (which hosted IPS 2010), and launched the SciDome digital projector system. I also worked with producer Mike Bruno to launch Spitz Creative Media.

Despite my love of science, the cosmos and immersive storytelling, our planetarium programming could not reproduce the incredible journeys I had imagined as a teenager. Arts and entertainment modalities were not a priority at most planetariums which—by necessity—were focused on informal science education. I yearned to push the boundaries of the fulldome format.

Vortex Immersion Media

I founded Vortex Immersion Media in late 2007 to expressly focus on fulldome arts and entertainment. We pitched a VR nightclub to Caesars in Vegas for a new attraction they were developing called the Linq. It included a gesture-controlled “immersive jockey” station, dancing avatars, photonic go-go booths and a fulldome dance floor. Caesars loved it! We also collaborated with Disco Donnie to plan a large inflatable projection dome as a venue for touring electronic dance music (EDM) artist Tiesto.

It turned out that 2008 was not a good year to launch a new company. As the economy eroded, the Caesars’ Linq project stalled and the 40-m Tiesto dome was abandoned.

I decided to move my office to Los Angeles—the entertainment capital of the world—and use my remaining savings to build our own dome theater. Producer and development executive Kate McCallum used her industry connections to secure a location for the dome on the Los Angeles Center Studios lot in downtown LA. Kate had recently founded a nonprofit called c3: Center for Conscious Creativity, which was focused on the potential impact of arts, media and entertainment to inspire a better future.

In June 2010, Vortex installed a custom 15-m geodesic projection dome with negative pressure screen and vinyl cover. The first

Ed Lantz’s title and background are included with his article. Planetarian readers may also remember him as the author of the Digital Frontiers column that appeared from 2005-2008.

(Continues on next page)
event hosted by the Vortex Dome was a c3 summit called State of the Arts 2010, which featured a live performance of Bella Gaia by Kenji Williams. With support from the planetarium community, we were able to project and showcase fulldome content. As projects rolled in we reinvested profits into acquiring our own projection system, video server, and lighting system and started co-producing original shows.

Experiential marketing
Our first clients were big brands who wanted to dazzle audiences with memorable experiences. The projects started to roll in—Nike, Microsoft, Nokia, NFL, EMC2 and more. The fulldome experience delivered!

Our first major event was the Nike Dome at Hollywood and Vine for the 2011 NBA All-Stars basketball games. The quad inflatable dome we rented presented formidable projection challenges. The venue included a half-court basketball court, gift shop, and art gallery. Thousands toured the space over the weekend.

Another early project was the Nokia Lab Dome at SXSW in Austin, Texas. The Nokia Lab was created for the 2012 SXSW gathering featuring a tri-dome inflatable design. This project featured our new dome server built upon Derivative TouchDesigner with real-time 3D capability. We ran movie clips, spun 3D models of Nokia’s new phone in the sky, and simulated northern lights that users could interact with using a touch table. We also projected live Twitter feeds and VJ’d for a live band.

Super Bowl 2012 and 2013
Vortex was engaged by the NFL Super Bowl Host Committee in 2012 to install and operate an 18-m inflatable dome structure to serve the nearly 1 million visitors anticipated at the Super Bowl Village, a temporary entertainment zone in downtown Indianapolis, Indiana. Microsoft’s Xbox sponsored the dome and asked us to theme it. We created 3D animated visuals on the dome interior and contracted Pixomondo—who won an Academy Award for their visual effects on the film Hugo—to create animated visuals for the dome exterior.

Xbox invited Vortex back to create another dome venue for Super Bowl 2013 in New Orleans, Louisiana. On the interior of the 15-m dome we included a Kinect interaction station allowing visitors to throw simulated Mardi Gras beads, levitate a playing field with running football players, or spin Xbox brand elements around on the dome. A smaller 7-m dome was attached to the main structure which housed a photo booth experience as visitors exited the venue.

4D storytelling
Creating walk-through immersive experiences for big brands was fun, but it was far from the awe-inspiring immersive entertainment experiences that we longed to create. Storytelling experiences better fit our desire to explore next-generation immersive experiences.

EMC (acquired by Dell in 2016) contracted Vortex over three years to create a dome experience at their EMC World Conference, which attracted nearly 10,000 attendees. In 2012 and 2013 we created 5-minute “thrill rides” into the world of electronic information in an 11-m tilted dome. We worked directly with EMC’s global brand managers to understand their message, hone a story concept, and produce a show.

In 2012 we flew audiences through a big “dataverse” showing how private and public clouds could be trusted to serve corporations. In 2013 we created a Tron-like world that we navigated in a “dataship” while that illustrated tools for IT security and governance. Both pieces included animation with live-action elements and visual effects.

In 2014 Adult Swim asked us to produce an experience featuring their “Meatwad” char-
acter from Aqua Teen Hunger Force, the 11-m dome experience featured bright 20k lumen projectors to accommodate visitors stepping into the dome out of bright sunlight at San Diego’s Comic Con.

Vortex produced the mobile dome theater and assisted London-based animators Golden Wolf with the story world experience. NSC Creative offered their theater for screenings and provided advisory support. The result was a stunning show that dazzled Comic Con visitors two years in a row.

That same year we were contracted by NBC Universal to create an original experience for the launch of Constantine, an upcoming series based on the DC Comics character and 2005 film starring Keanu Reeves (that was shot on our studio lot).

We had 6 weeks to deliver a 3.5-minute animated themed experience. It took 3 weeks just to get the script written and approved! Thank goodness for the 6,000 core render farm down the street. I directed the experience, including flythrough of a creepy sanatorium and collision with a ghost train while combating demons. Synchronized 4D effects included wind and strobes. We ran 1,200 shows packed with 50 people per show.

**Live entertainment**

Vortex was first drawn into live entertainment through our Artist In Residence Program led by Kate McCallum’s nonprofit c3: Center for Conscious Creativity.

Our first artist was Audri Phillips, a digital visual effects artist with substantial credits in Hollywood. Audri collaborated with musician and composer Winter Lazerus from Kate’s boutique arts+music label called the ART OF SOUND and together they created two albums and a crowdfunded show called *Migrations* which premiered at the Vortex Dome in 2011.

Audri then collaborated with choreographer Stefan Wenta to create a 360 ballet called *The Blue Apple* which was funded by a $50k grant through c3.

Esther Shapiro, former senior vice president for miniseries for ABC Television and co-creator of DYNASTY exclaimed that “…this feels like the next big thing!” Audri is now producing *Robot Prayers*, a “techno conscious sci-fi fantasy filled with ever evolving virtual and real characters seeking the truth of who they are.” The dome show features real-time interactive dance performance.

Artist and singer Amrita Sen and composer Anthony Marinelli pushed the envelope with their mixed media musical *BollyDoll*, which was performed to a public audience. Audience response to live performances was off the charts. We sold out many shows at $35-$45 per ticket and our newer productions will demand $100+ ticket prices.

Pharos was a mobile dome show featuring Childish Gambino (aka Donald Glover) located in the Joshua Tree desert. Gambino performed five shows over three days in a 49-m inflatable dome theater with a 2,500-person capacity.

The Microsoft-backed production team led by animators Mikael Gustafsson and Alejandro Crowfor spent two weeks in the Vortex Dome preparing the show, which was VJ’d live from dual Unity servers outputting 4k x 4k and re-mapped onto a 12-projector display at 60 fps. *Billboard* raved that “…the dome was truly the highlight of the night,” and Hip Hop DX called it “…the most innovative live show this decade.”

The largest dome we delivered was a 60-m inflatable structure at the LA Coliseum produced by The Production Club for a well-known game designer. He invited 3,500 of his “closest friends” to enjoy an immersive EDM party with the music of DJ’s Skrillex and Diplo under the magic of 360 imagery.

(Continues on next page)

2 To watch the 360 video of Donald Glover performing in Pharos Dome, go to https://www.youtube.com/watch?v=coWcTgU5PZ4
Vortex collaborated with artist James Hood on two 360 music+arts projects. Ceremony was performed live at IMERSA, the Jena Fulldome Festival, and the Hamburg Planetarium. A piece from Mesmerica was featured at the Immersive Film Festival at the Espinho Planetarium in Portugal, at the Full-dome Festival in Jena, and will be screened at the IPS Film Festival in Toulouse.

*Mesmerica* is a cross-platform production including a live performance, a fulldome film for distribution and a companion VR experience. Directed by Michael Saul, it features James Hood’s beautiful music set to world class fulldome art.

The show is expressly designed to activate positive brain states and a sense of wellbeing. Contributors include Jonathan A.N. Fisher, PhD, an assistant professor and director of the Neurosensory Engineering Lab in the Department of Physiology at New York Medical College, who provided brain visualizations from Neurodome®, and Mark Subbarao, PhD from the Adler Planetarium in Chicago, who provided a galactic zoom and brain sequence renders.

Pianist and composer Peter Manning Robinson performed *Refractor Piano* in The Vortex Dome with visuals by Hana Kim and Klaus Hoch. The concert was captured and live streamed in 360 video.

**Other applications**

A wide range of productions have been explored in The Vortex Dome, including traditional film screenings, performance art, EDM events, poetry readings, experimental art, meditations, workshops, panels, immersive dining experiences, a Teletubbies premiere party, and more.

Video shoots in The Vortex Dome include an MTV pilot for a global multi-cast dance party, two *60 Minutes* episodes, a scene from the TV series *Castle*, an independent sci-fi film, music videos, documentary interviews with legendary jazz musician Wayne Shorter and rapper Chuck-D from Public Enemy, and most recently a futuristic set for Jay Z’s music video called *Family Fued* with Beyoncé. We regularly shoot and live-stream 360 video of events.

**Paul Allen’s holodome**

In late 2015 a Request for Proposals from Paul Allen’s Vulcan³ was released seeking proposals for a “Holodeck.” It was a challenge that I could not refuse. We mounted a cluster of 4k projectors aimed into a semi-spherical screen driven by full-sphere equirectangular movies from our Touch Designer playback and remapping server and a separate Unity server. Vulcan refined our prototype system for public use and recently opened the Holodome at the MoPop museum in Seattle⁴.

Vortex collaborates with local universities, including CalArts (fulldome curriculum and student showcase for three semesters) and has presented an “introduction to fulldome” for USC’s Animation and Entertainment Business departments, University of Texas LA, and the LA Film School and the Art Center. We’ve also co-produced digital media labs for high-risk foster youth through the nonprofit Create Now. We also hosted MORPHOS, a summer artist-in-residence program with Ethan Bach and five artists who showcased their work in the dome to a live audience.

**Lessons learned**

**Corporate Events.** Digital planetariums can easily attract well-funded corporate events. You’ll need to get good at reading mood boards and accurately projecting logos and brand elements according to brand guidelines. Expect demanding clients and short production timelines. Market your theater to local brand managers of Fortune 500 companies and pitch exhibitors at upcoming conferences, festivals and sporting events well in advance of the event. Companies often seek local venues for parties, presentations, and more.

³ Vulcan Inc. is a privately-held company founded by philanthropist, investor, and Microsoft co-founder Paul Allen. It was established in 1986 and oversees Allen’s diverse business activities and philanthropic endeavors. Wikipedia


(Continues on page 28)
Meet the New Star Projector of the Digital Age
Simple, Compact, Powerful

MEGASTAR-Neo

- Requires minimum space, best for integration with digital planetariums.
- One million stars, 16 individual bright stars, over 170 deep space objects.
- 12 LED units, MEGASTAR deep and realistic sky quality.
- Affordable for small to mid-range planetarium domes 5m-15m.
- Lightweight, can be carried by one person.

Ohira Tech Ltd.
Tel: +81- (0)45-507-3531
Contact: sales@megastar.jp
https://www.megastar.jp/
product launches and more.

**Film and Video.** Make sure you let your local film commissioner know that your planetarium is a unique venue available for select productions.

**Live Music.** Most planetariums can accommodate solo artists and small ensembles. You’ll need gentle lighting that you can control, a small stage area, extra utility outlets, a good sound system, an audio mixer, some microphones, and an audio feed from the stage to your sound system. Items not in-house can be rented or provided by the performer.

Musicians who have large social media following can usually draw an audience. Remember, the dome is a very special performance space with limited seating—it is reasonable to charge more for tickets than an ordinary venue. Looping or static backdrops with slow transitions can suffice for the bulk of a performance, with an occasional “whiz-bang” immersive effect. You don’t want the dome to steal the show. Ask for the song list in advance and work with the artist on a theme for each song.

**Theatrical Productions.** Live performances including theater and dance are the most challenging formats for digital planetariums. Performers typically want foreground set pieces, a large stage with wood and marley flooring, dressing rooms, theatrical lighting and more. Touring performances must adapt to digital planetariums on a case-by-case basis.

**Visual Music Entertainment.** In the past, planetariums supplemented their revenues with ticket sales to evening laser light shows. Currently there are only a small handful of fulldome music entertainment shows. Vortex is producing original SciArt entertainment programming for planetariums that merges scientific visualizations with music and art.

**License Rights.** Make sure you have the proper rights to use third-party content for commercial events. Royalty-free stock imagery—both stills and video—is inexpensive and can be creatively mapped and manipulated in real-time or in post. Stock fulldome imagery is increasingly available from the fulldome community, which has been very supportive in our work. Fulldome imagery is also available under creative commons license with proper crediting.

**Future of immersive experiences.**

We see digital domes as the out-of-home entertainment format of the future. “Generation VR” will demand alternatives to passive flat-screen entertainment and proscenium shows.

Vortex is focused on building a global network of arts and entertainment dome theaters while empowering artists to create transformational entertainment that—as closely as possible—bridges the mind of a performer to the mind of an audience. Vortex is not the only entrant in this space. MSG Entertainment recently announced the construction of The Sphere in Las Vegas and London, a $360-million (U.S.), 152-meter diameter LED dome with 18,000 seats.

I remain close to my planetarian roots. Media sociologist Marshall McLuhan once said, “Anyone who tries to make a distinction between education and entertainment doesn’t know the first thing about either.” With all due respect to McLuhan, not all entertainment is educational. However “entertainment” and “engagement” are nearly synonymous. Education should be engaging if it is to have a deep and lasting influence.

Digital planetariums merge science and art in awe-inspiring ways that no other medium can. They especially favor Hutton’s Deep Time journeys\(^5\), Christian’s Big History storytelling\(^6\), Montessori’s Cosmic Education\(^7\), and other Great Story variations\(^8\). Under the dome we can contemplate the big questions of life, experience the thrill of travelling through space, time and mind, be moved by powerful music and art and visualize possible futures for humanity.

Digital domes were birthed in a community devoted to meaningful media and life-affirming programming. We seek to retain these values as the format expands into mainstream arts and entertainment.

---

[8] See for instance thegreatstory.org/what_is.html
Aurora: Lights of Wonder

Directed by Kwon O Chul
Writer Dan Neafus
Science Advisor Dr. Ka Chun Yu

You will experience sophisticated and still dynamic features of the real Aurora storm.

Gwacheon
International Planetarium Movie Festival
‘Audience Award’ 2016

Brno
IPS Fulldome Festival
‘World Premier’ 2016

Jena
11th Fulldome Festival
‘JANUS astro award’ 2017

Contact: Saetbyul Choi threestar@metaspace.co.kr

Image of the Ring Nebula, M57, colorized to illustrate the nebula's chemical composition. The deep blue color in the center represents helium, the light blue color of the inner ring is the glow of hydrogen and oxygen, and the reddish color of the outer ring is from nitrogen and sulfur. Credits: NASA, ESA and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration
Even if the expression “planetary nebula” is credited to William Herschel, it should be noted that the description of an unfamiliar “planet-like” object was first suggested by Antoine Darquier of Pellepois, who discovered the object that became know as M57 and NGC6720, and is commonly known as the Ring Nebula in Lyre.

Darquier discovered the nebula in 1779 in Toulouse, and he compared its shape and size to the planet Jupiter.

It seems appropriate to remark upon the conditions of his discovery and take a biographical approach to this French observer of the century of the enlightenment in this year of IPS 2018 in Toulouse and the 300th anniversary of his birth.

The Ring Nebula is a popular deep sky object for amateur astronomers. Located not far from Vega, one of the stars of the beautiful triangle that graces the summer skies, it is easily found in the line of the quadrilateral of the Lyre joining two stars of third magnitude, Sheliak (β Lyrae) and Sulafat (Ɣ Lyrae).

Its discovery by Darquier is the second of its kind. The first was the Dumbbell Nebula (M27) in the small fox, discovered by Messier in 1764. In 1780 Pierre Méchain found the small Dumbbell (M76) In Perseus and the Owl Nebula (M 97) in the Big Dipper the following year. Today, almost 2,000 are listed in the Milky Way, where their number is estimated at around 50,000.

According to the latest estimates, M57 is located at a distance of approximately 2,300 light years. Its real diameter is 2.4 ly and its apparent diameter, approximately 6 minutes of arc. The age of this nebula is evaluated between 3000 and 6000 years.

In essence, these nebulae are scalable, called to disintegrate over...
hundreds of thousands of years by dispersion in the space. The ring of M57 is ejected gas by its central star during its red giant phase, identified in 1800 by the German astronomer Friedrich von Hahn as a white dwarf a little more massive than the sun and very hot, of the order of 125,000°K, and an apparent magnitude of 15.8.

After having lost its external envelope, this star is now a white dwarf. The central region looks bleak in emitting in the UV. In the internal part of the ring visible, the green of the ionized oxygen prevails. In the external part, we find the red characteristic of excited hydrogen.

In 1864, the amateur astronomer William Huggins, studying the spectra of several objects that included M57, discovered the emission lines characteristic of fluorescent gas, proving their character of nebulae.

The central nucleus, essentially composed of carbon and oxygen, was discovered by the Hungarian astronomer Jenö von Gotthard in 1886. Its first photograph from the Observatory of Toulouse was carried out by the astronomer Louis Montangerand in September 1890 with the telescope of Gautier of 83 cm. The spread was 9 hours between the nights of 8 and 11 September.

Despite its name, M57 therefore has nothing relating to “planetary.” But in the eighteenth century, red giants and white dwarfs were not yet topical, and the appearance of these nebulae gave them an air of family with the planets when resolved with diameters apparent in the astronomical instruments. It is thus quite natural that Herschel instituted this appellation in 1784.

In 1779, Darquier discovers a nebula like no other.

In fact, this discovery was made by chance by Darquier while he explored the constellations traversed by the Comet 1779, the existence of which he had learned through the Gazette of France of 9 February, received with a week of offset as a result of transportation by the post. He pointed immediately his comet researcher and Dollond telescope in the region concerned and followed the evolution of this comet until March 24.

The comet’s path comet during the second half of February took it through the constellations of Bérénice, Crown, Hercules, and the lyre. In this context it tells the story of the discovery of the nebula, just a few lines in his astronomical observations:

“I met some nebulous in my way, most of which are unknown, but one to which I stopped with the greatest complacency is a nebula located between two beautiful stars of the third magnitude of Lyra, it is like no other: it is as big as Jupiter, perfectly round and well defined, dull as the dark part of the moon in the syzygy, it seems that its center is slightly less dull than a reflection of its surface... it should be surprising that no astronomer has spoken: it is true that you have a strong enough telescope to see it. Could this be a new production of nature or would she the same date as the stars that surround it? That’s why we keep quiet, not to indulge in speculation always illusory.”

Darquier used Dollond of 3 and a half inches of aperture (92 mm) and a 42-inch focal length (110 m), powerful enough to suspect the center of the nebula of different appearance. He liked to say that his instrument “had the same force as that of Messier.”

The trails of the posterity are sometimes curious. Without this nebula, his name would be fallen into oblivion. Yet he was far to suspect that this would be the contribution that we would retain, in the catalog of Messier who compiled it with the intention of allowing comet hunters not to be confused with these objects in the deep sky.

**Antoine Darquier, an amateur astronomer of talent**

Antoine Darquier of Pellepoix was born on 23 November 1718 in Toulouse and died on 18 January 1802 at Beaumont-of-lat, at the age of 83 years. The author of the leaflet published in his memory a quarter of a century later, in 1827, embellished in the romantic spirit of the time, associates the awakening of his vocation astronomical to the myth of the child prodigy:

“The young Darquier received his first education in the paternal house. One night, his tutor entered in the room of his student and was surprised not to find him in his bed. Frightened, he gives the alarm; in a moment, masters and servants are on their feet, but although the door of the house was closed, all searches are unsuccessful. Finally, the first glimmers of twilight, we saw the child on a roof, pressed against a fireplace, and absorbed in the contemplation of the stars. He admitted that since a month he was leaving his bed all the nights and was climbing on the roofs by a skylight to observe the stars.”

But Darquier, in the preface to the first volume of his astronomical observations, says in terms not just as lyrical that he devoted to the science of Urania after attending the meetings of the Society of Sciences of Toulouse:

“Particular observations, which were made in reading one of our sessions, awoke a natural inclination. I had no idea I could hear about the system of the universe, walking celestial bodies and progress that the navigation and the art if necessary wait time measurement of astronomy, without being highly agitated. The sky, immense space that contains them... those innumerable globes which roll over our heads... presented themselves to me like the work of the Supreme Being... I vowed me on the spot to Astronomy.”

This society become in 1746 the Academy
of Sciences. It was founded in 1730, when Darquier was but a dozen years. He became a student in the class of geometry, therefore theoretically admitted to attend its meetings in 1739.

After his studies at the Jesuit College in Paris, he returned to Toulouse because of the fragile health of his father. He seems to spend several years seeking his way “in the general study of mathematics, uncertain,” he said, to what particular object of this science he would focus preferably.” Further, he indicated that his practice of astronomy started two years before (the first observation we can consider reliably for the record), namely the partial solar eclipse of 25 July 1748.

Furthermore, according to the corpus of academic memoirs read in sessions and kept in the archives of the Toulouse Academy, the first Darquier communication dates back to March 26, 1744 and relates to the movement of planets.

Based on these elements, if the childish episode is not excluded through the expression “awoke a natural inclination,” we can estimate that it is around 1745, at the age of 27, that his interest in the stars takes shape, a passion that he carries to the end of his life as an amateur.

Darquier and Garipuy: A work that leads to the emergence of the Observatory of Toulouse

How can we discuss Darquier without mentioning François Garipuy (1711-1782), seven years his senior, as both of these two personalities occupy a place in the history of astronomy in Toulouse? It is Garipuy, main astronomer at the Society of Sciences, who awakens his interest to the celestial issues.

By mutual emulation a collective work is often favored by the meeting—or confrontation—of two outstanding personalities; thus Darquier and Garipuy play a fundamental role in the emergence of the Observatory of Toulouse.

The Academy of Science began establishing, on the initiative of Garipuy, an observatory on the tower of the St-Etienne bulwark in 1734. The tower threatening collapse, however, and the two observers, hampered by its remoteness, decide in 1750 to establish their own observatories.

Eventually Garipuy constructed a new observatory at the top of his house, which was acquired shortly after his death in 1782 by the states of Languedoc to make it the observatory of the province.

At the time where Garipuy built his Observatory at the top of his house, Riquet at Bonrepos, grandson of the manufacturer of the Canal du Midi, established an observatory at the Chateau of Bonrepos-Riquet.

These activities, plus Darquier’s continuing observations, led Jérôme de Lalande to write in his Astronomy (t. IV, p. 587) edited in 1792: “Toulouse. Mr. Darquier has published a large collection of observations in 1777. Mr. Garipuy has built a Nice Observatory in his house in 1773. Mr. at Bonrepos has made [an observatory] on land near Toulouse. It is of all the towns in the province where the astronomy is the most cultivated.”

With Garipuy’s observatory established as the observatory of the province, entrusted to the Academy. During the revolution it becomes the National Observatory of Toulouse with paid personnel. After a municipal status in 1808, it takes a new growth from 1840, with the elevation of the cupolas on the hill of Jolimont.

Garipuy is, therefore, on two occasions involved with origin of the observatories of the academy in Toulouse, first on the tower of the Ramparts and then the summit of his house. But the latter would probably not have been saved in 1782 without the action and the scientific will of Darquier, author of his praise academic.

Involvement in the scientific community

An interesting aspect of the work of Darquier is his involvement in the astronomical movement, structured through the efforts of Joseph-Nicolas Delisle in view of the transits of Venus in 1761 and 1769. Darquier was in correspondence with the greatest astronomers of his time: William Herschel, Jean Bernoulli, Pierre Charles Le Monnier, Giovanni Domenico Cassini, and of course, Lalande.

He becomes correspondent of Alexis Claude Clairaut in 1757, and then of Monnier some 10 years later. On the initiative of Lalande, in 1796, he is appointed non-resident partner of the class of astronomy in the creation of the Institute. As a Knight of the Order of Malta and a freemason, he shared with the astronomer Bressan and various philosophers of the Enlightenment a general enthusiasm characterized by the outbreak of many lodges.

He also made useful in encouraging such young astronomers as Pierre Méchain, that it pays for calculations of reduction of its observations with a view to their publication, regretting the lack of computers. Darquier spends most of its existence in the Toulouse area, sharing between the Pink City, its castle of Pellepoix, Auch, and stays in Barèges. Besides his studies in Paris, he made two additional long-term journeys: a second Parisian stay the summer 1756 to the following year, and a trip to England in May-June 1788 to a meeting with Herschel.

Its esteem for the British astronomer is important. There is a direct testimony in one of its correspondence with the astronomer Honoré Flaugergues, dated 19 December 1789 and preserved at the Observatory of Paris:

“...in the last year in the month of May and June the trip from England Express to see this astronomer and this telescope. His honesty and frankness are well made for him to reconcile the esteem and the joy of astronomers. Its large telescope of forty feet in length and five feet in diameter, in which I am entered, was all mounted and ready to receive its large mirror which was then almost finished... The manner in which these telescopes are mounted and move deserves to be seen. There will likely be for a long time before they can brag to enjoy the same advantage in any other part of the world that London.”

It is moving to consider that this nebulous of the Lyre had probably been the object of conversations, or even of observations between its discoverer and the author of the expression “planetary nebula.”
A man before his time:

Visions of immersion 50 years in the past

Jack Dunn
Retired from Mueller Planetarium
University of Nebraska-Lincoln
jdunn@spacelaser.com

Long before fulldome, before IMAX and OMNIMAX, a professor in Nebraska was thinking about immersive images on the dome. That man was my mentor in college, Dr. Gilbert C. Lueninghoener, or Dr. L, which was what everyone called him.

Dr. L received his Ph.D. in geology, but he had a long-time love of astronomy. Over the years at Midland College in Fremont, Nebraska, Dr. L had been teaching both astronomy and geology, but also had been called upon to teach physics and various math courses.

Doc had an immense love of the great geology places of the western United States. He had led students on field trips to visit a number of the national parks; in particular, he often went to the Grand Tetons, Yellowstone, and the Grand Canyon. But, of course, he could only take a few students with him on these trips and he wished he could bring their stories more effectively to his students at Midland.

Meanwhile in the 1960’s, the college had raised the funds to build a new science building. He took an active part in designing the classrooms and labs and even designed a special clock for the front of it. He had persuaded the college to let him have a new planetarium and observatory as a part of this grand new structure. The rooftop observatory had a roll-off roof, far less common in those days. As Dr. L postulated, it would facilitate groups of students observing on multiple telescopes all at once.

An acquaintance, then a mentor

But my story here is about the planetarium. I had known Dr. L since middle school, when I ran into him at several “hi-fi shows” in Omaha. Back then, these were gatherings and demonstrations of new “hi-fi” gear for audio enthusiasts. By the time I got to college he became my advisor and I learned about the new planetarium. As his student, I was thrilled when he asked me to help with the planning of the sound system for the room. So, that’s how I became a planetarian—it was all about those Bozak speakers.

In the film world, the largest movie screens of the 1950s were devoted to a process known as Cinerama. It used three 35-mm projector running in synch to project an immense image on a curved screen. And, in its way, it immersed you as none had before.

But there was the drawback of having to keep those projectors in synch, and where the three images overlapped it sometimes produced anomalies. Hollywood solved this and made their lives easier by creating single wide-angled lens systems such as Ulra-Panavision. One projector for the big screen.

Over time they gradually lessened the curve of the screen. Dr. L. noted that when he saw The Sound of Music in 70-mm Ultra-Panavision, those beautiful wide-angle shots of the mountains gave people a thrill right out of the box. He said: “you could almost have shown audiences anything after that.”

His new planetarium opened in 1966 and he got the idea that since he had a curved “screen,” there might be a way to use the idea of peripheral vision. He said that to fully understand the geology of a scene you couldn’t really do it in a standard photo. The information added by seeing what was to the right and to the left of that photo added immensely to the story.

By then 35mm photography was well established and there were some fine single lens reflex (SLR) cameras. He chose the Zeiss Contarex for its great lenses. Note that he bought the camera on his own. What the college purchased were three Kodak carousel slide projectors.

Dr. L had been an early advocate of unidirectional seating back when it was almost heresy.

The birth of Planevista

He did a number of other things unique to his theater that I might address some other time, but perhaps one of the earliest was to purposely make holes in his dome. He found a college maintenance person to help him drill three holes in the back of his perforated aluminum dome. He worked out the geometry to match the projectors and their lenses.

To get the image size he wanted, he bought 3-inch lenses rather than the standard 4- to 6-inch zoom lenses that most everyone used.

For those three holes in the dome, he took the pieces which had been drilled out and put them on powered arms with magnetic latches so that, at the push of a button, the holes would open or close.

He called the three-projector panoramic
projection system “Planevista.” At the time, the Kodak slide projectors didn’t have the tighter registration mechanisms of the later advanced professional models, so he mounted the two side projectors on platforms that could slightly swivel. There were controls for this down at the planetarium console. If the slides dropped and alignment were a bit off, he could compensate.

Back in 1967 there weren’t any dissolve units available to him and certainly, if there were any, they wouldn’t have been affordable. You had the three projectors that you had to advance all at once by hitting three remote buttons. He built most of this on donated labor and used his own designs.

Dr. L. took trips all across the western U.S., most of the time on his own funds, shooting his favorite geologic areas. He designed a special mount for his camera so that, while sitting on the tripod, it would rotate on the focal plane of the camera rather than on the normal screw mount.

He also added a number of levels to his tripod to help in setting up shots. He came up with a special way of strapping rubber bands to the camera on the tripod to steady it during higher winds (often encountered at places like the Grand Canyon). The film he used most was Kodachrome (as Paul Simon sang, “they give us those nice bright colors”), but that film only had a speed of 25 so there were limitations.

The challenge of the curve

He had slides of scenes in sets of three. But the sides of the slides would be distorted when projected onto the dome. How could you bring the images together with overlap and possibly match them? Dr. L. would spend hours applying paper masks by hand to each of the left and right slides.

The slides are still there at Midland; many are still in their trays set up for projection. Dr.

(Continues on next page)

2 Treat yourself to a listen to “Kodachrome,” from Paul Simon’s 1973 album There Goes Rhymin’ Simon.
Lance Johnson of the Midland Science Department helped me get a few sets of the slides for experimentation and scanning. (Of course, I found my current scanner wouldn’t do slides and I had to pull out an old scanner. Then I found that the software for that scanner would not run on anything after Windows XP. So I found other software. Now I’ve tried restoring some of the images. You can see the results here.)

Back then no one had heard the term “immersive,” but that’s what Planevista did. I should point out that Planevista was not a simple horizon panorama. Planetariums did go on to adapt various pan systems to replace the old cutout silhouettes that often were found in large domes. The Planevista image went about 1/3 up the dome because of those three-inch lenses. I’ve used modern planetarium software to simulate how Planevista would appear on a dome.

I’ve experimented with several fields of view, as I need more dome time to get good perspective on what is most like the originals. Being retired, I don’t have my own dome, so I must depend on others to try out the images in theirs. It’s a slow process, but gives me a very rewarding feeling to see these images again after so many years. Working with Lueninghoener shaped a lot of my beliefs that carried over once I had my own dome.

The timeline says it

Dr. L created Planevista back in 1969. IMAX first debuted at the Expo ’70 in Osaka, Japan, and the first permanent IMAX theater opened in Toronto in 1971. Those used flat projections.

The first OMNIMAX was installed in the dome in San Diego in 1973.

Spitz came along with a system in the 70s that used five projectors shooting vertically. They had an expensive five-camera rig. It never really caught on, although I know they sold a few; I would suspect a lot of planetarians didn’t want to have to put in all the work to make slides register properly. Plus, the format with those vertical slides had a lot of non-useful space at the top. Looking at full-dome today, you can see that covering higher up areas of the dome works a lot better when you have all of your horizon filled.

It wasn’t until the ’90s that “all-sky” systems were introduced in planetariums. In a way, they were the culmination of the ideas of Dr. L. and the forerunner of the fulldome video systems. We had an all-sky system in Mueller Planetarium, but had no way to shoot and create the masks for our own photography. I always thought what majestic images Dr. L would have taken in that medium.

Lueninghoener really had in mind many principles about composition and perspective that we use today in fulldome. As an example, he created a Planevista show of images to go with Ferde Grofé’s Grand Canyon Suite. One of my first projects was to work on the soundtrack for that program, for which I emphasized the thunder crashes that were in the recording. We built some primitive lighting projectors to add to the “cloudburst” movement.

His vision: you can do more

So, way back in the 1960’s Dr. L. thought it was ok to use the planetarium to do more than star talks. He still did those, but 50 years ago his vision was that there was more you could do with the dome. He used it for teaching astronomy and beyond, as well as for art and entertainment.

Note that I scanned the original slides at a high enough resolution that I can make 4k domemasters of these images. My hope is to get some of the Grand Canyon slides scanned as well. It would be a “grand” project to recreate the entire Grand Canyon Suite program.

For now, I’m glad I have put together some preservation of some of Lueninghoener’s legacy for the college and am adapting it into a short piece they can show on their fulldome system.

I graduated from what is now Midland University in 1969 and the planetarium was named for Dr. Lueninghoener in the early 1970’s.

My thanks to Dr. Lance Johnson and Dr. Jamie Simpson of Midland University for their support of preserving the Lueninghoener Planetarium.
This close to the surface, details matter. Overlaps, crimps, folds, and exposed rivets will affect your image. Perfect projection is only possible with a perfectly uniform surface. NanoSeam™ has no irregularities in the surface. None. It's why the most prestigious venues choose Spitz domes - including The Adler, The Hayden, and our partners like IMAX, Disney, Universal Studios, and Seaworld.
15 years of keeping track of the world’s planetariums

What began as a convenience for French-speaking planetariums has evolved into an international database now marking its 15th anniversary. It is the Worldwide Planetariums Database (WPD), found at www.aplf-planetariums.org/en/index.php.

The origin of this database dates back fifteen years and has its roots in a combination of circumstances: the overcrowding of the Association des Planétariums de Langue Française (APLF) annual publication with a long list of French planetariums, the start of the internet, the possibility to create a website easily, the creation of Google Earth and its predecessors, and the fact that here in France we found that the IPS Directory of the World’s Planetariums was obsolete for its French listings and difficult to update.

We updated the complete list of French-language fixed or mobile planetariums for France (and beyond), and it turned out that the list still took up six pages at the end of our annual Planetariums magazine.

Filters to allow visualization

We decided to transfer this list to the recently-created APLF website. Rather than a simple text listing, the choice was made to create a database whose filters would allow the public to visualize some essential information and also see photos.

The idea of achieving an interactive map of France quickly imposed itself. Divided into large areas, a simple click was used to display a list of all planetariums by regions and sizes, and to distinguish the fixed mobiles with a differently-colored background. Then, a second click on the chosen planetariums allowed to open an entirely dedicated page to that facility.

The result seemed to be adequate, but some drawbacks appeared, such as how to display French-language planetariums located in other countries (Canada, Belgium, etc.)? If we wanted to keep the idea of access via a map, a map of France alone was no longer suitable.

A map of the world could lead us into an "astronomic" work, far from what was envisioned at the beginning of the project. But the task matched with my favorite hobby: discovering the world from satellite photos. So I found pleasure in the work and the WPD was launched: all planetariums, all over the world, with exact location, geographical, and visual coordinates.

Lionel Ruiz from the Marseille Planetarium has ensured, since the start of the project, the IT development of the base.

Since it has become an international database, we have created an English direct access, so that everyone can easily find their planetarium. We kept the possibility of posting in French for the French community.

High turnover in mobile domes

During the 2003 census, it appeared that in seven years, the date of last update, mobile planetariums had seen a 70% turnover. This high turnover is one of the reasons why we decided not to list mobile planetariums for the rest of the world.

About fifteen years and 30,000 working hours later, we count 2,900 identified planetariums, of which 400 are permanently closed. Over the years, different fields of information have been added. The latest are directors’ or team members’ names (already public on their own website), the altitude of planetariums, etc.

A powerful internal search engine makes it easy to find a planetarium, with a name (or a fraction of it), with the city, or one of its team members’ names. Map and regions searches provide interactive lists and even menus that rank planetariums by continent, region, and country.

These menus also allow to display directly all these planetariums in Google Earth; each one of them has a proportional dome-sized landmark to its dimensions and shows its main installer’s colors.

In the menus, you can follow a Twitter devoted to planetariums: installations, leveling, work, closures, renovations, innovations, etc. (twitter.com/AUDEONdaniel). Each country is updated with new developments and changes. An email at the bottom of each page allows everyone to send me information to be corrected or changed.

This tool was presented for the first time at IPS Alexandria, Egypt, in 2010, as our active participation with and contribution to IPS. The possibility of merging this database with the IPS Directory was considered, but appears to be too complex because of the way the data is recorded. Now they complement each other and the IPS offers a direct link to WPD from its website.

Although the IPS Directory has been modified and is now searchable online through the (Continues on page 50)
SOLAR SUPERSTORMS
NARRATED BY BENEDICT CUMBERBATCH
From Chicxulub to Tunguska
The story of two impacts and friendships that spanned the globe

Esteban Sanders, Art Director
hm.sanders@gmail.com
Enrique Fonte, Planetarios Digitales
enriquefonte@planetariosdigitales.com
Mexico City, Mexico

The story about the fulldome show titled From Chicxulub to Tunguska begins at a dinner during the IPS 2016 meeting in Warsaw, Poland, when the president of Planetarios Digitales Enrique Fonte, along with his wife Jessica, sat down and met at the same table with Pavel Nikiforov, director of the Irkutsk Planetarium, and the planetarium’s public relations manager Eugenia Skaredneva.

The chance of a trip planned months before by Enrique and Jessica through the huge Siberian region and the warm willingness of Eugenia and Pavel to guide in the city of Irkutsk and Baikal Lake resulted in a strong friendship that would cross borders.

Enrique and Jessica were completely amazed by the Siberian region and the Lake Baikal. So there was born an idea to contrast this region with the Yucatan peninsula. The Chixulub crater in Mexico and the place of Tunguska event in Siberia gave us a chance to link these two regions that, at first sight, are completely different.

This is how, for more than a year, the planning of From Chicxulub to Tunguska began. In Mexico, Planetarios Digitales received the support and sponsorship of the Mexican Council of Science and Technology and an excellent work together with the National Institute of Anthropology and History.

(Continues on page 50)
Let’s Make the New
GOTO ORPHEUS HYBRID
Very Simple...

Clarity
The resolution of ORPHEUS stars equals that of a theoretical 70K video system... as if such a video-based system will ever exist!

Capability
HYBRID controls enable easy, professional, live programming, as well as sophisticated automated programs.

Longevity
30-year lifetimes are common for GOTO opto-mechanical projectors – or about four times longer than fulldome video system components.

Economy
GOTO HYBRID systems synchronizing an ORPHEUS with a 4K fulldome system can cost less initially than 6K or 8K video-only systems. And they cost much, MUCH less to maintain over several cycles of video equipment replacements.
This quote is my life’s motto, which has guided me for many years. I think that’s probably why, through my whole life, I have thrown myself into uncalm waters, in the hope of gaining new experiences.

Today, as the father of three children, I of course have to be more cautious, but I still try to live on the edge and give life my all. If I do something, I try to put myself into it 100% and not to think about the future; to simply be in the here-and-now and focus on what I am doing. Life itself takes me to new challenges and I get the impression that, to a certain extent, it is simply following its own rhythm as it leads me along.

That is how my passion for multimedia was born. It began at the Warsaw University of Technology, in the faculty of mechatronics (technology that combines electronics and mechanical engineering), when I failed an exam in metrology. That is how I got to know my future thesis advisor, the head of the multimedia department.

It was there that I learned the basics about film, photography, and 3D graphics. Soon thereafter I got a stipend from Polish Public Television (TVP) for young engineers and I started working at TVP as a lighting engineer. That was an intriguing adventure that gave me a lot of experience with multimedia environments, which continues to be useful to me today.

But an opportunity arose in 2006, when I won a scholarship from the Japanese government, and I was unable to resist it. I left behind my girlfriend, job, apartment, car, and friends, and with a single suitcase flew off to conquer the world.

And so I became the first participant in a double degree program. To this very day I remember the sense of fear as I first sat down on my bed in a dormitory room at the other end of the world, where I knew absolutely no one at all.

I thought “I am supposed to write a doctorate in semiconductors and quantum physics? A multimedia student who spent the last two years running around with a camera?”

I was never the scientist type, more the sportsman type. But my father is a sailing coach and ever since I was a young boy he taught me the value of hard work, resilience, striving towards an objective, and drawing upon inner strength. When you are out there racing on the sea, there is no way to give up, to say “I can’t go on.”

Fate took a positive course

And so I just threw myself into the thick of research work, and fate took its course. In fact, things went quite well, as a year later I also received a scholarship from the Twenty-First Century Center of Excellence Program for outstanding scientists, and in 2009 I defended my PhD in nanoconductors.

But when offered the chance to continue my research career in Japan, Australia, or the United States, I could sense that my heart was
yearning for some other way of expressing myself, and so I returned to Poland.

I realized that my decision was partly because I wanted to do something good in the city that my grandfather had once defended, back in the Warsaw Uprising during WWII. To me, this is a kind of tribute to all those who are no longer around, whom I have to thank for who I am.

But I also have a conviction that a person’s life is deeply rooted in the culture and land of their origin, in their family. The Slavic culture, with its thousands of different hues, its sensitivity, and its sometimes unbridled expressiveness, is for me an inexhaustible source of inspiration and energy. I could sense that I would not be happy anywhere else.

So, with my brand new PhD from the Nanovision Technology Department at the University of Shizuoka, I returned to Poland to start over. In 2010 I earned a second doctorate from the Warsaw University of Technology, but yet again I yielded to my life’s own sense of direction, which was then proposing another plot-twist.

My planetarium adventure begins—at the airport

My adventure with the planetarium world began at 6:00 a.m. at Chopin Airport in Warsaw. I started my first day of employment with the Copernicus Science Centre by leaving the country.

The task I had been given was to build a world-class planetarium. To achieve that, I realized, I really had a lot to learn. So I first flew off to visit top-notch facilities in Jena, Kiel, and Hamburg, to find out what was important and gain some inspiration. With each successive stage of that trip, I grew increasingly enthralled with the planetarium world. By Hamburg, I was already convinced: this is what I wanted to do for the rest of my life.

I found the power of the immersive environment under the dome simply astounding. But already then, my third day on the job, I had the impression that the shows I was viewing were still not fully harnessing the true potential of the dome. It was then, in 2009, on my third day of employment at Copernicus, that I felt a desire to change that.

After returning to Warsaw, I managed to convince the Copernicus management and soon I built not only a planetarium, but also a production studio. That was how I got to know all the amazing people who together created the Copernicus Science Centre, the Heavens of Copernicus Planetarium, and Central Europe’s first studio producing spherical animations. It was with the Copernicus production studio that I produced my first show, Dream to Fly.

One of the main animators for that project was Maciej Rasala, an artist of incredible talent. I have never met anyone with such an approach to work and to life. Now he is the number two man at the company Creative Planet, which I set up in 2013, one day after leaving Copernicus, a place that will forever remain in my heart. My time there had been an amazing period in my life: it was there that I had fallen in love with the “fulldome” world, and also fallen in love with my future wife Zuzanna, whom I married in 2011.

A year after our first daughter, the sweet little Mia, had been born, I realized that I no longer felt completely fulfilled in my job as deputy director of the planetarium and head of the production studio. I wanted to focus on the things that excited me and have a creative freedom. I also had to support my growing family.

Creative Planet comes to life

So I set up Creative Planet. The beginnings were not easy. To survive, Maciej Rasala and I both took day jobs and in our free time worked on the first film of our own, titled Explore. I also worked as an artistic director making medical animations for someone else’s company, organized the IPS 2016 conference, wrote tender applications, and helped set up other planetariums. Maciej, in turn, was animating the film Hello Earth at Copernicus.

We worked that way for several years, and for the last two we worked a lot at night. We were both on the verge of divorce and in 2015 we each had another child: the delicate Lea and the beautiful Marysia. This was

(Continues on next page)
a very difficult, but also very productive, time for our team. It was also during this time that my wife Zuzanna wanted to expand beyond the role of the loving mother of over-active little girls and began to find fulfillment in writing. That’s how our team was formed. Each of us contributes a bit of ourselves. Zuzanna brings an open mind, 1,000 ideas per minute, and creativity that astounds me every day. Maciej Rasala brings visual perfection, an extraordinary sense of style and an endless supply of positive energy. I try to pull this all together into something cohesive, taking care to ensure that our shows are not just pretty and interesting, but also convey a deeper message.

Looking from today’s perspective, I think that everything I have done to date has contributed to the path that I have taken. The combination of multimedia experience and a research career, as it turns out, comes in tremendously handy in fulldome production. On the one hand, I can read and understand research articles, while on the other I am sensitive to what will reach out and grab viewers by the heart. That is why I feel that what I am doing now is my dream job. It gives me vast satisfaction.

People are the key to what is good in life

I am also very grateful to the many individuals who have greatly helped me out along my path. It seems to me that people are the key. It is worth pursuing what one loves in life, fighting for it. Doing so fills one with much more energy and passion, which translates into results. For me it is also important that I have my own company and I can do what I love in precisely the way I love to do it. Although running a business in a still-developing country in the center of Europe is much more difficult than having a stable job at a prestigious university or large science center, it is an amazing experience that is fully in line with what I really want.

I think that everyone has their own path and their own ideas, but sometimes it is worthwhile to take that first bold step in the direction of one’s dreams. Sooner or later everything will work out, and fate will come to your assistance.

The fulldome world needs people, people with passion ready to bring their creativity to the dome. I think that this freshness, combined with the huge experience that has already been gathered, will help to create something qualitatively new. In my opinion, fulldome has huge potential and really needs this new quality. I hope that one day there will no longer be any cinemas with a small screen at the end of the room and there will only be domes.
Ulteria - Derived from the word Ulterior, meaning hidden or invisible.

Ulteria perfectly describes Astro-Tec seams under projection conditions. All of Astro-Tec’s seaming processes are virtually invisible under projection, but none more so than the new Ulteria Seam.

Unsurpassed Strength
Flush Horizontal and Vertical Seams
One Row of Rivets on Both Axes
No Shiny Edge Lines from Trimming
No Unsightly Gaps or Buckles
High Quality Installation
5 Axis CNC Precision Cut Panels
Larger panels than the competition resulting in less overall seams
Superior performance under the most advanced & brightest projection
DIGISTAR 6
Do More

Domecasting
Show Builder
Live Text
Data2Dome

Open Captions
VR Capability
Data Visualization

High Resolution Terrain
Cloud
Volumetric Models
Auto Blend/Align

Realtime Black Holes
Wires
Realtime

Fulldome Shows
Terrain Layering
Fulldome Stereo 3D

Music Visualization
Data Visualization
Laser Projector Options

www.es.com
Wireless Presenters  Music Visualization  Terrain Layering

STEAM Education  Updated City Lights  Fulldome Shows

Unity 3D Interaction  Fulldome Stereo 3D  MIDI Device Support

Astronomy  Custom UI Windows

Data Visualization

Data2Dome Realtime  Black Holes

Live Text

Show Builder

Auto Blend/Align

Domecasting

Laser Projector Options

Volumetric Models

High Resolution Terrain

Fulldome Shows

Terrain Layering
From a simple idea introduced at a fulldome event in Plymouth, UK, in January 2008, IMERSA has grown tremendously over the past ten years. Today, the organization embraces producers, animators, composers, technology experts, theater operators, and marketing gurus focused on the immersive content domain. Its annual summits are self-assembling villages populated by creative people and animated with passionate discussion about all things immersive, including fulldome, giant screen cinema, themed entertainment, VR, AR, and MR.

The 2018 IMERSA Summit, held in Columbus, Ohio, the first time out of Denver, Colorado, brought together 150+ immersive pioneers and innovators from all facets of the community. We enjoyed and learned from keynote speakers Clark Dodsworth about storytelling, Amy Blackman on understanding audience interests, and Bob Cooney on VR experiences.

Through four days of sessions, we took part in some very creative events, including a unique audio training presentation. Panels explored the world of festivals, audiences learned from filmmakers about their toughest challenges, and theater operators got inside tips on marketing for institutions. Coupled with a selection of amazing fulldome content, attendees came away enriched and inspired.

**Immersive Inspiration from a pioneer**

In one of the most highly anticipated sessions at the summit, master filmmaker and special effects expert Douglas H. Trumbull mesmerized the attendees with a master class in production for immersive experiences. I’d like to focus on his presentation in a bit more depth because it illustrates many useful perspectives that all immersive content producers can and should be bringing to their work.

As I wrote in my column for the March 2018 Planetarian, Doug’s work started the early 1960s when he got involved in immersive filmmaking. As he spoke, he sounded a lot like long-time planetarians who “caught the bug” early in life and never left the dome. Immersive is so important to him that he's founded his own studio and company to make and market immersive experiences (including purpose-built small theaters) called MAGI Pods.

Doug's first big challenges were with a film for the New York World's Fair. Long before many of us first set foot in a dome, he and his teammates were figuring out how to film (yes, film) a fulldome movie. They had to devise methods that would work with conventional cinema equipment to do what we do so easily today with fulldome video.

**From war to cinerama**

However, he didn't invent the idea of immersive video. As Doug related, World War II played a part in its development, too, under the direction of an inventor and filmmaker named Fred Waller, who created the Waller Flexible Gunnery Trainer. It used movies of aircraft flying past fixed points, projected onto a curved screen. Soldiers who were training as gunners used the simulator to practice “shooting down” those planes.

It probably was the first time anyone had tried a curved screen approach to simulating reality and its use led Waller to invent a technique called Vitarama, which led directly to the creation of Cinerama. That process uses three synchronized 35mm projectors to display a movie across a wide, curved screen. It was really the first immersive film experience.

Cinerama extended the film's action just beyond a viewer's peripheral vision, and was a huge hit when it opened on Broadway as a cinema experience (complete with assigned seating and printed programs) in 1952.

Creating a movie for a Cinerama is where Douglas Trumbull found his love for immersive experiences. The story of Cinerama's birth as a military trainer came as a complete surprise to many of us in attendance, owing largely to the fact that the Waller trainer was classified for a long time after the war. Reportedly, when one of the soldiers who used it went to a Cinerama movie for the first time, he said, “This must be the unclassified version!”

**Tricks of the trade applied to immersive content**

Much of Doug's talk focused on the production techniques he used in the Back to the Future ride that he developed for Universal Studios park. It, too, was created as an immersive experience, shot on a set for projection onto a curved surface. His discussion of forced perspective, programmed motion through the set, and special effects resonated with all of us. In particular, he pointed out some tricks that made his job easier—for example, building up high detail in visual elements that will be “front and center” in the scene.

In a discussion that strongly resonated with most of the domes in the audience, Doug talked about viewing an early
version of the ride resulting in test audiences “leaving the theater barfing.” Who among us hasn’t experienced that phenomenon? It’s a serious point.

In some immersive presentations today, induced motion sickness is still very much a problem. It’s largely brought on by production techniques that value fast motion over audience comfort. I’ve heard it referred to as the “gamers and lamers” approach. Trumbull and his team fought it too, experimenting with various techniques to reduce the likelihood of motion sickness.

In preparation for production, he did a great deal of research to see what worked in the immersive environment—and came across solutions that can and do resonate with today’s immersive producers. “When we were evaluating various image issues regarding the Back to the Future ride, I watched many IMAX movies at the dome in San Diego,” he says. “What we noticed was a severe ‘bending’ of anything straight—such as telephone poles, edges of vertical buildings, straight roads, etc. We determined that we could reduce this distortion problem (which occurs when viewing any dome image from sides or back, etc.) by designing our sets and locations to have as many irregular and curved shapes, as opposed to straight or parallel.”

As a result, the scenes for the futuristic ride that was set in Hill Valley (where parts of the original movie and ride take place) were designed as a 50s-style take, using curvy streets, question-mark shaped streetlight poles, curved buildings, boomerang-shaped signs, and so on. “We also trended toward the natural irregular shapes of nature: trees, rocks, glaciers, etc. to further limit the obvious geometric distortions of man-made shapes,” he pointed out.

The team shot the entire ride with a nighttime look. This allowed them to avoid the cross-reflected “wash-out” in the dome that results from bright skies. They also backlit many scenes to create a “rim-lit” look so that a smaller percentage of the overall frame was brightly illuminated. “Overall, we found that images like vector graphics, CGI with thin brightly colored lines like neon, looked best,” Trumbull said.

These are, of course, many of the same tools producers use today and their application can further enhance fulldome and other content.

Interestingly, Trumbull’s influence does stretch into the fulldome production world. Several key members of the team that developed the Rose Center in the late 1990s worked for Trumbull before coming to the American Museum of Natural History in New York City. They include Josh Mingus, Bently Bernhardt (who worked as a sound designer for the Trumbull Company), and Anthony Braun, who is now executive producer at the Rose. There remains a direct connection between him and the planetarium world.

Are we a ride tour?

One interesting aspect of the Back to the Future ride that Doug touched upon was the extension of the ride experience out to the building surrounding it. This is, of course, a staple in Disney experiences, where people waiting in line see elements of the attraction outside the theater/ride.

In her analytical look at rides and cinema experiences, Lauren Rabinovitz (professor of American studies and cinema at University of Iowa) takes a fascinating look at “ride films” and cinema in a book called Virtual Voyages: Cinema and Travel. In her chapter “From Hale’s Tours to Star Tours,” she talks about virtual voyages such as we have seen in ride films and in our own domes. She describes how the lobbies and entryways of ride buildings “carry an important atmospheric weight, providing a preparatory zone for the ride that prefigures the spectatorial processes inside the auditorium.”

Rabinovitz focuses specifically on ride tours such as Back to the Future and Star Tours, but her observations about how such films can approach the realm of virtual reality, for example, equally apply to domes in science centers and museums. In a very real sense, we are providing the equivalent of ride tours, although solely on the dome without use of ride mechanics. Many facilities do, in fact, “preview” the planetarium dome experience with their entryways. In this way, they can get the audience in the mood for the upcoming event.

As Doug talked about the full experience of the Back to the Future ride (with its pre-ride exhibition), I thought a lot about how our full-dome, VR, and AR experiences have a lot in common with “ride films” that Rabinovitz discusses. As such, production techniques to enhance their realism as well as the audience experience (eg., non-nausea-inducing) are important to all immersive producers.

We may think we in the dome and immersive community have invented our medium, but in reality, we are beneficiaries of people such as Douglas Trumbull and Fred Waller and many others who pioneered immersive filmmaking decades before the first fulldome video was ever made.

IMERSA thanks

The success of the IMERSA Summit 2018 wouldn’t have been possible without the many volunteers and Center of Science and Industry (COSI) employees who came together to make it happen. In addition,
In Siberia, an enthusiastic crew of Irkutsk Planetarium, with the support of director of Baikal Museum Vladimir Fialkov and the support of deputy director of Institute of Solar-Terrestrial Physics (Siberian branch of Russian Academy of Sciences) Mikhail Demidov, made possible an extraordinary binational expedition through the melting ice of Lake Baikal.

The expedition continued along the ring of sinkholes that follow part of the perimeter of the Chicxulub crater, the well-known cenotes of the Mexican Caribbean peninsula, to capture and show through fulldome the places where these events had happened and how they look today.

The target of the show is general audience, of any age, to learn the importance of space-caused events and consequences, especially the study and the riddles that continue to be deciphered to date.

In the case of Chicxulub, a possible event that triggered the extinction of the dinosaurs, and in the case of Tunguska, a possible collision with a small comet’s nucleus, it will teach us to measure the vulnerability of the planet to asteroids and comets of only a few meters in size.

This documentary is accompanied by spectacular and immortal images that will transport the audience to majestic landscapes that are separated by thousands of kilometers but which, in turn, are interconnected. These images contextualize the Mexican peninsula of Yucatan through its characteristic sinkholes, the cenotes with its treasures and latest discoveries, while the majestic Baikal Lake sensitizes us for its immensity and importance in the great Siberia.

Making this cooperation between Russia and Mexico was very gratifying for us both, despite the huge distance, environments and cultures, and the willingness and friendship were total and reflected in the excellent production From Chicxulub to Tunguska. The program will be available to any planetarium anywhere in the world this summer.

(Fulldome, continued from page 49)

we thank Evans & Sutherland, Creative Planet, Christie Digital, Altair VR, Metaspace, LochNess Productions, the Museum of Science Boston, Barco, Clark Planetarium, Digital Projection, Bowen Technovation, California Academy of Sciences, Denver Museum of Nature & Science, and all of the sponsors for their kind and generous support. Finally, we couldn’t have done it without the delegates, who each year bring enthusiasm and knowledge to share with everyone in the community. For a full program guide to the 2018 summit, go to imersa.org/summit and click on “Download the Program Guide (PDF).”

Special thanks to Michael Daut, Douglas Trumbull, and Ryan Wyatt for their advice and commentary as I was preparing this column.

References
Waller Flexible Gunnery Trainer: in70mm.com/cinerama/archive/gunnery.

(WPD, continued from page 38)

new IPS website, access to the previous directories allows us to keep track of our history and our stories.

Similar work has been achieved on WPD: we no longer erase closed or moved planetariums, so it keeps a historical work about the evolution of our community. In order not to interfere with planetariums in activities, these closed planetariums no longer appear in searches via the internal engine, interactive maps, menus, or Google Earth. However, you can easily find them using the query tool on the database by clicking on “Query,” selecting “closed,” and choosing from a variety of search options.

Manufacturers and providers of planetariums may find this tool useful. But it is hoped that journalists will take an interest in the database. It is sometimes surprising, reading some articles, to find mistakes about planetariums information (sizes and statistical data most of the time). Let’s hope that in the future, everyone will find WPD useful. Everyone can contribute, ask for a change of contents, or send updated photos.

It’s your tool!
HUGE STARTER CONTENT PACKAGE with every Fulldome.pro system

If you are interested in new shows for your planetarium, request a catalog from info@fulldome.pro
I am excited about the upcoming 2018 IPS biennial conference in Toulouse, France. Many Education Committee members will be participating there, with a panel on serving people with special needs and two hours of interactive planetarium lessons beneath the dome. I note many other education-themed sessions and papers, so education will be represented very well. I invite anyone attending who is not now on the Education Committee to join us at the Education Committee meeting that will be held on one of the conference days, time and day to be announced. I look forward to seeing all planetarian friends in Toulouse.

An Education Committee meeting was held in October of 2017 at the Pleiades meeting in St. Louis, Missouri. Chrysta Ghent expressed interest in situations in the planetarium and within IPS involving language differences. She and college Peter Licona have prepared the following article they have researched concerning language differences. I thank them for their thoughtful and helpful contribution and look forward to further dialogue about language communication.

We also appreciated the comments and concern that Planetarian Editor Sharon Shanks expressed in the March issue about this problem of “one sky, many languages.”

One Sky, Many Languages

Chrysta Ghent
The Pennsylvania State University
PhD Candidate, Planetarium Educator, Liberty Science Center
cghent@lac.org

Dr. Peter Licona
Elizabethtown College
Assistant Professor of K-12 STEM Education
liconap@etown.edu

Introduction
This article is written from two different perspectives in the field of education coming together with a common interest: accessible learning opportunities.

This all started from a meeting of the Education Committee at the 2017 Pleiades Conference. While discussing ideas and thoughts about our planetarium community, Chrysta brought up the importance of awareness about different language learners in our spaces. She then reached out to a colleague from Penn State, Peter, to work together on expanding this idea. Let’s start out with a little bit about each author.

Chrysta Ghent started her education career teaching science in inner city public high schools, where the student population included native English-, Spanish-, and Nepali-speaking students. In Chrysta’s short time as a member of the planetarium community, and IPS specifically, she has met people from many different countries.

She attended her first IPS conference in Poland, and has connected on social media with planetarians from many countries. For both of these examples, however, her experiences were/are almost entirely in the English language.

Peter Licona’s work in education spans over 25 years and most of this work has afforded him the opportunity to work with many culturally and linguistically diverse students—students from Mexico, Puerto Rico, Jamaica, Italy, Germany, Vietnam, The Sudan, and many other areas. These experiences have included teaching emergent bilinguals in the United States and in Honduras, providing math and science educational outreach to multilingual and multicultural urban school districts, and conducting research in dual language science classrooms.

As such, these varied experiences have challenged him, but most importantly have provided him the opportunity to think critically about providing equitable science learning opportunities for emergent bilinguals in both formal and informal science learning environments.

Under the dome
There are at least 50 countries represented by members of the International Planetarium Society. Editor Sharon Shanks (2018) recently noted in the March 2018 of this periodical that language is a barrier among the planetarium community, and “at conferences, we try to speak slowly, and we use a lot of gestures” (p. 4). In the United States alone, over 850 million visits are made to museums (AAM, 2017). As of January 1, 2018, Mark C. Petersen shared that “each year 152,297,583 people visit the 4,194 planetariums of the world” (p.32). We ask, for how many of these visitors does the planetarium become a solely visual show without being able to understand what is being said? Is the visualization enough?

Planetariums are unique environments, and can be described in many different ways, somewhat like a blend between a formal classroom environment and an informal science institution (such as a museum). It is no question that it is difficult to describe all planetariums in one way. Here are just a few differences...
amongst the community:

- they are found as stand-alone institutions, within schools, and within larger museums;
- they are led and staffed by all ranges of educational backgrounds and paths;
- they focus on K-12 students, college students, and/or the general public;
- some can hold over 300 people at a time, and some can be transported around in a car.

But I think it is safe to say there is one main thing all planetariums have in common: they share the wonder of astronomy with others.

In a study by Small and Plummer (2010), 36 planetarium professionals were interviewed about their goals for planetarium audiences, among other questions. Some 71 percent of the planetarium professionals interviewed listed “education about content/prior knowledge” as their general goal in the planetarium, and 68 percent noted “interest/engage” as a general goal (Plummer & Small, 2010).

This study suggests that in general, most planetarium professionals have similar goals when it comes to their audiences: teaching new content, and sparking interest in astronomy. However, this is easier said than done. Every audience is different, and that can include the language spoken. Combine this with the fact that most planetarium visitors are under the dome once for an hour or less, in a dark room no less.

Still, “it is critical to consider diversity issues and the science learning of nondominant groups...” (National Academies Press, 2019). What are some strategies that can be used to address this for our unique environment and different formats (live presentations, full-dome movies, special events)?

**Under the roof**

Most nations in our interconnected world are influenced by cultural and linguistic diversity. The dissolution of borders, rise of online modes of communication, current trends of migration, and a historically large refugee population have resulted in an increasingly multicultural and multilingual global community.

The United States of America is one example of such trends. While cultural and linguistic diversity have always been a hallmark of the U.S. and its formal educational system, it is fairly safe to say that the country currently is experiencing an era of increased multiculturalism and multilingualism like no other time in our history.

A recent study (Ryan, 2013) revealed that according to the most recent US Census Bureau figures, there are 381 different languages spoken across the country. While our work describes the continual diversification of the U.S. of America, many nations are also experiencing similar trends. Therefore, we will argue that our work applies to many other nations across the globe.

Nowhere is this diversity more evident than in our schools, and consequently in our informal learning environments. It should, therefore, not be a surprise that culturally and linguistically diverse students (CLDs) are the fastest growing demographic in the US schools.

Culturally and linguistically diverse is an umbrella term that is used to refer to a wide range of students that conveys the diversity of culture and language that students bring to the classroom. In response to this increasing cultural and linguistic diversity, many educational institutions, from pre-school to post-secondary levels, are considering how this diversity necessitates new and innovative pedagogy and curriculum to meet the learning needs of the changing student body.

Addressing the educational needs of diverse students is by no means a new concern for educators and researchers throughout the world. In the multicultural education community, much emphasis has been placed on practices framed as culturally relevant (Ladson-Billings, 1995) or culturally responsive (Gay, 2002; Villegas & Lucas, 2003). These approaches promote sets of practices in which teachers should engage to plan and implement learning opportunities that are relevant and/or responsive to students’ diverse cultures. Gay (2002) describes culturally responsive teaching as consisting of five practices:

- developing a cultural diversity knowledge base,
- designing culturally relevant curricula,
- demonstrating cultural caring and building a learning community,
- cross-cultural communications, and
- cultural congruity in classroom instruction.

Villegas and Lucas’ (2002) conception of culturally responsive teachers seems to parallel that of Gay (2002). They describe culturally responsive teachers as demonstrating the following six practices: sociocultural consciousness, affirming attitude towards students from culturally diverse backgrounds, commitment and skills to act as agents of change, constructivist views of learning, learning about students, and culturally responsive teaching practices.

Recently, scholars have placed explicit attention on teacher ability to respond to the unique linguistic needs of CLD students. Lucas and Villegas (2013) have described linguistically responsive teachers in terms of orientations (i.e., sociolinguistic consciousness, value for linguistic diversity, and advocacy) and pedagogical knowledge and skills (i.e., knowledge of students’ academic and linguistic backgrounds, understanding second language learning, ability to identify classroom language demands, and scaffolding strategies). While their work is situated in the U.S., linguistically responsive teaching applies to any educational setting where two or more languages come into contact with each other. Additionally, these ideas apply to how teachers can address issues related to the marginalization of the non-societally dominant languages.

The notion of linguistically responsive teachers is of particular importance as it complements theories of that foreground the importance of considering diverse cultures when planning and implementing curriculum and pedagogy.

**Making STEM accessible**

While there are general strategies for providing accessible learning opportunities for diverse students, there has been much recent interest in ways to make STEM (Science, Technology, Engineering, and Mathematics) learning opportunities more accessible. The interest in accessible STEM learning opportunities for CLDs in the U.S. is based on a number of arguments: the opportunity gap,
often referred to as the achievement gap, in STEM learning; an underrepresentation of diverse individuals in STEM careers; and the importance of producing future STEM-literate professionals and citizens. Furthermore, there is a strong overarching element of social justice when considering ways in which learning can be made more accessible for CLDs.

While much attention has been placed on offering equitable STEM learning opportunities for CLDs in formal learning environments, it is equally important to consider how the tenets of culturally and linguistically responsive teaching applies to informal STEM learning environments, such as science museums and planetariums.

For example, if we combine the work of Gay (2002) and Lucas and Villegas (2013), we can define what it means to be a culturally and linguistically responsive teacher and, in this case, a culturally and linguistically responsive informal STEM educator and how this applies to informal science learning environments, such as planetariums.

The million dollar question

As mentioned above, there has been research and interest in making science accessible for all students in formal education environments. How do we apply the suggested strategies to the planetarium?

Tran (2007) stated that teaching in a school and in a museum are very similar: they are both learning environments, they are both teaching environments, and lessons and experiences are planned and developed. One could therefore consider that pedagogical strategies used in the classroom with CLDs can be applied in an informal space such as a planetarium.

Perhaps the most pertinent tenets of culturally and linguistically responsive teaching that apply to planetarium would be developing a cultural diversity knowledge base, examining cross-cultural communications, understanding second language learning, and promoting advocacy.

While it is impossible to know visitors to planetariums as classroom teachers come to know their students, informal science educators and organizations can easily build a cultural diversity knowledge base that can inform them of the various cultural characteristics of visitors. This is not to suggest that a stereotypical cultural archetype exists; rather this is suggesting that a deeper and more comprehensive cultural knowledge base be constructed.

Part of this cultural diversity knowledge base is understanding that different cultures have different norms and expectations for communication, thus it is important that planetarium understand how to communicate across cultures. This can be achieved through communication and partnerships between formal and informal educators, where both institutions work and plan together about their visit.

Informal science institutions can also host community events, where the diversity and needs of the visiting population can become shared.

One final suggestion that ties all of the above together is advocacy. As visitors to planetariums and other informal science learning settings continue to diversify culturally and linguistically, it is important that we, as a community, advocate for practices that afford access for all visitors.

By this, I mean all decisions regarding exhibits, signage, and docents should consider how culturally and linguistically diverse visitors will be included in the planetarium.

It is important to note that we do acknowledge the limitations for some of our suggestions, the biggest being, as always, the financial cost for updating signage, adding captioning to dome presentations, or training/hiring staff. However, considering the needs of culturally and linguistically diverse populations is a win-win scenario for all involved. Visitors will gain access to the rich learning opportunities in planetariums and planetariums will benefit from an engaged multilingual and multicultural audience.

(Continues on page 80)
2018 is int. Year of the Reef

Kaluoka’Hina: The Enchanted Reef

An endangered reef, a lunar riddle, two fish on a mission!

The most watched planetarium program worldwide

www.reef-distribution.com
www.softmachine.de
www.iyor2018.org
Observing when the skies are gray

Spring was very late to my section of the midwest and the weather made it difficult to get out to do some observations. I was working with seven non-traditional students in a college astronomy class this semester and had to get creative with their time to observe the actual night sky.

Since we only met every other week, there was a pretty high chance that it was going to be partly cloudy or have an uncooperative moon phase and thus we needed a few easier-to-measure topics that would not need perfect skies each night. As a result, there were a couple of activities that we did while waiting for the skies to clear up: one on measuring the angles in the sky, and the other on seeing the impact of light pollution.

For the most part, observations for the course were supposed to be of something that changed over time in size, color, or appearance. Using the angle measurement technique from timeanddate.com, the students were able to gather data to help dispel the myth that the moon is larger when it is closer to the horizon. Below is a sample of the quick table I had them fill out.

It was a very powerful experience to at least one of the students when that myth was busted, who said this was a myth that had bothered him since childhood but he had never had the chance to compare them to see if there was differences.

Measuring Polaris in slow-motion hand jive

They also really enjoyed measuring the altitude of Polaris. The first night we gathered it was cloudy except for a region in the northern sky, so they could actually find Polaris. In class they had learned that its altitude above the horizon is equal to the local latitude, and were able to test this face in the field. One of the students said that anyone walking by would just see a group of people doing a very slow version of the hand jive.

At the start of each of our sessions (when we could see stars), I would point out a constellation for them to measure some part of its altitude, then two hours later, at the end of the session, I had them repeat the measurement from the same place. This was the change over time part of the assignment.

The goal was to have them start seeing the pattern that over the two hours a constellation would move around 30 degrees. I say “around” because there is going to be variation between people using the hand method to measure the angles.

Light pollution: the other bane for observers

Light pollution was a real issue for us on top of the partly cloudy weather. If we were on campus, only the brightest handful of stars were visible, which was why I asked them to meet at one of my darker sky places, a rural baseball diamond. I had spoken to the parks manager and had a printed email confirming that I had permission to be at the diamond without lights on just in case the sheriff stopped by. It was twofold advantage meeting off campus: being off campus gave us darker skies, and there was less of a chance of losing our night vision to a car blasting us with their headlights.

After showing them the Sky Glow graphic, we decided that campus was about a 7 while the baseball diamond was between a 5 and 4 since we could see the Milky Way easily, but it did not have any apparent color.

As a fun activity I picked up a few swatch samples of gray paint for them to sort from lightest to darkest. I cut the swatches apart into uniform rectangles that only had a single color on them. The theory was the more light pollution in the area, the easier and more accurately the swatches could be sorted.

As they were sorting the 7 shades of gray, the lightest was easiest for them to find regardless of the light pollution levels, but the three darker grays were harder for them to get in order. It was a quick and easy thing to do while waiting to use the telescope or hoping for a cloud to pass.

A note to planetarians and teachers wanting to use this activity: don’t flip the cards over like a memory-type game since most paint companies use flat white on the back of the color swatches and they can be used as comparators.
I also experimented with using yarn of different shades bundled together that they the students tried to fan out from lightest to darkest. While it was easier to move the yarn than the swatches, the knots in the yarn bundles preposition and hold the order of the yarn strands.

Lesson plan (more of a management technique)

Supplies

- Personal chalk or white boards for each student
- Nerf or indoor basketball hoop
- Floor-safe tape (wide enough to write on)

Transitions between topics or disciplines in class can really make or break a class. If the transition goes smoothly, the students are ready for the next topic and you as the teacher have had time to pack away the materials from the previous topic. If it goes poorly, the students will need additional redirections to get back to task.

Several weeks ago I was working with a couple of 5th grade teachers. I was there for part of math time one day and a teachers had a cool way of assigning the math homework. After the lesson she puts a “challenge” question on the board. This challenge question is an advanced question from the upcoming homework.

The students answer it on erasable boards. As kids answer they flip the boards to hide their answers, and this is a cue to the teacher to collect them. All the students who get the challenge question right head over to the math center, where there is a Nerf basketball hoop set up and three marks on the floor. The closest (2 meters) says “Evens,” the next (3 meters) is labeled “Multiples of Three,” and the furthest (4 meters) says “Multiples of Five.” Each challenge winner gets one shot from each location. The student in charge of the calendar that day keeps track of the scores. The category with the most points is the homework of the day: either all even-numbered questions, or all questions that are a multiple of three, or all that are a multiple of 5.

The day I was there the high score was in the “Evens” category, so the class was assigned the even questions on the homework.

If no one got the challenge question, the teacher would do a little re-teaching moment and the students would do all questions for homework. Ties were decided with a coin flip with one student being each side of the tie.

The teacher established a very positive environment, with a great deal of support between the students, and there was a lot of buy-in from the students who did not get the challenge question correct. The time of the few minutes of the basketball shots provided the students a chance to decompress, because if they got the question right they were walking around the room. It was also a productive time for the teacher to pull out the materials for the science lesson they were transitioning to.

What do you do as “get up” and transition activities? I did 30-second dance breaks get some motion during our 90-minute block schedule. Drop me an email with what you do.

The Bortle Scale in a graphic from the SkyGlow Project. The scale is a nine-level numeric measure of the night sky’s brightness in a particular location. It quantifies the astronomical visibility of celestial objects and the interference caused by light pollution. John E. Bortle created the scale and published it in the February 2001 edition of Sky & Telescope magazine to help amateur astronomers evaluate and compare the darkness of observing sites. Learn more about the fascinating SkyGlow Project at skyglowproject.com; image used with permission.

Jack L. Northrup is an American Midwestern astronomy educator who loves the dark skies from living in a flyover state.

PARTYcycles

Ah! At last some quiet time!

No neutrons! No photons! No tachyons!

Just a proton and an electron...

... a plain hydrogen atom...

So... what should we do? Just hang here, waiting for the Universe to expand some more?

I guess. But it does sound boring, though...

BORING?!

Not when you realize the Universe is expanding into itself...

A non-Euclidean manifold in multidimensional space.

OK... that was confusing!

I’ll take boring over confusing anytime...

SHUT UP!
Have you ever wanted to power your camera for all-night photography, but didn't have enough battery power to do so? Or what about those cold nights when low temperatures reduce your battery to a fizzle?

The solution is to provide power to the camera from an external power source. Most DSLR-type cameras will already have the ability to plug into an external power source. But some do not, like my Sony A7II. The camera is great, but the internal battery is small and the camera isn’t designed to be powered externally whilst the camera is in use.

I have found a number of solutions online, but I also wanted to use my large, 12-v DC battery to run my telescope at the same time. What to do, what to do?

My solution was to make a power adapter using a regulated buck converter (also called a step-down converter) to convert 12-v DC to 8.2-v DC. The project is actually quite easy to make and simple in design. And, even better, the design can be easily modified based on the output voltage you need.

Adding a wooden base

Once everything was wired up correctly and tested, I made a wooden base for the buck converter that has Velcro straps running through it. It needed to attach in different ways based on its use and I didn’t want the converter to scratch up any other equipment. See Figures 1 & 2.

(For liability note, and let’s be careful out there: If you make this and it outputs the wrong voltage for your camera or you made a mistake in the wiring, that is your fault and I cannot be held liable. Serious damage to the camera can occur.)

Looking over the illustration, you will see there are two configurations for my personal needs. Plan A is if the camera is to be used by itself on a tripod. An example use would be a time-lapse sequence.

Plan B is if I’m shooting through my telescope (or piggyback) and the telescope mount and camera are powered through a Losmandy Gemini II controller. See Figures 3 & 4.

The Gemini II has two power jacks, so you can daisy-chain input and output power connections. The output is the same as the input. Of course, you could have a Y-connector at the battery with two female DC plug sockets, but I wanted to minimize those large connectors.

Also note that DC has polarity. There is a plus and a minus to every connection. Be very careful that you connect plus to plus and minus to minus!

In the diagram, in general, you see that 12-v DC power travels from the external battery and through the buck converter, and then the lower voltage travels through the dummy battery that replaces your regular internal battery. As I said, very basic.

You’ll need a dummy battery

The dummy battery can be purchased by itself, but you can also get them with an AC adapter. See Figure 5. The beauty of the AC adapter version is that it is already made modular and connects up with jacks. You can also run your camera off AC right away if you are around house current. The jacks used are 5.5mm long and 2.1mm in diameter.

There are a few benefits of the buck converter. One is that it contains an entire set of circuits to make sure the output voltage is stable and won’t burn out your wires or device. There is some power loss, but it is about 90% efficient. The big benefit is that it keeps the output voltage the same, even if the input voltage changes. This is important when using a battery that can drain over time and its voltage drops. The output voltage of the buck converter is adjustable.
via a tiny screw on the bottom. Note that the output needs to be lower than the input.

For this unit, the DROK DC-DC buck regulated converter, there needs to be at least a 2-v DC difference between the input and output. This unit can also handle the right amount of amps for the project; I need at least 2 amps. Note, the continuous amps it provides is based on the output voltage.

This unit outputs 4 amps at 5 v, 3 amps for 6-9 v, and 2.5 amps for 10-15 v. The input can be anywhere between 5.5 and 32 v, and the output (with the 2 v less than the input) can be 1 to 27 volts. It is also waterproof, so it’s great for outdoor use.

As you can see, this is a step-down converter. There are step-up converters as well, so don’t confuse them when purchasing.

A note about camera voltages: It seems that cameras can run on a range of voltages. The Sony is able to run on 7.2 to 8.4 volts. When looking at the voltage listed on the battery, the AC adapter that was included with the dummy battery, or the measured voltage from the AC adapter, the values were 7.2 v, 7.6 v, and 8.23 v respectively. Hmmm. So, as long as your output voltage is in the acceptable range, you are OK.

I used the output of the AC adapter under no load and used that value to adjust the output of the buck converter under no load. As it is right now, the converter under no load is 8.23-v DC; under a load it is 8.2-v DC.

The rest of the parts needed are jacks for connections, the dummy battery for your camera, and, of course, the external battery.

The buck converter cost about $14. The AC adapter with dummy battery was about $22. Everything can be purchased online.

Now I have a number of ways to power the camera under different circumstances, allowing me to use the camera for hours on end.

---

Another Bright Idea from Ash!

LED Replacement for Spitz Star Lamps!

> Drop-in replacement for original arc lamp.
> Lifetime measured in years not hundreds of hours.
> Smaller, brighter stars with more vivid colors!
> No UV output to age gels and transparencies!
> 3 year warranty.
> Price: USD $3550 (some discounts are available).

CONTACT: Eric Melenbrink - eric@ash-enterprises.com

ASH ENTERPRISES INTERNATIONAL
www.ash-enterprises.com
International News

Dear fellow planetarians

One again, I’m delighted to present for you a record of conferences, meetings, events, star-gazing, new shows, and many other activities taking place in our domes. This is proof of a thriving community ready to take the guests on dream tours into the universe.

For this section I’m indebted to contributions from Lee Pullen, Miléne Windling, Björn Voss, Aase R. Jacobsen, Kai Santavuori, Loris Ramponi, Alexis Delivorias, Vadim Belov, Frank Florian, Michele Wistisen, Bart Benjamin, Beau Hartweg, Ignacio Castro, and José Roberto Costa.

Let’s start this tour around the World at the North Sea.

British Association of Planetaria

In September 2017, former BAP President Dr. Jenny Shipway left her role of director of Learning and Participation at the Winchester Science Centre and Planetarium to return her focus to planetaria as an independent consultant providing training, content development, and consultancy. She also is delivering a Royal Astronomical Society project (funded by the Science and Technology Facilities Council and linked to the James Webb Space Telescope), supporting southern astronomical societies with their public engagement activities, and would be interested to hear about projects in other countries that similarly provide support to such groups (contact jennyshipway@gmail.com).

At-Bristol Science Centre, home to the UK’s only 3D planetarium, has been relaunched with a new name: We The Curious. Seeking to take a more participative and cross-curricular approach, We The Curious has a fresh vision and manifesto, to build a culture of curiosity.

The latest show from NSC Creative had its world premiere in the newly-refurbished Sir Patrick Moore Planetarium at the National Space Centre, UK on 28 February 2018. *The Planets 360* is a sonic-led fulldome extravaganza set to Gustav Holst’s *The Planets* suite performed by the renowned London Philharmonia Orchestra.

It also features a new modern interpretation with specially commissioned music by sonicXploras and contemporary stylised visuals. The project is supported by the Royal Astronomical Society RAS200 programme and aims to bring new audiences into the planetarium. The show was set to be screened at the Jena Fulldome Film Festival 2018 in May and will be featured at the IPS Film Festival 2018 later this year.

Association of French-Speaking Planetariums

Following the selection by the IPS Council in 2015 of France and Toulouse for the host of its 2018 Congress, it was important that the APLF council took the decision to mobilize its members around this exceptional event. And for this, there has been actions put in place that allow a significant participation of its members, despite three major obstacles perfectly identified: a lack of knowledge of the interest of a conference of this importance, a barrier in the communication in English, and a lack of financial supports for small structures, most often associative.

The result of this mobilization, thanks to the work of the APLF council, is impressive: first of all, the decision to integrate the 2018 national meeting with the IPS conference in Toulouse, with the agreement of the colleagues of the Ludiver Planetarium that were to host this event.

Then, the establishment of a differentiated financial participation of 50, 75, or 100% of the conference registration fees for more than 25 members, depending on the nature of their structure, which will allow the participation of nearly 70 French-speaking planetariums at this international meeting.

Dear fellow planetarians

Mobile dome operator Explorer Dome Midlands has been researching if a planetarium experience can have a lasting effect on the learning of the children, beyond simply the excitement of the day. The results are available online at: www.explorerdome.co.uk/explorerdome_news_February2018.html. (In this clearly-written article, Bell points out the problem with nearly all of us face: how to quantify the value of planetariums and their inherent “wow” ability in a world more demanding of data and outcomes. It’s a great start on research that will become even more valuable as more data is collected. - Editor)

Lars Petersen, PhD, is an astrophysicist and science communicator. From 1997-2016 he was director of Orion Planetarium, Denmark and is now science communicator at Museum Sønderjylland. He is a fellow of IPS.

BAP. New name, new mission, new logo! Courtesy of We The Curious.

APLF. The APLF council at the annual meeting. Courtesy of M. Favret.
And finally, funding of more than 9,000€ working concretely on the professional development of its members.

Two other beautiful actions to present French culture are the two-language edition of the APLF magazine Planétariums (French and English) and the holding of an APLF booth at the conference.

After following Thomas Pesquet in his astronaut training (from Houston to Moscow and from Cologne to Baikonour), comic author Marion Montaigne has released the book Dans la combi de Thomas Pesquet (Ed. Dargaud, 2017). The Nantes planetarium welcomed her for an evening of dedication and questions-answers. Since September 2017, in addition to the usual program, it offers monthly evenings on a specific subject. Next topics: the James Webb Space Telescope, Mars, and the history of astronomy, galaxies, etc.

After the success of Seasons and Tides, the two new episodes of the series Between the Earth and the Sky are now being presented at the Planetarium Cité des sciences in Paris. Far from light pollution, the shows Moon and Night Lights offer to rediscover the sky and understand the behavior of the celestial bodies that seem so familiar.

Society of the German-Speaking Planetariums

Saxony-Anhalt. The planetarium in the central German city of Halle was located close to the Saale river. During catastrophic flooding of the river in 2013, it was heavily damaged and has been closed ever since. The damaged building has now been demolished. However, not all is lost: The construction of a new planetarium is scheduled to begin later this year at another site in Halle, with the (re-)opening planned for 2020. The new planetarium is headed by Dirk Schlesier, the former director of Wolfsburg planetarium.

Hamburg. Hamburg planetarium reopened in early 2017 featuring new projection systems and expanded visitor areas. In the 12 months since then, it welcomed a record number of 380,000 visitors. This is the highest annual attendance number of a planetarium in the GDP countries that has been achieved so far.

In April 2018, the planetarium presented the 3D world premiere of Creative Planet’s Explore show. Directed by Maciej Ligowski, this show retraces mankind’s dream to reach the stars and its quest to understand the movement of the planets. In June of this year, Hamburg planetarium will also host the world premiere of Mirage3d’s Mars 1001 show.

Switzerland. Planetarium Lucerne is starting production on its Rosetta show. As reported earlier here in Planetarium, the planetariums in Vienna’s natural history museum (Austria) and in Lucerne (Switzerland) are leading an effort to create a full-dome version of ESA’s famous “The amazing adventures of Rosetta and Philae” cartoons. This full-dome production is now starting, managed by the planetarium in Lucerne. Planetariums who support this by paying a small fee will receive early show licenses. Please contact Marc Horat (marc.horat@verkehrshaus.ch) if you are interested in this show.

Nordic Planetarium Association

Denmark. In a new exhibition at the Tycho Brahe Planetarium in Copenhagen, a diverse group of visitors is invited to ask the question “What am I?” To answer this question, they must go on a journey through the universe in search of the elements that make up life.

In designing a new exhibition about astrophysics, the topic is turned upside down and the visitor is asked the question “Why should people care?” The answer: “Astrophysical phenomena like big bang, stars, and supernovae are a part of our cosmic history” has made the foundation of the exhibition. In all the choices regarding the dissemination,

(Continues on next page)
inclusion was kept in mind. With PhD-student Line Nicolaisen from Copenhagen University collaborating on the project and looking at gender inclusion, a more untraditional angle was taken to the subjects you normally meet in exhibitions about astronomy and astrophysics.

The human body of the visitor is used as a starting point, and the exhibition describes how the hydrogen in the water in your cells was made in the Big Bang and how the iron in your blood comes from the centre of large stars. In spectacular interactions and stunning visuals, the exhibit always links back to ‘you’.

There has been—on occasion—a collaboration between the institutions teaching astronomy in making Facebook events. The first time was the Mercury transit in 2015 and now an event is set up about the Lunar eclipse on 27 July this summer. In that way, it is possible to reach out to an audience nationwide and promote the different events throughout Denmark. Follow at www.facebook.com/events/164159806887996/

**Finland.** A new planetarium project is underway at Kakslauttanen. The Kakslauttanen Arctic Resort is one of Finland’s best-known tourist attractions and is located in northern Finland, 250 kilometres north of the Arctic Circle. The nearest international airport is in Ivalo, located just over 10 kilometres north of Kakslauttanen. It attracts more than 30,000 visitors every year.

The majority of the visitors come from Asia, but many also come from the United States, Australia, and Europe. The place has become famous for its glass igloos, where visitors can sleep under the starry sky and admire the northern lights and, in summer, the midnight sun. Visitors are offered different types of activities, too, but northern lights, or aurora borealis, are the main attraction in winter.

Planning and design of the planetarium were started early 2017. Project manager is Kai Santavuori, former staff member of Heureka in Helsinki. The objective is to provide the possibility to enjoy northern lights and the wonders of a night sky indoors. In winter, temperatures can drop to below −30 °C (−22 °F). During the spring of 2017, plans moved forward and it was decided that the diameter of planetarium dome would be 18 metres. The auditorium is tilted 24° and there will be approximately 150 seats. The basement of the planetarium, a glass-roofed restaurant, and brewery were built in the summer of 2017.

A special feature of the planetarium is its scissor-type hoist rising from the basement. It can be used for lifting, for example, a grand piano or a car to the front part of the planetarium. This way, the planetarium can be used for a variety of purposes, such as musical concerts and various customer events.

The planetarium’s spherical exterior will be built during the summer of 2018. Installation work of the projection dome will begin in autumn 2018. This will be followed by the construction of the auditorium. Installation of the planetarium system (projectors, audio, lights, etc.) will commence early 2019.

All fulldome shows will be screened in eight languages, so that as many visitors as possible can listen to the shows in their own language. A wireless 10-channel interpretation system will be installed in the planetarium for this purpose. If all goes according to plan, the planetarium will open its doors towards the end of 2019. For further information regarding the project, please contact: kai.santavuori@gmail.com.

**Sweden.** The Swedish Museum of Science and Technology in Stockholm and several other science-related institutions in the Baltic region have been using a colorful educational building material from South Korea—4DFrame—since 2009. Invented by architect Ho Gul Park, its “tubes and connectors” construction method is perfect for a national museum whose focus is on science, technology, and hands-on interactivity.

Student builders using 4DFrame can model existing things, like cars, insects, dinosaurs, and roller coasters, or freely use their imaginations to make things like “dream machines,” “5-senses detectors,” and “fantasy flowers.” Since it is reusable (and recyclable), once one construction project is completed, they can take it apart and start right in on another.

Some of the space-related things that could be applicable in the planetarium field that have been made with 4DFrame are rockets, space shuttles, satellites, and student-designed moon bases and vehicles that are constructed to use on simulated lunar surface with craters and mountains. It is possible to find more space- and astronomy-related activities at the Nordic4DFrame (distributor of 4DFrame in the Nordic countries) web site (www.nordic4dframe.com/eng/N4DF%20AstronomyandSpace.html).

Included on this resource page is a classroom exercise called Spiders (Continues on page 64)
NARRATED BY SEAN BEAN

FASTER THAN LIGHT
THE DREAM OF INTERSTELLAR FLIGHT
The workshop is divided into three steps. The first consists of a PowerPoint presentation about the differences between the geocentric and the heliocentric models. In the second step, students build a paper model called the “Astronomical Dante Watch.” It is formed by two concentric bands: the external band has the zodiac and the hours of the day, while the inner one represents the horizon with the four most important places of the Divine Comedy spread out on the cardinal points.

In the third step students read some “terza rimas” with astronomical meaning from the Divine Comedy and then they search for the time and position of the situation on the watch. Each student keeps a watch, which can be used with their teacher on other occasions.

Among the asteroids discovered or named by astronomical institutions of the Brescia area and connected with its territory, there are now two celestial bodies dedicated to Benedetto Castelli and Camillo Golgi. They obtained the official denomination from the International Astronomical Union in 2017 through the work of Massimo Della Valle and Marco Micheli, astronomers from the city of Brescia, who noticed that these two important Italian scientists of the past were not included in the list of named minor planets.

Benedetto Castelli (Brescia 1578–Rome 1643) studied mathematics at the University of Padova and later became abbot at the Monastery of Monte Cassino. He was a favourite pupil of Galileo Galilei, with whom he discussed the importance and significance of the phases of Venus to prove the Copernican theory. He also published On the Mensuration of Running Waters, an important work on fluids in motion. Benedetto Castelli is universally seen as the founder of modern hydrodynamics.

Camillo Golgi (Corteno, province of Brescia 1843-Pavia 1926) was an Italian scientist, physician and biologist. Many structures in anatomy, physiology, and cell biology are named after him, including the Golgi apparatus, the Golgi tendon organ, the Golgi tendon reflex, and the Golgi receptor. Camillo Golgi is recognized as the greatest neuroscientist and biologist of his time; in 1906 he was awarded the Nobel Prize in Medicine, the first Italian scientist to receive the Nobel prize, for his studies on the structure of the nervous system.

The next national astronomical event will be the occasion of the Day Against Light Pollution, organized in Italy since 1993, that will be held on 6 October. Planetariums are involved through special events, public presentations, and astronomical evenings. Serafino Zani Observatory and the Science Museum of Brescia will host on that day the national conference of the association Cielo e Sammaino that promotes, at a national level, initiatives to control the diffusion of light pollution.

**European/Mediterranean Planetarium Association**

*Croatia.* In January, the Rijeka Astronomical Centre in Croatia participated in the national Night of Museums cultural event. This year’s theme, Museums and Sports—Faster, Higher, Stron-
ger, inspired two workshops, one for adults and one for children, both coordinated by Croatian artist Ivo Matoštíc. Kids who participated in the workshop had to draw a spaceship as fast as they could to win free tickets for future planetarium shows.

The centre’s digital planetarium celebrated Valentine’s Day with the show Romance Under the Stars, focusing on the ancient Greek myth of Perseus and Andromeda, a love story that offers a great opportunity to introduce the audience to these two great constellations. The demand for tickets was so high that an additional show was organized for the same day.

On March 10, the Rijeka Astronomical Centre participated in the International Day of Planetariums for the ninth time. All programs were fully booked, and the Centre’s program was presented at the website of International Planetarium Society as an illustration of best practices.

Main themes for the events organized throughout the day focused on narration through storytelling for children, both inside and outside the planetarium, as well as poetry reading under the planetarium dome for the adult audience. In particular, apart from the various planetarium shows on offer during the day, children participated in the Space Talks storytelling workshop, organized in collaboration with the Portić Association for the Promotion of Children’s Well-being.

In the evening, visitors enjoyed the live show The 10 Best Constellations and also Losing the Dark, related to some of the most impressive constellations in the northern hemisphere and light pollution respectively. For the adult audience, the Stellar Verses and Space Landscapes event was organized, a poetry and musical performance bringing together poetry reading, with the projection of space vistas in the planetarium dome. Anthological verses of poems, both from Croatia and worldwide, were selected and read by Croatian astrophysicist and poet Rajka Jurdana-Šepić and the music was chosen by music editor and journalist Ivica Vrkić.

At the time of writing, the Rijeka Astronomical Centre is creating a program for Dark Sky Week and is planning to participate, along with the regular program, in Science Festival, Yuri’s night, and Earth Day.

**Greece.** Further south, the Eugenides Planetarium in Athens organized on 12 February an evening dedicated to “Life in the Universe.” The event started with an inspiring public lecture by astronomy professor P. Niarchos on “Searching for extraterrestrial life: evidence and unanswered questions,” followed by the Eugenides Planetarium 2016 production Life in the Universe.

On 19 March, the Eugenides Planetarium premiered its latest production, Searching for Dark Matter, and uploaded on its webpage an illustrated guidebook that expands on the key theme of the show. Searching for Dark Matter focuses on the many pieces of evidence we have collected so far for the existence of dark matter, as well as on some of the methods used by scientists to detect dark matter particles and infer their nature.

At the time of writing, the Eugenides Foundation, the National Observatory of Athens, the Paris Centre for Cosmological Physics, and the Hellenic Society on Relativity, Gravitation, and Cosmology are actively working in bringing together an exciting series of cosmology seminars for high school physics teachers. Scheduled for July, the seminars will be taught by experts in their field, both from Greece and abroad, headed by George Smoot, who won the 2006 Physics Nobel Prize with John Mather for their work on the COBE satellite that led to the “discovery of the black body form and anisotropy of the cosmic microwave background radiation.”

**Russian Planetarium Association**

Adygea (Caucasus). There is only one planetarium in the republic of Adygea, and the courts must now decide its fate. The former priest and pensioner Viktor Matyushin built it at his dacha. He does not have astronomical education and special knowledge, but he, at his own expense, developed a project and erected a building. Everything inside is made from improvised materials, including the starry sky and the layouts of the planets. Lamps, gears of a motorcycle, old pans and much more were used.

Matyushin receives children from neighboring districts and cities every day for free. Almost 50,000 people have visited here for 17 years. Matyushin read and looked through hundreds of books and films before construction. He did not, however, clear his dream with the EMPA. Children participating in the Space Talks storytelling workshop at the Rijeka Astronomical Center during the International Day of Planetariums. Courtesy of Rijeka sport Ltd.

EMPA, Children participating in the Space Talks storytelling workshop at the Rijeka Astronomical Center during the International Day of Planetariums. Courtesy of Rijeka sport Ltd.


(Continues on next page)
regions of Russia talked with particular enthusiasm about the first results.

Delegations from Italy, Belarus, Kazakhstan, Ukraine, and more than 20 present, and half of the participants came to the school for the first time. The XI School of Lecturers was held in the Moscow large center is the pilot-cosmonaut, twice Hero of the Soviet Union, Viktor Savinykh. The grand opening of the Space center took place on 13 March. The meeting of researchers and teachers from Moscow, St. Petersburg, and Novosibirsk was held on 14 March in Novosibirsk. It was devoted to the experience of introducing astronomy into the practice of Russian schools.

During the expert discussion, the second supplemented edition of the textbook on astronomy for grades 10-11 was presented. The book was written by V. Kudryavtsev, a professor of the Institute of Astronomy of the Russian Academy of Sciences (RAS), and is part of the A. P. Vinogradov educational series. The book is intended for students in grades 7-8. Its goal is the training of earthlings for life on the moon and Mars. This program formed the basis of the all-Russian project Internet-platform Cosmodis 3.0.

Novosibirsk. The meeting of researchers and teachers from Moscow, St. Petersburg, and Novosibirsk was held on 14 March in Novosibirsk. It was devoted to the experience of introducing astronomy into the practice of Russian schools. The meeting of researchers and teachers from Moscow, St. Petersburg, and Novosibirsk was held on 14 March in Novosibirsk. It was devoted to the experience of introducing astronomy into the practice of Russian schools. The meeting of researchers and teachers from Moscow, St. Petersburg, and Novosibirsk was held on 14 March in Novosibirsk. It was devoted to the experience of introducing astronomy into the practice of Russian schools.

In addition, the new Space Monitoring center project works here. The equipment is installed in the school, allowing to take images of the Earth's surface and atmosphere from Russian polar satellites and process them. Their own weather station allows school children to make weather forecasts. They plan to put the new Lorett system in the school, which will allow children from all over the country to use this tool and carry out their own observations.

A particular pride of the Podolsk Astronomical club is the cognitive game program The Colonization of the Solar System, designed specifically for students in grades 7-8. Its goal is the training of earhings for life on the moon and Mars. This program formed the basis of the all-Russian project Internet-platform Cosmodis 3.0.

Canadian Association of Science Centres

The Planetarium at the Manitoba Museum in Winnipeg is preparing to celebrate the star theater's 50th anniversary. Begun in 1961 as a centennial project for the 100th anniversary of Canada's confederation, the planetarium opened 15 May 1968 with a Zeiss Mark VS optomechanical star projector and 287 concentric seats. Its construction was made possible through the generosity of the Saiyde and Samuel (Continues on page 68)
Supervolcanoes

Narrated by Benedict Cumberbatch

Winner
Best Immersive FullDome
Jackson Hole Wildlife
Film Festival 2013

Award Winner
South Korean
Planetarium Festival
2012

Award Winner
Jena
FullDome Film Festival
2013

SPITZ CREATIVEMEDIA
Thomas Lucas Productions, Inc.
DENVER MUSEUM OF
NATURE & SCIENCE
mirage3D

Contact: Robin Sip rsip@mirage3d.nl T: +31 70 3457500
Contact: Mike Bruno mbruno@spitzinc.com T: 610.459.5200
Rocky Mountain Planetarium Association

Utah. Clark Planetarium launched their digital interactive exhibit sales. They are currently offering about a dozen titles of interactive software that help make difficult content accessible and engaging. Some use kinetic sensors to give people a “full body” experience while making the learning kinesthetic.

Colorado. Fiske Planetarium has produced short videos under a NASA grant and they are free to any planetarium facility. The first was a public service eclipse announcement, which also was sent to 7,000 libraries all over the U.S. More information at: www.starnetlibraries.org/2017eclipse/

A really nice one about how NASA’s GRACE mission detected droughts under the ground was released in April. Currently available free fulldome videos are found here: www.colorado.edu/fiske/about-us/fiske-productions.

Arizona. The Dorrance Planetarium started doing monthly laser shows with planetarium karaoke beforehand. Singing under the cosmos is a lot of fun. They are coming up with original shows for all kinds of events, and notably, they’re doing a “Grand Tour of the Empire.” It’s a show where the public gets to visit and hear about the various planets in the Star Wars universe. They also did live streaming of the solar eclipse.

Idaho. The centennial Observatory at Faulkner Planetarium has an ongoing regular schedule of observing events during the year. These include a free star party the second Saturday of every month, Telescope Tuesday observing session on the second and fourth Tuesdays of standard time (small fee), and free solar viewing sessions every Wednesday afternoon during the summer between Memorial Day and Labor Day.

The observatory houses a 24-inch DFM reflector and has other telescopes for use on the stargazers’ deck as well. The observatory also participates in helping put on three offsite observing sessions around south-central Idaho during the summer months.

Great Lakes Planetarium Association

Illinois. In February, Chicago’s Adler Planetarium hosted LSU Professor Emeritus Brad Schaefer for a talk on the origins of the constellations. Adler also rolled out a new show for its Astro-Overtight sleepover program. Taking advantage of their removable seats, Adler turned its Grainger Sky Theater into a remote wooded location and took groups of campers on an informal stargazing experience. The March 2018 issue of Sky & Telescope magazine included a feature article about the Adler.

The William M. Staerkel Planetarium at Parkland College in Champaign planned Girl Scout merit badge workshops in April and Boy Scout astronomy merit badge sessions in May. The staff is pleased to announce that their annual lecture series has been renamed The James B. Kaler Science Lecture Series in honor of University of Illinois astronomer Jim Kaler.

GLPA. Todd Slisher, executive director of the Sloan Museum and Longway Planetarium in Flint, Michigan, displays a piece of a meteor that exploded in the atmosphere over Livingston County, Michigan on 16 January 2018. Aided by fresh snow, good data, and calculations, Slisher, Brian Wolff, and Buddy Stark searched a frozen lake and found three pieces. Once the meteorites are done being examined by NASA, they will be exhibited to the public in Flint. Photo courtesy Todd Slisher.

You can watch Slisher and Stark describe how they found the meteorite at www.facebook.com/LongwayPlanetarium/videos/1797546510289881/
Now available in 4K/8K at 30/60FPS
Updated with the latest scientific data and cutting-edge visualizations.

FOR MORE INFORMATION
amnh.org/planetariumcontent • mheenan@amnh.org
The Kalamazoo Valley Museum Planetarium's new seasonal sky show is *The Artists' Sky* and was written and produced by former KVM Director Eric Schreur. This show illustrates how the beauty and elegance of a dark starry sky has made connections to famous works of art, poetry, and music. In other news, KVM participated again in the State Wide Astronomy Night (SWAN) on 20 April.

The Longway Planetarium has been running a very popular monthly trivia night for several months, averaging an attendance of 50. However, the big news this quarter was finding fragments of the Michigan Meteor, which fell over Southeastern/Mid-Michigan on Tuesday, 16 January. This bolide lit the skies over Michigan almost to daylight levels and was seen in six states and Canada in the Great Lakes Region. See box on page 68.

**Ohio.** The Shaker Heights Planetarium had a very successful downlink with the ISS in November. Over 450 students in grades K-12 from every building in the district traveled to the high school and watched their classmates ask questions during this live event. The planetarium is expected to host 265 field trips this school year.

The Bowling Green State University Planetarium recently offered Winterfest 2018, which featured nearly all the purchased shows that the planetarium ran in the thirty years before it went fulldome in 2014.

**Wisconsin/Minnesota.** In February and March, the Charles Horwitz Planetarium in Waukesha presented *Space Aliens: Looking for Life in the Universe, Seven Wonders,* and *The Little Star that Could.*

Over the past couple of years, the Madison Metropolitan School District Planetarium has renovated its theater, installing new seats and a Digistar 6 system. Their previous Spitz A3P opto-mechanical projector may possibly seed a planetarium in South Dakota.

The Minnesota State University Moorhead Planetarium started the new year with a new program called Solar System Explorers for two different age groups. In February, they hosted their annual special event: “Stars of PBS.” The biggest draw was the appearance of a PBS character. This family-friendly day of fun brought between 400-500 people. For the fourth year, they ran Romance Under the Stars in February. The MSUM Planetarium has been chosen to be the host site for the 2018 IPS A Week in the United States. The staff is honored and excited at the opportunity to share knowledge and experience with Úllar Kivila of Estonia. (See more on page 12.)

This spring, the University of Wisconsin-Milwaukee Planetarium offered a special production titled *Indigenous Voices: Sharing the Wisconsin Sky,* which highlighted the cultures and star stories of different American Indian Nations in this region: Ho-Chunk, Menominee, Ojibwe, Oneida, Potawatomi, and Stockbridge-Munsee.

**Association of Mexican Planetariums**

Milagros Varguez, Cozumel Planetarium director, reports she recently received 3,2,1 Takeoff!, the first 100% animated production with full-dome 4K technology made in Chile. The medium-length film, narrated in Spanish, was made in 2016 by the Chile Planetario, Universidad de Santiago de Chile team as part of an agreement made when Milagros presented the animated production *Mayan Archeoastronomy* in May 2017 in the Chile Planetarium.

The show tells the dream journey of Laura, a 7-year old girl, curious, restless, fanatical about astronomical phenomena, who travels through a dream of the universe to experience and understand such things as the force of gravity, the speed of light, the movements of rotation, translation of the planets, and how energy is generated in the sun. In this fantastic trip audiences have the opportunity to get to know our solar system, pass through the asteroid belt, and even leave our galaxy. The film participated in the III International Festival of Mexico in 2016, and can be shared with other AMPAC planetariums. For additional information, please contact: www.planetariochile.ck or milagrosvarguez@gmail.com.

**Southwestern Association of Planetariums**

The Cook Center Planetarium at Navarro College in Corsicana, Texas recently received a sound system upgrade. This is phase 1 of their plan to upgrade the planetarium to fulldome video in the next few years.

The Frontiers of Flight Museum’s (Dallas) portable planetarium has had a very successful 2017-2018 school year thanks to a generous grant from the Prichard Foundation. With the grant, the museum was able to reach 9,195 underserved students in several school districts, including Dallas, Fort Worth, Grand Prairie, Irving, and Rockwall. Schools were able to take a field trip to the museum or bring the planetarium to their campus, providing a great and astronomical experience for their students. On average, 77% of students served by the grant were from low-income households.

The University of Texas Arlington Planetarium premiered *Phantom of the Universe* in April with a special event. The event featured Nobel Laureate George Smoot, Michael Barnett from Lawrence Berkeley National Laboratory, Kaushik De from UT Arlington, and many more. The show is now at 340 planetariums in 58 countries (on all six continents) and in 40 states. It has been translated and recorded in 17 languages, with more in progress. Audiences are very enthusiastic about it.

One of SWAP’s officers, Beau Hartweg, recently completed his Ph.D. in Science Education from Texas Christian University (Fort Worth). His research focused on planetarium education, and his dissertation is titled “A Case Study Exploring the Experiences of Preservice Teachers in a Live-Interactive Portable Planetarium Program.” He hopes to disseminate this research to the planetarium community soon.

**Association of Brazilian Planetariums**

The Association released another issue of its quarterly magazine *Planetaria.* The publication (available online for free, in Portuguese) brings several articles by regional and international authors and has been very well received by the country’s planetarium community; proof of this is the present edition opens the fifth year of continuous releases. More information can be found at the ABP website: planetarios.org.br. The 17th issue of *Planetaria* can be downloaded at: planetarios.org.br/revista-planetaria/edicao-atual

---

---
On His President’s Secret Service

Working at the National Air and Space Museum’s Albert Einstein Planetarium was 13 years of some of the most interesting years of my life. Because NASM is a part of the Smithsonian Institution, it was a great magnet for all sorts of personalities: from manned and unmanned spaceflights as well as civilian and military aviation, and that’s not even counting the assortment of celebrities and dignitaries from around the world who dropped in from time to time.

Located in Washington, D.C. on the National Mall a very short distance from the U.S. Capitol building, with the Washington Monument and the White House at the other end of the mall almost two kilometers away, we were literally surrounded with all manner of government-related buildings. NASA Headquarters was just across the street, an easy five-minute walk (not counting the traffic lights on Independence Avenue that ran in front of the museum). As a result, it was not too unusual for politicians to attend events, such as exhibition gallery openings, and on even rarer occasions, stage their own events in the building.

Celebrating a quarter of a century

In 1983 NASA turned 25 years old, and President Ronald Reagan¹ was going to come to NASM for a ceremony to mark the event. And, like anything else involving presidents and their safety, a security sweep of the building would have to be performed to ensure that there weren’t any potential threats.

You have to keep in mind that this was a city where the manhole covers on Constitution Avenue—the major street that runs from the Capitol Building to the White House—were welded shut for occasions like the motorcade on Inauguration Day in January following a November election.

Each department in the museum was to assign a person who would serve as a liaison with the Secret Service, that part of the U.S. Treasury Department that is responsible for the agents who serve as the president’s bodyguards. As it turned out, I got tapped to be the person from the Albert Einstein Planetarium, and at the duly appointed hour I met two agents at the museum’s information desk and proceeded to bring them up, first to our office area on the sixth floor.

Just like you’d imagine

They were just like you would have thought they would be if you had seen enough TV shows or movies: suits and ties, identical lapel pins, and a little earphone stuck in one ear with a thin coiled wire that ran down the back of their necks and disappeared under the collar of their suit coats. Being indoors, they must have left their sun glasses back in the office.

After a sweep through the offices, we toured the technician’s shop and the semi-secret back hallway that followed a hexagonal-shaped narrow hall going around one of the exterior walls of part of the planetarium dome.

Probably the most unusual place for them in the office area was our panorama shooting room, which was shoe-horned into an odd-shaped corner. Inside, there was a massive vertical camera mount on one side and on the opposite, the panorama jig that both held and gently curved the panorama board art while it was being photographed under polarized light.

There was also a short metal stairway leading to a door that went onto the highest third level of access to the back of the dome, our next stop. Switching the lights on, we took a walk around the uppermost catwalk long enough to satisfy them that the area was secure. After this, we headed down the office’s back emergency stairs to the actual theater.

Checked out all 250 seats

It was still before any scheduled shows for the day, so we had ready access and they walked all around our 250 seats. We were essentially looking for anything out of the ordinary, or anything that was out of place and shouldn’t be where it was. They next checked inside the two extra projection galleries that were behind false interior walls that formed cords with the rear curved wall that supported the dome.

Next were the projection galleries that ran around the perimeter of the theater. As you could imagine, the dozens of special effects projectors (remember, this was in 1983, so pre-video) got their attention, especially since they were all light-tightened with black cloth or black aluminum foil, which could mean that there was a potentially dangerous device under each one. Every so often we would stop by one or another projector and I would answer their question(s) about what it was.

After a look in the back audio control room, we took the flight of metal stairs up to the upper projection gallery, which was about a two-meter-wide concrete walkway that went around the entire circumference of the dome. Here and there were various boxes of stored equipment, spare cables, and even some boxes of publications.

¹Reagan, the 40th president of the United States, served from 1981-89.

Bronze statue of former President Ronald Reagan in the California Capitol Rotunda. The statue was given by the state of California to the National Statuary Hall Collection. Public domain image.
A suspicious object behind the dome!

We had started in one direction around the walkway and had almost made it back to the stairs again when the two agents drew up short and paid close attention to an object lying on the floor up against the wall. It looked just like a thermos bottle, and there was an accumulation of crud coming from its top and dried onto its side. Their first question they asked was whether or not I had seen it before, which I could truthfully say that I had not. This lead to even more interest on their part.

Fortunately, closer inspection revealed it to be exactly what it looked like. At one time or another, one of the technicians had left a thermos from lunch up there, it had fallen over, leaked, and the stuff on the outside was the remains of what had leaked out.

Even if it had been a bomb, it was highly unlikely that its blast would have been powerful enough to affect anything outside of the part of the museum's structure—four large stone blocks with three glass bays equally spaced between them of which the planetarium was in the upper floor of the second most of the blocks—to the area where President Reagan would be speaking.

Those NASM staffers who were working with the Secret Service agents were supposed to stay with their two until the president had left the building in case they would need to get somewhere in a hurry and we could help them to do so being more familiar with the layout of the building.

So, what's in the case?

We three exited the planetarium and took a position on the second floor balcony overlooking the podium down below where Reagan was to speak. I had noted earlier that one of the two agents I was with had a rectangular case—probably 45cm long by 25cm wide by 10cm thick—that hung from a short strap under his one arm, but cinched so that it was up tight against his armpit. Killing time, I casually asked him what it was, and he replied by asking me what I thought it might be. Green as grass, I guessed that it might hold some sort of a communication device, but I could not have been so far off from the truth.

A Velcro flap along the bottom of the case allowed it to be quickly opened, revealing a short-length Uzi machine gun inside. In case of trouble it was only a simple matter of pull, open, cock the bolt and Brrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr
Interactive programs for every dome?

I sometimes hear from presenters that they would like to do interactive planetarium programs, but their dome environment prohibits it. While I recognize that there are challenges in audience interaction in some domes, I firmly believe that you can (and should) have some type of audience interaction in any dome.

Several dome configurations influence interaction:
- Dome diameter/seating capacity
- Seating configuration
- Empty space: Are there aisles that break up rows? Open space for kinesthetic activities?
- User interfaces: Mobile or stationary
- Tilted dome versus flat: Steep stairs make it difficult (even risky) to move around in the dark
- Springline height
- Projection equipment positioning: Center or cove mounted?

How do these various factors affect interaction? As always, I turned to the LIPS community. Unsurprisingly, seating configuration was a hot topic.

Shannon Schmoll of the Abrams Planetarium in East Lansing, Michigan wrote:

I know once I got into a unidirectional dome as opposed to concentric seating, I started turning my sky around. I had never changed where north was in the dome until then. You kind of have to do that with unidirectional, but I liked that I could make people just turn around and orient themselves in a way that feels a little more natural with concentric seating.

Karl von Ahnen, former director of the Fujitsu Planetarium at DeAnza College in Cupertino, California, had the opportunity to experience concentric and unidirectional seating configurations in the same dome.

When we renovated in 2006, we changed from concentric to unidirectional. One big difference was we went from 170 to 140 seats, which is still pretty large for a lot of personal interactivity. The feel of the room changed a lot.

There was an intimacy with concentric, like everyone sitting around a campfire, and as people entered it was obvious to them that this was not a movie theater or a typical classroom. Our concentric seating arrangement had four aisles which made it easier to get closer to audience members.

Moving around among the audience is an important part of engaging with them.

With the presenter in the middle, it made for more of a closeness. The down sides were that you always had your back to half the audience. You had to spin around to see how many people were holding up hands in response to a question, or who might be asking a question. It was often hard to hear and be heard. A microphone was essential.

In our situation the change to unidirectional was a practical improvement. The majority of time the planetarium is used as a classroom. The concentric arrangement made normal class teaching very challenging. With everyone facing the same direction—toward you at the front of the room—communication becomes different. You are here and the audience is there, but you can see everyone at once, and back and forth communication can in many ways be easier.

In the end, no matter what the configuration, there is always a way to interact and make the experience special for everyone.

Dayna Thompson, Ball State University’s Ball Planetarium (and LIPS 2017 host) in Muncie, Indiana, commented:

I went from concentric, bench seating for about 65 people to unidirectional seating for over 150 people. In the 9-m dome, I would always start my school presentations in the middle of the dome. Afterward, I would squeeze back to the console and be confined there for the rest of the program. If we had the technology at the time that allowed me to be in the middle of the room for the entire program (i.e. iPad controls), I would not be able to give an equal amount of attention to everyone in the audience. My back would be facing someone at all times and walking around in a circle in the dark isn’t the easiest, especially when feet are sticking out nearby.

I feel like the concentric, bench seating in this dome encouraged audience participation and discussion. Concentric seating is similar to the u-shape or circle seating arrangements you find in some formal classrooms. Formal educators have noticed that some of their students feel uncomfortable or exposed in this arrangement. However, in the planetarium, there is a key focus point—the dome—which helps alleviate some of these feelings.

Now in the 16-m dome, I still start my presentations in front of the audience, but I can stay in front of them for the entire show and control the system with an iPad. If the dome is half full, I seat learners in the back rows and present close to them in the middle of the dome by our star and digital projectors. If we have a full house, I present in the very front of the dome and also walk around the center aisles. I try to involve the entire audience in my presentation. The routes I have to take around the room are always
clear (no feet or other obstructions are in the way) and I'm not limited to walking in a circle.

The unidirectional seating makes the experience more presenter- and dome-centered. Having focus points—the presenter and the section of the dome they are all facing—helps keep a guest’s attention (especially important since there is a lot to see on the dome). Furthermore, I aim to have a two-way conversation with my audience. As much as I am speaking to my audience, they are talking back to me. The audience is talking by using verbal and non-verbal communication. All of these factors—room layout, presentation style, learning objectives, etc.—add up to create one package: a memorable planetarium experience.

In a 30-foot dome and moving around

John Erickson, Lawrence Hall of Science Planetarium director, Berkeley, California:

Our 30-foot dome seats about 50 people. We have bench seating, which is excellent for interactions among the participants and it allows flexible seating for families. Benches are in two concentric rings with the console and digital projector in the middle. There is ample space between the rows, which lets presenters move easily among the participants, as well as letting participants move easily for an activity or to get a better view of a different part of the sky.

Our presenters tend to move around a lot. We always have to swing by the console, near the center of the chamber, to perform the planetarium functions. We have the capability to use an iPad and other remote devices, but none of us has gotten into the habit of using them. We have occasionally invited a participant up to the console, such as in a program about celestial navigation where a volunteer steers a boat with advice from the other participants.

Although we are not unidirectional, we have chosen a sweet spot over one of the exits where we usually center an object of interest if we do not want it at the zenith. If there is an important piece of data that we are examining together... we project it twice on opposite sides of the dome so that everyone can view it comfortably.

An important issue with our two-ring layout is reading lights. We use them when our participants use star maps or record data. For roughly 30 years we had a smaller dome with a single ring of seats. This worked excellently because dimmable lights around the edge of the chamber served all participants’ need for reading light.

When we expanded about ten years ago, we needed light for people in the inner ring. We use clipboards which we have fitted with orange LEDs.

Toshi Komatsu, current director of the Fujitsu Planetarium at DeAnza College and formerly of the Planetarium at the Lawrence Hall of Science:

I cut my teeth doing interactive planetarium shows at the Lawrence Hall of Science Planetarium, which originally was a 6-m dome with a single row of 27 concentric bench seats, and the control console at the center. During my time there, we upgraded to a 9 m dome with two rows of 50 concentric bench seats, still with the control console at the center. Now, I am in a 15-m dome with 139 unidirectional seats and the console at the rear.

In the smaller domes, the bench seating made it easy for audiences to break into small groups (e.g., one family, three to four students) for activities, and it was easy as a presenter to move among the groups and check-in with everyone. It was an intimate setting, designed to have conversations with the audience, as opposed to lectures to the audience. Our 40- to 50-minute live shows were workshops of learning for school groups and the public.

In my big dome now, the configuration is less personal, and walking between all the seats is not practical. Usually, we have just over an hour for each show. This includes a fulldome movie (20-30 minutes), so that leaves us with 30+ minutes of live presentation.

I will start with an introduction to the theater, and then ask them what things they know in space. This gives an opportunity for the engage the audience and let them answer something straight off the bat. Here, we simply explore, like what can you see with just your eyes? What do you observe? After the fulldome movie, we will look at constellations and at deep sky objects, and then do a digital flight. This flow creates distinct sections, and switching things up... helps keep the audience’s attention.

I still try to engage the audience as much as possible. We take questions as often as we can, especially after the fulldome movie. Instead of the small group activities, I will do whole group activities. For example, “everyone please point to the brightest star in the sky.” As the audience points, I then ask “check with your neighbor—are they pointing to the same star you are?” Inviting the audience to confer with their neighbor (a variation on “think-pair-share”) has become a favorite technique of mine.

Also, when asking yes/no questions or multiple choice questions, I will have the audience vote by answering with a single, simultaneous clap. For instance, I might ask what direction the sun sets. “If you think the sun sets in the east, clap once. If you think the sun sets in the west, clap once.” The single-clap method gives an auditory method for the presenter to quickly gauge votes.

A few techniques I would encourage anyone to use in large or small domes—some of which I learned at the very first Live Interactive Presentation Symposium (LIPS)—include continuing to take answers to questions even after someone gives the “right” answer. This way, an audience member is more likely to feel they can still participate, even if they do not know the correct answer. It helps encourage a space where you as the presenter are interested in all answers, not just the right answer. I also always leave open the option of, “how many of you don’t know?” because it is okay not to know, as long as you are also willing to learn.

Another technique is to say something ridiculously wrong, and empower the audience to correct me. The key is to be ridiculous. Saying, “the closest planet to the sun is Venus, right?” is not a good example. However, pointing to a barely visible star and asking “is this the brightest star in the sky?” is a better example. Again, this is about creating a space where the audience is actively thinking about what you are saying or asking, not just passively listening to you.

The most important technique, for any size dome or any age audience, is to stay flexible, and to respond to the audience you have in front of you. Make the show uniquely theirs.

Excellent comments from all! To bring the conversation briefly back to seating: I personally prefer concentric seating for my presentations, partly because of what Shannon alluded to (under the real sky and with concentric seats, you have to turn your body to look in different directions), but also because concentric seating enables the audience to...
more easily see and hear each other, not just the presenter.
In my opinion, however, movable seats in fixed domes are ideal, as you can configure the audience optimally for each program. Portable domes already have this flexibility, and it makes sense for fixed domes, too. The trick is to find movable seats that are comfortable and offer good neck support.

**The importance of visuals**

Others addressed non-seating ideas. Alan Gould, former director of the Lawrence Hall of Science planetarium, brought up the importance of visuals:

*In the olden days, before digital projection systems, we developed audience-participation activities as the central elements of shows. For visuals, we relied on slides and flat screen movie clips shown on the curved dome/screen. Movie clips were always pretty short, usually under a minute.*

*Nowadays there are many fulldome visuals that can be found for free using the standard functions of any digital system. All of our “vintage” Planetarium Activities for Successful Shows (PASS) programs are so easy to enhance immensely using built-in fulldome capabilities of today’s digital projection systems. There are free clips (and music) available from the IPS Free Media pages (http://www.ips-planetarium.org/?page=freemedia) and IPS encourages people, members, and vendors to continuously to contribute and grow that collection.*

*I would especially encourage increasing the collection in the realm of very short clips that can be easily used in live audience-participation shows. There are a number of vendors who have short clips available for sale (Sky-Skan, George Fleenor’s GeoGraphix, GOTOo, to name a few) and some who have libraries available for users (e.g. Digistar). We should continue to encourage vendors and producers to create short fulldome clips (free or inexpensive) that we can use in live shows.*

Jeff Nee, currently of NASA’s Museum Alliance and formerly of the Lawrence Hall of Science and California Academy of Sciences, took a broader approach:

*Interaction really comes down to three key components: audience control, knowledge, and exploration.*

1) **Audience Control.** Merely with the introduction that I, your presenter, am taking your input during the show, and that we’re here to learn together, to pursue your interests and your thoughts, can be very powerful for an audience.

Recently, one of my more popular shows has been a simple solar system/universe tour. The key is that the audience gets to choose the destinations, making every show truly different and unique. Also, whenever I get a request for a new destination, I try my best to add that to the possibilities for next time. Allowing audiences a measure of control gives me continuous feedback and concretely helps me craft a better show for my audiences both on the fly, and going forward.

2) **Audience Knowledge.** Assessing an audience’s collective prior knowledge allows me to add to their knowledge instead of just rehashing things they already know. If, on the off chance they don’t have prior knowledge about something, that also affects how I frame even the most basic information.


3) **Audience Exploration.** After you’ve provided control and assessed prior knowledge, it’s time to guide your audience in their explorations. One key tactic is wait time. One of the best interactions is you, the presenter, asking the right question at the right time, then giving the audience time to think and formulate an answer/hypothesis for themselves. Don’t be afraid of a bit of silence in your dome.

Some of the best interactions I ever had were literally sitting down next to my audience members, operating the planetarium remotely (or letting them push the buttons). If you can possibly remote control your planetarium, you absolutely should. I hope you’ll be amazed by how much better audience response you get when you can physically come to them, talk with them face to face, and give them a taste of your “magical” planetarium powers.

All these still apply in bigger theaters; when I was doing shows at the California Academy of Sciences, even if we were showing a dome movie, we still had audience interaction. The introduction and house rules while people are finding seats, any live sections build into the middle of the movie, and the “thank you for coming” at the end can all be live and interactive.

For any presenter, the show doesn’t start and end at the posted times, it starts as soon as an audience member can see you from across the exhibit hall (some would argue even before then), and hopefully ends long after they’ve gone home. In that time, you have countless ways to interact with, engage, and inspire the next generation of explorers. The first person to step foot on Mars is in school right now, and it could all start with your smile as they hand you their planetarium ticket.

Jeff’s final paragraph is a great call to action: I encourage you to think about how your unique environment can be maximized for interaction. If a small change will make a big difference in the level of interaction (such as adding clipboards with reading lights), then why not try it? Obviously some aspects cannot easily be changed, such as the springline height in a fixed dome, but chances are good that you can try something.

Some factors—tilted vs flat dome, location of the projection equipment, and springline height—were not discussed in this conversation. Stay tuned for these in a future LIP Service column.

**Save September for LIPS**

A reminder: LIPS 2018 is coming up quickly! Our host is the Willard Smith Planetarium at Seattle’s Pacific Science Center. LIPS days are September 12-14, and there is an optional add-on Data to Dome Day on September 11. Learn more at: LIPSsymposium.org

As always, I invite your comments, questions, and feedback: Karrie@DigitalisEducation.com. You can also email me about joining the Live Interactive Planetarium Symposium Facebook or Google groups. I look forward to hearing from you!

---

We need to have people up there who can communicate what it feels like, not just pilots and engineers.

— Buzz Aldrin, quoted in *The Real Mars*, 2004 (Spacequotations.com)
EXpedition Reef

Embark on a journey into the hidden world of coral reefs in the new fulldome experience from the California Academy of Sciences.

Available for licensing

For more information on licensing our shows, visit www.calacademy.org/licensing.
Calculating time and money

Time is money

How much does it cost? Le prix? Incroyable! Surely you’re joking, Mme. Planetarian?

As your team’s project leader who wants to build a planetarium, does this question strike fear into your heart?

So, we’re back to scary in Outside Space! But, as my daughter says, “no matter.” We can also go back to the future, into the 4th dimension, to make the budget and project scope align.

In this quarter’s installment of the Design and Operations Guide, we will conclude the feasibility study and look at how to calculate both the capital budget and the project timeline. They are interrelated with each other, and directly linked to the previous space calculations in the last checklist, the schedule of accommodation.

Therein lies the cosmic beauty of the feasibility test, you, ma jeune femme, have the power to manipulate time, the 4th dimension! You can phase your project! If you can’t afford that classroom initially, then move it to the future! Fantastique!

Feasibility test: Capital budget

As promised, the number crunching continues as we test the feasibility of our project: are the quality level, area, budget, and timeline in balance? To develop the capital budget, we will carry forward the most important variable, the area quantity from the schedule of accommodation.

In that previous analysis, we made a comprehensive calculation of the spaces for the planetarium, entry, and staff, as well as optional spaces for complimentary functions like classrooms and a production lab to make dome shows.

The second most important variable, the unit rate, or cost per area, should come from your cost estimator or QS, quantity surveyor. By working through the budget checklist below, you will calculate all the variables to consider, from site costs to fees, contingencies, and administration.

In a planetarium, the cost for equipment is the third most important variable, and could be more than half the total cost. As your team’s planetarium expert, you should carefully calculate both the fixed and moveable equipment lists. Be meticulous, be comprehensive!

Project timeline

Buildings can last a long, long time. Thousands of years. Sometimes, it seems that design and construction could also take millennia to complete. An optimistic and aggressive timeline from start to finish for design and construction could be 3 years, if you have your funds and approvals in place. If you are starting from scratch, a reasonable and cautious schedule could be 5 years to occupancy. Design could take 1 to 2 years, and construction an additional 2 to 3 years.

The timeline is inextricably linked to the budget. The unit rate from your QS should be at the mid-point of construction, to allow for labor and material cost increases over time. Another critical time-budget link is phasing: if you can’t afford everything on your wish list up front, consider a second phase down the road.

There are two checklists below for the capital budget and project timeline. They are also online available in a spreadsheet format, all linked together and to the schedule of accommodation: www.ips-planetarium.org/?page=2017DesignGuide

Checklist-Design Brief: Capital budget

The budget checklist begins with the three major cost categories. building, fixed equipment, and site development (A, B, C) for the total

<table>
<thead>
<tr>
<th>Category</th>
<th>Calculation</th>
<th>Budget</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Building Costs</td>
<td>Unit Rate of Mid-point of Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Fixed Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Site Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Total Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Site Acquisition / Demolition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Moveable Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Professional Fees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Contingencies / Overrides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project Budget Required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Checklist-Design Brief: Capital budget

<table>
<thead>
<tr>
<th>Category</th>
<th>Calculation</th>
<th>Budget</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Building Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Fixed Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Site Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Total Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Site Acquisition / Demolition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Moveable Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Professional Fees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Contingencies / Overrides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project Budget Required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
construction cost of the building (D). In addition, there may be five or more categories of other costs which need to be considered for the total project budget, at the bottom of this checklist. Those include: site acquisition, moveable equipment, professional fees, contingencies and escalation, and your own administrative costs.

The most important cost for our project, under the moveable equipment category, will be the investment made in the planetarium equipment for projection and viewing.

A. Building costs
This most important category includes all costs of construction of the building and site work within two meters of the building line; all items required by codes (fire sprinklers, alarm systems); and items normally found in buildings (restrooms, drinking fountains). The area quantity, total gross building area (here in GSM or gross square meters), comes from the previous checklist, the schedule of accommodation. The unit rate, or the cost per area (cost/GSM), is a critical variable which should be provided by your project team’s design and construction professionals, specifically your cost estimator or quantity surveyor.

B. Fixed equipment
Includes all equipment items which will be permanently installed before completion of the building and which are a part of the construction contract, such as a whiteboard inside the dome, or food service equipment in a café. For a planetarium, this may range from 3% to 5%.

C. Site development
Includes all work required which lies between the site boundary and two meters from the edge of the building, to align with the building cost line from category A. Site variables include earth grading and fill, fencing, roads and parking, utilities, landscaping, sidewalks, site lighting, street furniture, site signage, and so on. Important factors are: location, size, topography, climate, storm water, soils, vegetation. Ranges from 5% to 15%.

D. Total construction
This represents the total budget for construction, usually the contract documents, or base bid.

E. Site acquisition and/or demolition
Money budgeted for purchasing the project site and/or demolition of existing structures. This category can have a wide range, from zero to a very large amount, so it should be uniquely calculated (TBD=To Be Determined).

F. Movable Equipment
This category includes all movable equipment and furniture items, but does not include operational equipment or consumables (i.e. those items purchased from operating funds).

NOTE: This would especially include planetarium equipment: systems, projectors, servers, audio system, dome screen, cove lighting, seating, etc. Since planetarium equipment is a significant expense, and itself has a wide range of costs depending on the quality and resolution of the hardware and software, this category should also be uniquely calculated TBD.

(Continues on page 80)
**Checklist-Design Brief: Project timeframe**

This timeframe is based on a reasonable or average project schedule. It is possible to speed up a project with fast-track techniques, but those may come at a premium cost, such as the cost for overtime labor. Some tasks may be able to complete simultaneously, with careful scheduling.

The example timeframes below assume you are ready to go and have funding in-hand. It also assumes there are no complications and you have the required approvals for your land, site, zoning, and municipal regulations. It is based on a simple stand-alone planetarium building, medium “Subaru” quality level, one-story tall, in the range of 1,500 to 2,000 Gross Square Meters.

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design brief</td>
<td>1-2 months</td>
</tr>
<tr>
<td>Master plan + concept design</td>
<td>1-2 months</td>
</tr>
<tr>
<td>Schematic design</td>
<td>2-3 months</td>
</tr>
<tr>
<td>Design development</td>
<td>2-3 months</td>
</tr>
<tr>
<td>Construction documents</td>
<td>4-6 months</td>
</tr>
<tr>
<td><strong>Subtotal, Design</strong></td>
<td>10-16 months</td>
</tr>
<tr>
<td>Site work</td>
<td>2-3 months</td>
</tr>
<tr>
<td>Building core + shell</td>
<td>10-12 months</td>
</tr>
<tr>
<td>Building finishes, fixtures, equipment</td>
<td>3-6 months</td>
</tr>
<tr>
<td><strong>Subtotal, Construction</strong></td>
<td>15-21 months</td>
</tr>
<tr>
<td>Planetarium Equipment</td>
<td>1-3 months</td>
</tr>
<tr>
<td>Installation + testing</td>
<td>1-3 months</td>
</tr>
<tr>
<td><strong>Subtotal, Planetarium Equipment</strong></td>
<td>1-3 months</td>
</tr>
<tr>
<td>Total project duration</td>
<td>26-40 months (2½ to 3½ years)</td>
</tr>
<tr>
<td>Mid-point of Construction</td>
<td>18-27 months</td>
</tr>
</tbody>
</table>

---

**References**


---

*(Outside Space, continued from page 79)*

**G. Professional fees**

Costs of architectural, engineering, and consulting services. Depending on the site and conditions, may range from 7% to 12%.

**H. Contingencies and escalation**

A percentage of the total construction cost is included to serve as a planning contingency, bidding contingency, and construction reserve (for minor change orders, etc.). Typically, this is 10% to 15% during pre-design, and then reduces as the project progresses, generally 3% to 5% after bidding. If construction costs in your region are rapidly increasing, or it may take a long time to raise funds or gain project approval, an additional percentage should be allowed for cost escalation from the time of the budget calculation in the design brief to the mid-point of the construction time period.

**I. Administrative costs**

Items your organization is responsible for during the planning process, such as management, legal fees, site survey, soil testing, insurance, material testing, etc. May range from 2% to 7%.

**J. Total project budget required**

This represents the total project budget required to occupy the new planetarium.

---

*(Seeking What Works, continued from page 54)*

There is an obvious limitation to this article, being that most of our resources and discussions are based in the US. It is our hope that we can open the door to a discussion and another avenue of collaboration. We are a rich and diverse population that have many strategies and information, with one big passion: sharing our love of astronomy with anyone who will listen!

---

Tim Barry is a registered architect from Texas who specializes in the design of planetariums. In 40 years of professional practice around the globe, he’s worked on over 100 million cubic meters of some out-of-this-world buildings.

---

*(Outside Space, continued from page 79)*

---

*(Outside Space, continued from page 79)*

---

*(Outside Space, continued from page 79)*

---

*(Outside Space, continued from page 79)*

---

*(Outside Space, continued from page 79)*
really, really multi-curricular

SciDome offers teaching capabilities and curriculum for detailed, practical STEAM education. With three volumes of Spitz astronomy lessons, dome-to-classroom file compatibility, ZygoteBody anatomy simulation, and our new 3D interactive physics modules, your teaching possibilities are almost limitless.
Magnitude, moons, and making sense of the world

Magnitude: The Scale of the Universe
Kimberly Arcand and Megan Watzke, Black Dog & Leventhal Publishers, 2017
Reviewed by Francine Jackson, University of Rhode Island Planetarium, Providence, Rhode Island, USA

Once again, the team of Kim Arcand and Megan Watzke have given us a book that is both very informative and totally colorful. With illustrations by Dr. Katie Peek, *Magnitude* goes into, well, the magnitude and the structure of everything we have, from the tiniest blood cell to a supernova blast wave, from the density of the universe up to an atomic nucleus. Every dimension we have is increased in logarithmic scale, giving us an awareness of our surroundings we might have never believed.

For instance, an average fast-food meal contains 10 times more energy than a 100-watt light bulb burns in an hour, but only 10 to the minus 12 that of rain from a typical hurricane. The chapter on mass correctly discerns that from weight, something often not explained very well, even in general physics textbooks. From there we learn the difference between an eyelash and a standard dog breed, compared to the mass of the Earth. Each chapter is an adventure in learning, from the tiniest to the largest, even to the historic speed of grass growing compared to the speed of light.

Everything is carefully documented and described, with its own illustration, on a scale dedicated to the measurement at hand. The last chapter also gives a history of computing, from the hectoscale of those in the 1940s to what most likely be the zettascale within the next decade or two, and the importance of that much computing power in all forms of academic and practical uses.

Finally, the authors go into astronomical observation, both present, such as ALMA, and future, to the James Webb Space Telescope and the Square Kilometer Array.

*Magnitude* is a fun read, whether you are looking for just the right information with which to impress your friends, or to liven an academic conversation. No matter which set of units you see when you open the book, you’re sure to find a tidbit of information you might not have been aware of.

You might have trouble putting this book down, as every page will have you wanting to learn more. *Magnitude* will hold your interest from cover to cover.

Helping Students Make Sense of The World Using Next Generation Science and Engineering Practices
Reviewed by Kamal Carter, Fernbank Science Center, Atlanta, Georgia, USA.

Many teachers are being asked/required to adopt the Next Generation Science Standards in some form or other. The standards can be confusing, and some of the “helpful” books and resources out there are less than helpful.

But once I started reading this one, I was unable to stop. I even ordered an electronic version, to have access when writing future lesson plans. The book in empowering. It is structured in a way that helps science teachers demystify the NGSS practices, down to the basic goal of science making sense of the world.

I found it particularly interesting how each chapter intentionally addresses equity in science learning, as it pertains to main idea of that chapter. Brilliant! Very few individuals have to courage to state what is noted in the beginning of chapter three: students from underprivileged communities do not and have not received a quality science education. We’re all working with students from every imaginable background. The information and tips in this section are excellent.
Engaging vignettes bring key points to life and encourage reading just to find the next real world example. Whether it was the “There Was A Bull Frog” or “What Would Granny Say?” vignette, each is intriguing and memorable.

The majority of books written for science educators seem to be so densely written with data and facts that the author’s intent gets lost in translation. Not in this book. Each chapter has facts coupled with interesting real world examples, such as connecting scientific literacy and the manner in which the media talks about weight loss and dieting.

I have already recommended this book to several of my colleagues. Find a copy and share it with yours.

Exploring the Martian Moons: A Human Mission to Deimos and Phobos
Reviewed by Francine Jackson
The author really knows what he wants: with all the talk of a mission to Mars, von Ehrenfried would rather, instead of an immediate landing on our neighbor, link up to Mars’s satellites as a first trip there. And, not only are many of his arguments for doing so quite persuasive, he has done his research on all aspects of getting there.

In meticulous detail, the author has a step-by-step formula for creating an orbit around Mars that would either “stop” at both satellites, or just “stack” a ship, allowing a small exploration vehicle to have an astronaut get close enough to retrieve samples from them.

The importance of going to the moons seems to be related to their origins, as it is believed they could hold information on the formation of our inner solar system. Also, not landing on the planet itself would be much less expensive as a first trip out there.

Von Ehrenfried, although admitting he has “...never been to Mars,” or anywhere else outside the atmosphere, has been involved in many of the NASA missions, as a flight controller for the Mercury, Gemini, and Apollo programs, as well as being a pressure suit test subject for Apollo, giving him much insight as to what would be needed for a journey of that magnitude.

Any organization looking into traveling to Mars might wish to both consult with him and read this book, as virtually everything relevant to a Mars trip is here in this volume. He gives all the major subcontractors, with their contributions, lists all the NASA headquarters and their separate contributions, all other government departments and international space agencies, stating what they all need to concentrate on to be a part of this. He has truly, in incredible detail, and with beautiful images and illustrations, given us an almost perfect outline for our next major voyage off the Earth.

The only slight thorn in his plan is his dependence on the Space Launch System (SLS) which is, at this writing, much further behind its original schedule. However, if he is willing to hold off his plans for a while or get together with others looking ahead to Martian travels, then this book is ready for the flight. In fact, it should be a must manual for everyone associated with a mission to Mars, from all aspects of the ground crews to all the astronauts planning to go.

Imagine the Moon: A Primer of Full Moon Names
Gerald Fierst, illustrations by Leslie Stall Widener, Plume Street Publishers, 2017
Reviewed by April Whitt, Fernbank Science Center, Atlanta, Georgia, USA.
I don’t know how many frantic e-mails you received because “There was no full moon in February it-is-the-END-OF-THE-WORLD.” Probably fewer calls than the super blue blood/blood blue moon of January, that was visible during daylight here in the eastern U.S.

Cultures all over the world have given names to the full moons throughout the year. An internet search yields multiple names for each month’s full moon, mostly describing some aspect of the season, weather, or wildlife for that month.

But in any case, this beautifully illustrated volume is a great resource, particularly for elementary school visitors (many of us use books as introductory material with school groups, I’ve learned). Each month’s full moon gets a two-page spread with a colorful painting, short poem, and sidebar full of information. There is information about lunar traditions from varied cultures, some natural history, and even a simple explanation of a blue moon.

Younger students will enjoy the illustrations and poems. Older students will learn from the sidebar information. Teachers and planetarians will appreciate the large format.

This is a good choice for gift shops and libraries.

Vol 47 No 2 - June 2018
Planetarian

Girl of the Year might visit your planetarium

You might be seeing a new face in your planetariums, thanks to a doll company that has decided to highlight astronomy for their “girl of the year.”

The face is that of Luciana Vega. It is a plastic face with a permanent smile, but the face of the girl bringing her to your dome will be real and, one hopes, ready to learn more about the stars.

Luciana is the child of American Girl, a company began in 1986 by Pleasant Rowland called Pleasant Company (now owned by Mattel). The company started with 18-inch dolls as historical characters, and in 1985 started a contemporary line called American Girl of Today. Dolls can be ordered in a variety of face molds, skin tones, eye color, and hair color, length, texture, and style. A Girl of the Year doll like Luciana is released each year, and, as with all the dolls, has her own story and history.

Luciana is a “champion of STEM and a natural-born leader who puts her whole heart into making her dreams a reality.” This idea of empowering young girls is reflected consistently in the company’s books, videos, games, and other educational material, as well as in its philanthropy and its willingness to take on controversy over dolls from different ethnic and social backgrounds (including one special release doll who was homeless).

Accessories are available, everything from the mandatory clothes and fashion accessories to furniture and, in the case of Luciana, even a telescope. The telescope, disappointingly, is an ill-working projector with a blurry image or two; I would suggest leaving the battery out and allowing imagination to pretend it’s a telescope.

Despite my comment about the telescope, however, I have found that all American Girl dolls are of high quality. They are well made, with attention to detail paid in every part of the doll and her accessories. They are the dolls that stay in families for generations.

Warning: The dolls are a bit pricey ($115 U.S. for the doll and her first book). The quality, however, makes the cost easier to bear. You can learn more, of course, at www.americangirl.com.

- Sharon Shanks
Lauren Rae Layton Ard provides us with a good example of a planetarian thinking “outside the box.” I have been following Lauren’s efforts for several years, from when she first built her own portable dome; in fact, you may remember that I have written about her before. This is an update on her efforts; I applaud the success she has experienced in just a few short years.

Lauren’s forte seems to be her incorporation of pop culture into her programming; she also combines state standards in language arts, social studies, math, and science in all of her programs. Over the years, she expanded and promoted her business of mobile dome planetarium shows by also making presentations at conferences and teaching some of her shows on the Outschool platform (see more below).

In 2013 Lauren was accepted as a presenter at the Phoenix Comicon. She did presentations on “Star Trek Astronomy” and “Harry Potter Astronomy” using her inflatable planetarium. Later she put together presentations for “Anime/Manga Astronomy,” “Comic Book Astronomy,” “Video Game Astronomy,” and “Astronomy in Popular TV and Movies” (i.e. My Little Pony, X-Men, The Simpsons, Power Rangers, The Hunger Games, Star Wars, Transformers, Halo) for use in her public shows, and presentations at summer camps and local conventions.

Her first dome was a very small and white with stars and planets painted on the fabric. In October 2013, she built her second dome, which was yellow like the sun and double the size of her first dome, using funds raised through her Kickstarter that was launched in the spring.

In 2016 she got another new dome and ordered a set of patches for the entrance that makes it look like the TARDIS. When asked what projector she uses now she replied “I’m still using the Homestar Extra projector, which is meant to basically be a toy (costs $1,000), but compared to a true planetarium projector ($9000+) it does the job well enough and I’ve never had dissatisfied customers...that I know of!” As I shared with her, I think that she is such an engaging storyteller that the low-tech projector works just fine!

Here is a list of some of her current program for students:

- Aliens!
- Cartoons in the Night Sky
- Comics in the Cosmos
- Heroes in the Night Sky
- Villains in the Night Sky
- Intro to the Night Sky for Video Gamers
- Harry Potter Astronomy
- Astronomy of Middle Earth (Lord of the Rings)
- Doctor Who in the Stars
- Star Trek
- Anime Astronomy
- Astronomy in the Bible
- Star and Constellations from Around the World
- Native American Star Lore
- History of Astronomy
- Constellations of Words (exploration of Latin and root words)
- Sports in the Sky
- Animals in the Night Sky (best show for young children)

Lauren does not have a book of all of these lessons yet, but she daydreams about making one. If you know someone who would be interesting in publishing such a book, please contact her because she’d love to make a pitch to them.

She also generously told me, “I’m happy to share my pop culture knowledge with anyone who’s interested in using it in a nonprofit...” (Continues on page 87)
TO WORLDS BEYOND
JOURNEY THROUGH THE SOLAR SYSTEM

From the fiery surface of the Sun to the icy realm of comets, travel to worlds with enormous volcanoes, vast canyons, dazzling rings, and storms that would swallow the Earth.
Latest from Pluto and Mars.

OUR VIOLENT PLANET
EARTHQUAKES | VOLCANOES | TSUNAMIS

Written by Dr. William Gutsch
Narrated by Star Trek's John Billingsley

Contact: Joanne Young
joanne@av-imagineering.com
407-859-8166
As I write this I sit in 75-degree F temperatures and can’t help but gloat a bit as those of you in the far east of the United States prepare for your forth nor’east. But temper that with the fact that when you read this my temps will be well over 100 degrees and the humidity is just days away.

We all have our good times and bad times, Northern or Southern, Eastern or Western hemispheres. (It is now some thirty days later since I wrote the opening and the snow is still piling up in the Midwest U.S. Perhaps we all need to set our projectors to mid-August and do a kind of planetarian karma thing.)

Another point of confession is that I am only a day away from when this column is due. Now, this is not me. Normally I have the next quarters’ worth of dissertation ready to go just after the last issue has gone to print. I could blame it on everything from tax forms to the flu or to just plain laziness and the need for a nap when I should be typing away. I really hate waiting until the last minute (or second in this case), as that puts a lot of stress on my editor as she never knows exactly what I’m going to put down on electronic paper.

So for the two or three of you who read this column, please note that I'm actually rushing to get something down that you might enjoy reading and will endeavor to do better in the future.

What is really surprising to me is this June completes the forth year of my giving planetarium shows. It seems like only yesterday that I started building, but that was over six years ago now. Time does fly when you’re having fun.

Speaking of fun, how about:

Keith’s Captured Quips, Chapter Three

“I hope you cepain bisnus” (keep in business?)

“I brought some licorice into the show and threw some in the theater during the movie. I want to apologize to you for doing this….our school is normally pretty good.”

“Io…is the volcanoes moon.”

“Thank you for letting us come. I was not there, but I have been down there before.”

“I learned about 16 things.”

About the only thing worth repeating that I’ve heard as people exit my dome is how relaxing a time they had, no doubt brought about by my sleep-inducing presentation. Actually I’ve heard one or two worthwhile quips which could be the beginning of next quarter’s blurb.

There, something to look forward to!

Ten years ago

June 2008: Looking back ten years (good grief, that’s when I found my projector and started trying for a building permit), the June 2008 issue cover displays two boys and a girl looking up at the dome through 3D glasses! Both boys appear overwhelmed with the spectacle of it all, while the girl appears bored to death. Perhaps it takes a lot more to impress girls then boys, but then the image on the dome above says it all.

While the image might be a true representation of the presentation, it could certainly be a computer generated image just for printing. Perhaps the girl doesn’t appreciate the beautiful sky covered with 3D pyramids out of a cutout of Earth.

But the background stars are not all that perfect either. Take Orion in the lower left of the dome. It looks more like a grouping of nebulae then stars. Or maybe that’s the stereoscopic effect. Perhaps I am over critical, more so as I age (face it, I’m an opinionated old curmudgeon which is why you read this probably), but I’m really liking a clear night sky over things like 3D pyramids or six sided whatever they are.

Not sure if my editor will let this stay, but I sure liked a bit from that issue’s “In Front of the Console: “We share a common goal: fighting the threatening darkness that the lack of science education brings with it. Oh, my. That got a little strong, didn’t it? Sorry.” (I didn’t think it was so strong, more like right on! She continues, “I’m personally happy that planetarians, no matter where they’re from, are so willing to share their different ways of doing things. Different isn’t wrong; different is exciting!”

“Another Dimension in the Planetarium,” the story about the ‘Imiloa Astronomy Center’s new system, talks about doing 3D under the dome. The problem is as always finding programming to play on the dome, but the effect is certainly dynamic.

This leads us to “Forum,” which asks the question, “Who in hell needs a planetarium?” As Forum Editor Gary Lazich noted, while a philosopher might ask, “Why is there air,” it takes an old Bill Cosby record to answer “To fill up basketballs.”

I actually like Gail Chaid’s reasoning the best. To paraphrase, after the lights go out there is a bonding with the community of the audience. As everyone exclaims, Oh! and Ahhhhh, there is a magical moment. “It is that moment and the night sky and all that it teaches us that keeps us connected with history, with humanity and with our own humanity.”

Tobias Wiethoff does an excellent article on “The Evolution of the Fulldome Planetarium,” which starts with a 15,000-year-old prehistoric cave painting through the full motion video that adorns our domes today.

1 The cover featured a publicity photo courtesy of Sky-Skan to help announce the installation of their difinity 3D stereoscopic system at the ‘Imiloa Astronomy Center of Hawaii.
Last Light by April Whitt is always good for a read, like the exam question “Is there water on the moon?”, with three possible answers, Yes, No, or Maybe. Between the time the exam was given and the grading finished, the answer had changed with the discovery of water. The right answer was wrong and the wrong answer was right.

**Twenty-Five years ago**

**June 1993:** “The Peoria Area Solar System Project” by Sheldon Schafer of the Lakeview Museum is probably the most accurate and largest one around. The 11-meter dome at the museum represents the sun and Pluto (yes, it was a planet back then) is a 2.5-cm ball 64 km away.

“The Status and Future of the United States Planetarium Profession” is an interesting look back at several things like salary vs. dome size vs. educational degree, but most interest is describing the planetarian as “a renaissance man.” What did planetarians dislike about their jobs back then? Paper work and lack of funds (some things never change), but interestingly, “canned show” shows up as well. How things have changed.

“Planetentica” talks about round loops in audio and how to get rid of them. This is worth as much now as back then. If you have hum or are picking up radio stations, this article is worth the read.

“Survival of the Planetarium” talks about the inroads the personal computer has made which might make the planetarium obsolete. They should see us now! However now, as then, the personal computer can never replace the planetarium “experience.” It is summed up with “Planetariums should be a place, not for astronomy information, but rather for an astronomy experience.”

**Forty-five years ago**

**June 1973:** The cover photo of the Spitz A-1 begins an issue devoted to education in the planetarium. It is said that “Zeiss brought stars to the cities, but Spitz brought stars to the classroom” at one tenth the cost. I question the cost of a Zeiss II projector as ever around a $5K price point, but that’s not the point. The point was that the Spitz was available at a price that most school districts and universities could afford. The age old question is what to do with it once you have it.

“The Planetarium In College and University Education” is a rather in-depth article on what the planetarium dome can teach other than seeing stars. There are literally hundreds of subjects listed, but, alas, no real details on the subject matter. There are some broad categories like “The Planets–Wanderers In The Zodiac” and my personal favorite, “Flight Military Instruction,” which is said to contain no dialog but uses six motion picture film projectors and nine fully loaded carousel slide projector trays.

So much of this appears more entertainment oriented rather than educationally oriented, so I guess keeping people awake was a problem even back at the beginning.

“The Technical Side” talks about the Zeiss Spacemaster projector. This is a full dumbbell-type machine about the size of the Minolta machines of the time. None had made it to the US at the time, probably more because of its East German roots than any problem with its design.

“Zeiss to celebrate 50 years of the planetarium with a gala black tie party.” It’s hard to believe the 100th anniversary is just around the corner.

Always a worth a visit is Jane’s Corner, and she features a story from Robert Tate of the Harper Planetarium in Atlanta, who relates that the director of a small planetarium, having for years suffered feelings of inferiority because his equipment was not denoted by Mark IV, Mark V, or Mark VI, now proudly refers to his projector as a Mark Spitz!

See you all next quarter.

---

**Outschool**

Lauren recently also became a teacher on Outschool, a virtual classroom platform where kids can take “classes” on all kinds of things.

Lauren’s Outschool classes: Dr. Who Astronomy; Science and Star Wars: Aliens; Star Trek Astronomy; Poké Primates: Explore Monkeys, Apes, and Prosimians using Pokémon; The Rabbits and Rodents of Pokémon; and Marine Biology with SpongeBob Squarepants. See more at outschool.com/online-classes?order=upcoming&q=Lauren%20Ard#us06bnjz3j

Perhaps Lauren will inspire you to think outside of the box too; you just might reach more clients and increase your business and profits!

Lauren Rae Layton Ard contact information: Email Lauren.rae.ard@gmail.com; website tucsonplanetarium.com; Facebook www. facebook.com/PortablePlanetariumPresentations

**Source for replacement bulb?**

I was recently made aware that the replacement bulb for the STARLAB Standard Projector and the Cardinal+Meridian bulb for the STARLAB Fiberarc projector has become prohibitively expensive to purchase from the usual supplier, Science First.

They advertise, “This small halogen bulb is a replacement for the main lamp on a Starlab SL-131 standard projector. It also is the replacement lamp for the cardinal points and meridian projectors on the STARLAB SL-13S FiberArc projector. Part # 400-5550 $246.53 for 1 bulb.” (shop.sciencefirst.com/starlab/684-replacement-parts)

If you have a less expensive source for these bulbs, please email me so I can pass it along.

**IPS 2018 Toulouse**

This June Planetarian issue will come out right about at the time of the conference this year. I hope you have made your plans and will attend this marvelous event. If you see me there, please say “Hello” so I can get to know you!

---

2 Mark Spitz is an American former competitive swimmer, nine-time Olympic champion, and former world record-holder in 7 events. He won seven gold medals at the 1972 Summer Olympics in Munich, West Germany, making it current events for the 1973 issue.
Michael Daut snapped up by Mousetrappe

Mousetrappe, an award-winning immersive media production studio in Burbank, California, announced recently that Michael Daut has joined the company as director of New Business Development to further expand their growing portfolio of national and international projects.

Michael comes with a wealth of experience within the industry, most recently at Evans & Sutherland (E&S), where he was instrumental in acquiring numerous large accounts and expanding the product line.

As the leader of the New Business Development team, Michael joins Mousetrappe “to continue the company’s recent successes in their groundbreaking approach to media-centric attraction development, mapped projection events for theme parks worldwide, and award-winning world-renowned experiences,” the company press release said.

Michael comments, “With my experience as an immersive media producer and as a board member for both IMERSA and GSCA, two organizations fundamentally focused on immersive experiences, I’m excited to bring my passion and creativity to the Mousetrappe team to help imagine and realize unforgettable seamless experiences for audiences of all ages, not just in themed entertainment venues, but in new and unexpected places where people can be captivated and carried away by immersive storytelling. It’s going to be a blast to find new opportunities and to see what we can develop and achieve together.”

IPS sends its congratulations to Michael, along with best wishes for a fulfilling career move. Learn more at www.mousetrappe.com.

Newest scholarship winner announced

The Hamilton Planetarium Scholarship Fund has announced that Jeff Carr, a student at American Public University, an accredited online university headquartered in Charles Town, West Virginia, has been named the latest scholarship recipient.

Jeff, a resident of St. George, Utah, is finishing his first year in the master of space studies program with a concentration in astronomy.

“Recalling back to my earliest memories, there is a deep fascination with the cosmos and all things space. About two years ago, inspiration for the Earth’s first outdoor planetarium formed in my mind. How incredible to observe the wonders of the universe on a transparent screen that is overlayed onto the actual night sky, creating an augmented reality effect?”

“What a privilege to share the stories of science with the public as we stare at and through the Cosmospherium screen. The Cosmospherium will combine the power of the planetarium with the awe of the night sky,” he said.

The Hamilton Scholarship Fund exists to provide scholarships to students interested in gaining employment in the planetarium field as professionals. These scholarships are open to all United States citizens or legal residents attending accredited educational institutions in the United States or possessions.

Scholarships range in value from $500 to $5000, and may be renewed on an annual basis. Learn more at http://www.planetariumscholars.webs.com.

Community pride helps La Porte retain planetarium

The new planetarium at La Porte Independent School District, located about 30 miles south of Houston in Texas, was among 12 schools in the state recognized for top innovative programs by Bragging Rights, a publication of Texas School Business/Texas Association of School Administrators.

Community support and fond memories of the original 1964 planetarium, equipped with a Spitz A3P, went a long way toward the decision to build a new planetarium when it came time to issue bonds in 2014 to construct a new STEM classroom building.

The new planetarium has a 24-ft (7.3-m) dome, 34 seats, and a Barco laser projector with ZEISS lens, powered by Uniview and powerdome. Installation was by Seiler Instruments.

Physics teacher Matt Hauser (who is also a tennis coach) is managing the facility and said that, in its first year of service, the planetarium has had 1,750 visitors (from August 2017 through April this year). In addition to high school astronomy classes, the dome has been used by elementary and junior high students, Girl and Boy scouts, and the community.

In the story in Bragging Rights, La Porte Superintendent Lloyd Graham is quoted as saying that “the old one was functionally obsolete in its delivery...but not in its mission.”

The district also points to the cross-curricular opportunities in the planetarium, making it useful for other science teachers and nearly every other discipline taught, as well as by community groups and by the nearby San Jacinto College Maritime Academy for celestial navigation study.

Graham, to conclude the Bragging Rights story, also said that “schools are charged with teaching logic in a world that summarily accepts that the sun sets when in fact the horizon rises. So I think [the planetarium] challenges a child’s known universe and predisposed assumptions about the world. And from that, it piques interest.”

Special thanks to Bragging Rights for allowing use of the cover image above, and to Editorial Director Dacia Rivers and Designer Phaedra Strecher for designing a cover that works on a lot of different levels of astronomy “coolness.”
INTERACTIVE EXHIBITS

Clark Planetarium interactive exhibits support hands-on learning and immerse visitors in experiences that challenge minds and engage imaginations. With over 10 titles available, we have exhibits that will take your museum to the next level.

For more information and demonstration videos, visit clarkplanetariumproductions.org or contact us at: +1 385 468 1226
Tributes

Stephen William Hawking
8 January 1942-14 March 2018

An icon of 21st century science and culture died at age 76 on March 14, 2018, with the passing of Professor Stephen Hawking. He surpassed most expectations, even his own, to live far beyond his 21st year when he was first diagnosed with motor neuron disease, when he thought “my world ended.”

In addition to being one of the most notable scientists in the world, able to comprehend the complex mathematical rigors of advanced cosmology, he maintained a bright sense of humor throughout his long life, produced the best-selling book A Brief History of Time, and became a celebrity on television and film, representing himself, his disability, and always expressing the logic and elegance of the scientific view of the universe.

Stephen William Hawking was born in Oxford on 8 January 1942. His academic career began with a first-class degree in physics from Oxford, and he then went on to Cambridge for postgraduate research in cosmology. His skill was soon recognized, continuing his research remarkably after his shattering diagnosis.

His monumental work, in part made during a visit to Caltech in 1974-75, rocked the world when he famously predicted that black holes aren’t entirely black. Radiation, now called Hawking radiation, can leak out.

He held the post of Lucasian professor of mathematics at the University of Cambridge, the same post held by Isaac Newton 300 years earlier.

With his growing intellectual and cultural popularity in the 1980’s and 90’s, Hawking traveled the world, attending conferences, giving speeches, and even flew in the Vomit Comet, NASA’s jet for simulating freefall. His annual visits to CalTech enabled Hawking to make frequent visits to planetariums. Our community is filled with personal anecdotes, particularly following his appearances through the Hansen Planetarium in Salt Lake City.

In June 1995 Hawking attended the opening of the London Planetarium’s digital theater in June 1995, which hosted the UK premiere of Buhl Planetarium’s Cosmic Perceptions. Following the viewing, which included a virtual ride filling the whole dome into a black hole, Hawking expressed that it was his favorite part of the show.

Hawking’s intellectual trajectory chased the elusive nature of the universe by attempting to reconcile Einstein’s theory of relativity with quantum physics. “My goal is simple,” he once said. “It is complete understanding of the universe, why it is as it is and why it exists at all.” The Theory of Everything also leapt across the scientific-cultural boundary and became the title of a movie portraying his life, based on a book by his first wife, Jane Hawking.

His iconic electronic voice synthesizer used since he lost his voice early in his illness became synonymous with his stature as a scientist, and as a human being. His ability to take the complexity of the world and the universe and translate words that resonate with a broad public audience was remarkable, one that we planetarians can relate to, and attempt to emulate with as much skill as Hawking had.

-Martin Ratcliffe, Sky-Skan, Inc

Gloria Ariane Villalobos
February 5, 1968-March 11, 2018

Gloria Ariane Villalobos, former director of the Novins Planetarium in New Jersey, passed away on March 11, 2018.

She was born on February 5, 1968 to Emetrio “Emmett” Villalobos and Lucille Villarreal in Stockton California.

Her father was in the military, so Gloria began to travel the world at just seven weeks old. After high school Gloria went on to attend Washington State University, where she attained her bachelor’s degree in science, and then went on to receive her master’s degree in Astronomy.

Gloria began her career at the Vandebilt Planetarium on Long Island, New York. She then worked for the Museum of Natural History and Science. Gloria finally settled in Lakewood, New Jersey; here is where she worked for the Ocean County College at the Robert J. Novins Planetarium.

Gloria’s love for all things astronomy led her to teach the course at Ocean County College as well to toured local elementary schools with her “Mad Scientist” program. She was a “roving astronomer” and owner of Wild Cosmos.

A memorial service was held on March 18 at the Robert J. Novins Planetarium at Ocean County College, Toms River.
2018 - International Year of the Reef

1 June. Deadline to submit bids to host 2024 IPS Conference.


4-6 June. Annual Conference of Japan Planetaria Association, Fukui City Museum of Astronomy, Fukui, Japan. Contact: Sumito Hirota schmidt_h@mac.com; www.fukui-planet.com; planetarium.jp

4 June. Meeting of Mediaglobe Users Group prior to the SEPA/WAC, Holiday Inn Memphis, University of Memphis, Memphis, Tennessee, USA. Contact: steve.hatfield@konica-minolta.com

5-4 June 2018. Joint meeting of Southeastern Planetarium Association (SEPA) and Western Alliance Conference, annual conference, Pink Palace Museum, AutoZone Dome, Sharpe Planetarium, Memphis, Tennessee, USA. www.sepadomes.org

6-8 June. IPS Fulldome Festival Brno 2018, Brno Observatory and Planetarium, Kravi hora 2, Brno, Czech Republic. The festival is supported by the International Planetarium Society. Contact: Jiri Dusek, director@hvezdarna.cz; www.fulldomefestivalbrno.com


27-29 June. IPS Fulldome Festival, Cité de l’Espace, Toulouse, France.

30 June, Asteroid Day. asteroidday.org/united-nations


1-3 July. 24th International Planetarium Society Conference, Cité de l’Espace, Toulouse, France. Contact: Marc Moutin, m.moutin@cite-espace.com; www.ips2018toulouse.org

1-4 July. APLF, Annual Conference, will be part of the program of the IPS Conference, Cité de l’Espace, Toulouse, France.

9-14 July. ESOF, Euro Science Open Forum, Cité de l’Espace, Toulouse, France. Contact: Marc Moutin, m.moutin@cite-espace.com

19-21 September. Digistar User Group, University of Utah, guest house and ES, Salt Lake City, Utah, USA. Contact: Kevin Scott, kevscott@es.com; www.digistardomes.org or www.dug2018.org

29 September - 2 October, Association of Science-Technology Centers (ASTC) Annual Conference, Connecticut Science Center, Hartford, Connecticut, USA. www.astc.org

4-10 October, World Space Week. www.worldspaceweek.org/calendar

Vol 47 No 2 - June 2018

Planetarian

Compiled by Loris Ramponi - osservatorio@serafinozani.it
"Working" and "powerpoint" in the same sentence. That's cute.

The world ain't all sunshine and rainbows.

When describing special events held in the Peoria Riverfront Museum, and the complicated logistics required, Renae Kerigan was asked, "How do keep on top of all of that?" Her reply: "We're nerds."

The edge of technology is sometimes ragged.

Q. How can we target misconceptions and help people overcome them?

A. Close down the internet.

And student thank-you notes:

"Thank you for letting us come. I hope you get paid well. I hope you feel good at work. I hope you like your job. I hope you enjoyed me (sic) thank you letter. Good bye and see you next time."

"I really liked it (the planetarium program) and it was good. My brain is going to be smarter next week."

"When it was getting darker at night. The moon was made of itself. When the Sun is covered sometimes parts of the sun is dark and the rest is light."

"I like the questions that you say to us. I sleep there. The chare is coftudle." (chair is comfortable?)

"Thank you for the wonderful presentation and so that we could recall what we remember what the sun does in the galaxy and what the moon does for the Earth."

"Thank you for letting us explore the Fern Bank for the third time but we can still use that as a review what not to say about the Sun does."

"I also liked looking at the constellations and I have a question does Aquarius have a constellation? Just a question. Anyway, I enjoyed the presentation." (We were observing the spring evening sky - no Aquarius.)

"I can't wait into (until?) we come back. Your a sweet and nice person. Also thank you for letting us different animals in there." (?)

"Thank you for teaching us correct facts about the earth, Sun and the moon. I hope to see you next year."

"Now in my writing I could include lots of facts I learned in Fernbank Science Center."

"The field trip was good and joyful. I like that you were loud and clear when you spoke."

"(I liked) how the sun gets its own heat. Also how eclipses happen. And how we get the seasons. And I loved when you showed us how the stars make pictures. Like leo the lion."

"We learned that the moon orbits around the Earth, and Armstrong was the first American (sic) on the moon. Did you know that his footprints are still on the moon?"

"The moon's light comes from the sun, and the sun is a hot ball of gas that the moon reflects! This was a sensational field trip!"

"My favorite part of the presentation was when you talked about Orion's belt and the bull's eye."

From the New Horizon flyby

"I have a screen with a bunch of numbers on it, and just make sure they don't turn red."

"You can't have a category with only one object. Hence dwarf planet."

Then-Science Mission Director John Grunsfeld, showing images of solar system: "If anybody doesn't recognize the next object, please leave the auditorium. Security will escort you to Area 51."

"Things are 'nominal' which is engineer-speak for 'beautiful.'"

Kindergarteners know best

Working with kindergarteners in STARLAB is always full of potential. Students are excited to crawl into the dome, teachers are delighted with their science standards being met, and I get to hear commentary during the lesson. During a recent session, I started with the Greek constellation outlines, then switched to "stars only."

A little girl sitting nearby exclaimed, "This is just like Dance Party," and started an arm-waving version of some dance. Probably something I don't watch on television...

And keep these wise words from Jeff Nee (educational specialist at NASA's Jet Propulsion Lab) in mind: "The first person to step foot on Mars is in school right now, and it could all start with your smile as they hand you their planetarium ticket." (See also LIPS on page 74.)

---

According to this ast paper, every galaxy is being pulled toward one area of the sky. They hypothesize that it may be due to a supermassive object beyond the edge of the visible universe.

Do you think? Pull harder, mom. I miss you.
Uniview™ 3.0 is simple and hassle-free to get either as a full installation or as a Drop-In™

Seamless for you. Unforgettable for your audience.

OUT NOW

Easy to Drop-In™
Exactly as it sounds. Whether your theater runs on Uniview™ or another planetarium software package, we can get your new Uniview™ 3.0 up and running quickly and easily.

Introducing Panels 3.0
Seamlessly glide through your live presentation with the new, more intuitive Panels 3.0, designed for high functionality and ease of use to delight the presenter.

Tru-Space Pilot Mode™
With Uniview™ 3.0 you will impress your audiences with perfectly smooth flight paths and visually stunning presentations with unprecedented accuracy.

Order now or get more information:
Sciss International (HQ) | +46 8 55 11 91 00
Sciss North America | +1 978 270 5835
Sciss Middle East | +971 4 256 6695
Email | sales@sciss.se

Keep in the know!
facebook.com/scissfamily/
facebook.com/scissuniview/
twitter.com/scissuniview/
Enter a new age

SkyExplorer 4
Real Time Universe

R.S.A. Cosmos
Planetarium Designer

www.rsacosmos.com