Space+: Pathways for All Abilities

OUT-OF-THIS-WORLD SENSATIONS

MAKING THE UNIVERSE FEEL LIKE IT LOOKS

An interview with David Hurd
Professor of Geosciences and Planetarium Director
Pennsylvania Western University

Hurd describes his passion for education and his dedication to improving accessibility as being born out of coincidences put in his path by external factors. These engagements were not necessarily made with intention, but they make a lot of sense in retrospect. A near-perfect definition of serendipity.

Hurd initially destined himself to be a field geologist, reading quietly in a corner, but a lack of professional opportunities in geology at graduation pushed him into teaching and astronomy education and he fell in love with it.

From teaching physical science to classrooms of teenagers for 4 years to working as a curator of astronomy at a museum in Michigan and directing the Pennsylvania Western University's Planetarium for the last 31 years, he has thoroughly enjoyed taking the fascinating findings of research scientists and helping educate the public on these matters.

From quite early on in his career, Hurd sought to expand the ways in which we can explore our universe. His work with students with different abilities gave him the chance to gain a richness of perspectives and angles on knowledge and understanding. Through teamwork with colleagues, he has built an important library of tactile charts, graphs, models, and books which is still growing, with two new books coming out this year. For him, each tactile product is an opportunity to do better and to come up with creative ways to make astronomical phenomena feel like they look.

In this article, Hurd shares his experience as a planetarium director and educator who is dedicated to making astronomy more accessible to people with different abilities. He discusses the different projects he has worked on as being an occasion to share good practices and advice for teachers, institutions, and students with disabilities.

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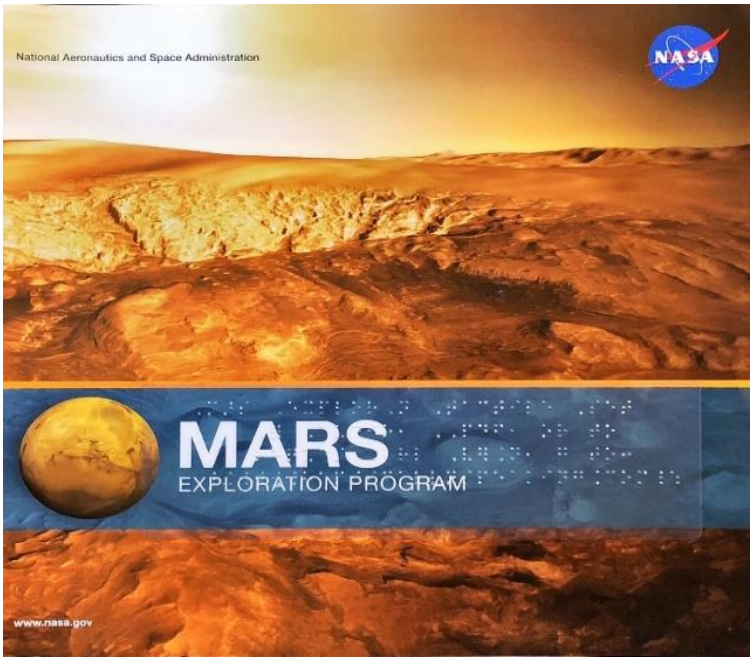
UNOOSA: Have you always been interested in science outreach and education or is it something that came later in your career?

Hurd: I knew by the time that I was in eighth grade that I wanted to be a geologist. I did not intend to be an educator and rather imagined myself as a field geologist, working by myself in a remote region of the globe. But at the time that I graduated, there weren't any jobs in geology, which kind of pushed me into pursuing a teaching certificate. And lo and behold, I got into astronomy education and fell in love with it, in particular the idea of taking the inspirational findings of research scientists and helping to educate the public about them.

Has this switch to teaching changed your approach to astronomy and science and, if so, how?

It did change my approach to science. Before that, I was on the learner's end, so it was about intake and process. As I delved further into education, I found out that there's a lot more to it than that. It's not just that you understand key concepts and their application, but rather how you communicate these effectively to others. That was the key difference.

My goal as an educator is to help my students to understand concepts. And students that have different abilities have helped me gain a richness of perspectives and angles, particularly of the different ways we can come to our own understanding. My work is mainly with the visually impaired, where the sense of touch becomes very important. Therefore, we create and use models and representations that can be held and explored by touch. We often call these resources "tactile materials." When we create tactile materials with which they can explore the universe, we must try to make them feel like they actually look. This is a difficult task and requires a good deal of iterations and testing with competent users to "get it right." Related to "getting it right", it's interesting because most of the visual data that we get as astronomers is numbers anyway. We interpret it as color, which we can see. There are various ways of understanding our universe, and different ways of even thinking about it. Exploring them all is magical.



Mars exploration programme braille book.
Credit: NASA SSERVI

Tell us a bit more about your work with science and accessibility? You shared with us that two of your sons have significant disabilities. Is that what sparked your commitment towards inclusion?

My work with students with disabilities came before I had my two sons. I run the planetarium at Pennsylvania Western University and about 26 years ago, my Dean came to me and said "hey, you're going to welcome a student who is blind". And if you've ever been in one, a planetarium is very visual. Let's say it's 90% visual and 10% audible. I was a bit reluctant at first, but he insisted and ultimately I was blessed to welcome a student who was blind to the planetarium.

At that time, Pennsylvania Western University had a tactile lab, dedicated to students who are blind, and the director of that lab, John Matelock, happened to be an avid astronomer. We hit it off right away and started developing tactile material to enable my student to learn astronomy.

Someone heard of this material, and I was invited to give a presentation at an observatory in California where I met Dr. Cassandra Runyon. At the time, she was running what is called the Exceptional Needs Workshop. When she saw my materials, she said: "You're coming to this summer's workshop whether you want to or not!" And she kind of hooked me in. My journey, my path of working with students with special needs was born out of my resistance to it, and encouragement from colleagues like Cass Runyon at the College of Charleston. I didn't have a background or expertise working with students with disabilities, but I was thrown into it. And this journey continues. We're still learning, we try to do the best job that we can. Now I look back and see the blessing of it. After that, my twins were born with special needs, and it gave me even more passion, more desire, and more drive to continue this work in helping those students learn and grasp STEM concepts.

Under your management, the PennWest Edinboro Planetarium has received national recognition in the US for its inclusion of all learners. Could you give examples of how your planetarium is adapting to the needs of visitors with disabilities?

I wear two hats, one as a professor, and the other as a planetarium director. It can be challenging at times, but it is also a real joy as there is never a dull moment. On any given day, I can have a group of second graders visiting the planetarium, turn around and teach college students astronomy, and then welcome a group of elderly people for a public show.

> *"Some people have asked me: "Why do you bother with students who can't see anything?". To which I answer that these students have as much right as anyone to experience the wonders of the heavens."*

One important thing to underline here is that I am not the guru of meeting the needs of all learners. Nevertheless, we certainly invite groups of students from kindergarten through to twelfth grade [17 to 18 years old] who are blind or visually impaired, or who are deaf or hard of hearing. We also have many learning support groups with students who are autistic or have other cognitive disabilities. Regarding our outreach to those who are blind or visually impaired, some people have asked me: "Why do you bother with students who can't see anything?" To which I answer that these students have as much right as anyone to experience the wonders of the heavens. I would even go as far as saying that I am a huge advocate of taking students who are blind to observatories, to planetariums, and museums. They can hear, they can sense, they can smell. They're exploring these magical places with different senses and giving us perspectives that we would most often miss or overlook. I think that is true of any disability and that's what is marvelous about it.

> *"They're exploring these magical places with different senses and giving us perspectives that we would most often miss or overlook. I think that is true of any disability and that's what is marvelous about it."*

How do you share programmes or materials specifically designed for persons with disabilities with those without disabilities?

In the U.S., we try to encourage and foster as much as possible the inclusion of students with disabilities in regular education classrooms. Therefore, I would say that although some of the groups that come to the planetarium are exclusively composed of persons with special needs, most of the "regular education" classes have at least 1 student with special needs.

We might have, for instance, a group of second graders [7-8 years old] with one student who is hearing impaired out of 60, who we can accommodate because their learning is as important as everybody else's in the group.

> *"Meeting the needs of students with disabilities does not always have to be expensive or elaborate… A lot of our materials are free, and we want to get them into the hands of people who love astronomy."*

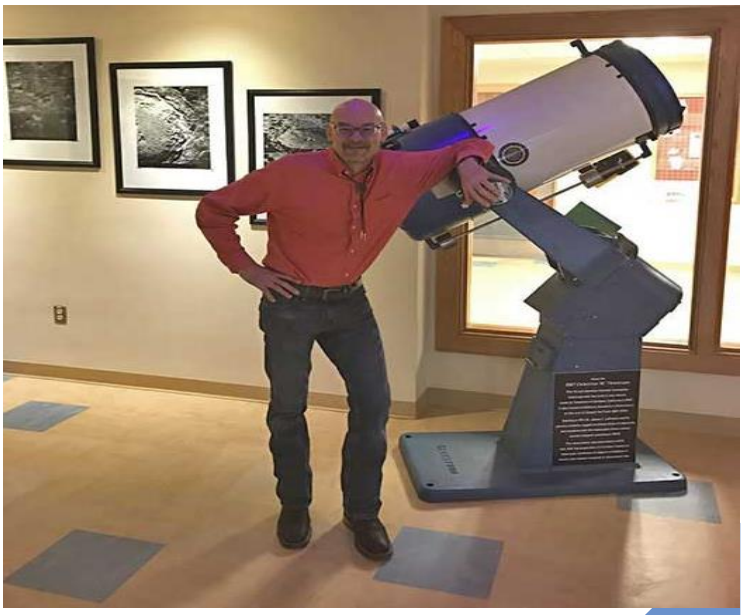
This really is a beautiful thing because then the other students have access to this new perspective and can see how it's done. Because of our limited resources, the material is often only given to the students with disabilities but the tactile material that we develop with Dr. Runyon and Joe Minafra from NASA for blind and visually impaired is much more widely available and good for all learners. After all, in the end, we are all kind of tactile learners, so we try to get our books into the hands of anybody who's interested.

Some countries or regions have little financial support for planetariums or other astronomy education facilities. Would you have any "maximal impact, minimal cost" best practices to share regarding disability inclusion?

Meeting the needs of students with disabilities does not always have to be expensive or elaborate. Taking the example of a planetarium, it is pretty easy to add closed captioning on full dome videos. For hearing-impaired visitors, it is also easy to work with lighting for live programs where a presenter takes you through the night sky. At Pennsylvania Western, interpreters or signers have two options: glow-in-the-dark gloves, or better yet, we have positioned a red light that illuminates their faces so that the audience can see the lips and hands as they sign what's being said. It is just a matter of having it available because what is important here is that we do not always know if there is a student in the group who is deaf. We need something that we can set up quickly.

If an interpreter comes along, I can set them in a specific place that is convenient for them to get the message across. If a student who is blind or visually impaired comes in, I can place them where I have access to them so I can also walk through the tactile materials with them while we're looking at the sky with the group. Those are readily available and inexpensive. Programmes like this series of interviews for instance are good to get the word out because a lot of our materials are free, and we want to get them into the hands of people who love astronomy.

Other accommodations can simply involve the placement of students and/or having space available for wheelchairs. For autistic participants, it is important to consider the amount of stimulus that is present. Reducing or eliminating distractions and extraneous stimuli is important for this group of learners. Again, it is important to communicate with appropriate personnel who are present with the group to ask what special needs should be attended to, for each group and each individual student will be different.



David Hurd manages the PennWest Edinboro Planetarium and provides the local community with interactive and engaging live and online planetarium programs. Credit: PennWest Edinburo

What more could be done in terms of planetarium education and accessibility? What kinds of special needs do we still need to meet? From a structural/institutional perspective, what kind of support would you need? Is it about networks, money, knowledge, or sensitivity?

I have been talking a lot about physical disabilities. I think we really need a lot more work done for visitors with learning disabilities and who are on the autistic spectrum. I'm not an expert there, but other people are. Anna Green for instance, who works in Germany, does great planetarium programs for autistic children. There are a lot of different areas, with people who have distinct expertise and are doing some great things with a wide range of disabilities. For example, I belong to the Great Lakes Planetarium Association which has a special interest group gathering and sharing best practices regarding students with disabilities.

> *"I have been talking a lot about physical disabilities. I think we really need a lot more work done for visitors with learning disabilities and who are on the autistic spectrum."*

As for the resources, the answer is that all the above kinds of supports [networks, money, knowledge, sensitivity...] are needed. I think it's also good to try to encourage facilities to actually hire people with special needs because, who better to help you meet the needs of a special needs population than somebody with that particular disability?

What do you think are some of the conditions that need to be in place to facilitate access to STEM among persons with disabilities? How can persons without disabilities, notably those at the top of institutions, help create an inclusive environment that embraces those with disabilities?

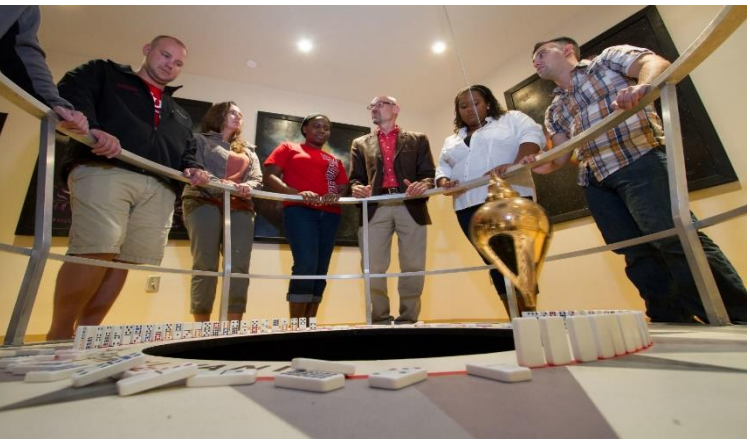
To a large extent, it can be particularly effective if it comes from the top down. It can work from a grassroots level of course but it certainly helps if you have an administration that is willing to take those chances, support the infrastructure, and the change in attitudes, allowing employees to be contributors.

> *"We need to take a team-based approach where we value what everybody brings to the table and capitalize on them, no matter what their disabilities are."*

As far as the institution side is concerned, be willing to flex. Be open to opportunities to expand your vision of what you know about your learners who are coming to your institution. Keep an open mind and do not put them in one box because there are going to be many different boxes. Also, we should not expect everybody to be able to do everything. We need to take a team-based approach where we value what everybody brings to the table and capitalize on them, no matter what their disabilities are. A personal example of this is how my colleague Ken Quinn, who is blind, and I team-taught the visually impaired children who came to our astronomy summer camp last year at Pennsylvania Western. Ken has a much better feel for what these students are dealing with than I do. I would do most of the presenting and he would help with the tactile understanding and correct the things that I got wrong. It made for a good combination.

Also, surround yourself with the experts, most of whom have disabilities themselves. If you do not know any, ask around - these experts with disabilities can steer you in the right direction. It developing our tactile materials, it would be easy for Cassandra Runyon, Joe Minafra, and I to sit there and say "Wow, that looks beautiful."

But just because something looks beautiful does not mean that it communicates beauty tactilely and we must constantly ask ourselves, “how can we make it more effective?”.



David Hurd with students at Pennsylvania Western University standing around a pendulum. Credit: Chris LaFuria.

In general, considering persons without disabilities who want to help, I would say they need to engage themselves in getting involved. As the old euphemism goes, they need to "put themselves in the shoes of others" and be willing to get into those uncomfortable situations and experience the challenges and barriers that other learners have. In the Exceptional Needs Workshop I mentioned earlier, part of what we did as participants in order to make NASA's educational material more accessible, was to simulate different disabilities. We would "wear" different kinds of vision obstructions, different hearing impairments, or mobility impairments. In doing so, although we cannot totally relate to somebody with those struggles, we certainly realize that there are some barriers, there are some hurdles in how we need to change and how we need to present this material for certain learners. There is still a long way to go and I think we are just at the beginning, but we are seeing more persons with disabilities entering the STEM fields and I like to think it is partly because of our efforts.

So you are saying: be willing to try even if it's not perfect and even though you may be scared to make mistakes?

Yes, absolutely. I work almost exclusively on STEM initiatives for people who are blind and visually impaired. I have a team around me composed of people that are blind and act as a wonderful sounding board. Ken Quinn, Ken Silberman at NASA Goddard, Robert Shelton at NASA Houston. We will bounce our materials off them, and they will tell us "Oh, that really looks horrible. What were you thinking?" And that is what we need in the development of these programs. It is a process and we are not doing everything right, but at least we are trying. And in a lot of cases, it is the only thing that these learners have at their disposal to experience the wonders of STEM.

What advice would you give to young people with disabilities who want to pursue a career in a planetarium or get an education in STEM?

For individuals with disabilities who have the desire to work in such facilities, I would say: be persistent, be upfront and honest about your limitations, and just show up. I know that if somebody keeps showing up at my planetarium, telling me they want to be involved, pretty quickly I am going to want to connect with this person and get them involved. Unfortunately, I do not have the resources to hire anybody but the students who work with me on a volunteer basis are those who were persistent and showed their interest. And they usually bring a dynamic, different perspective that I appreciate.

> *“Be persistent, be upfront and honest about your limitations, and just show up.”*

For students as well, this idea of persistence is key. If somebody keeps pounding on your door persistently, then naturally you have to respond. This is a good lesson on persistence. It is also especially important to be specific, too. We may not know your specific challenges or what you are struggling with. But we need to know. Don't expect us to be able to figure it out necessarily. Help us help you.

Do you have any specific advice for teachers in astronomy and other science fields who work with students with special needs?

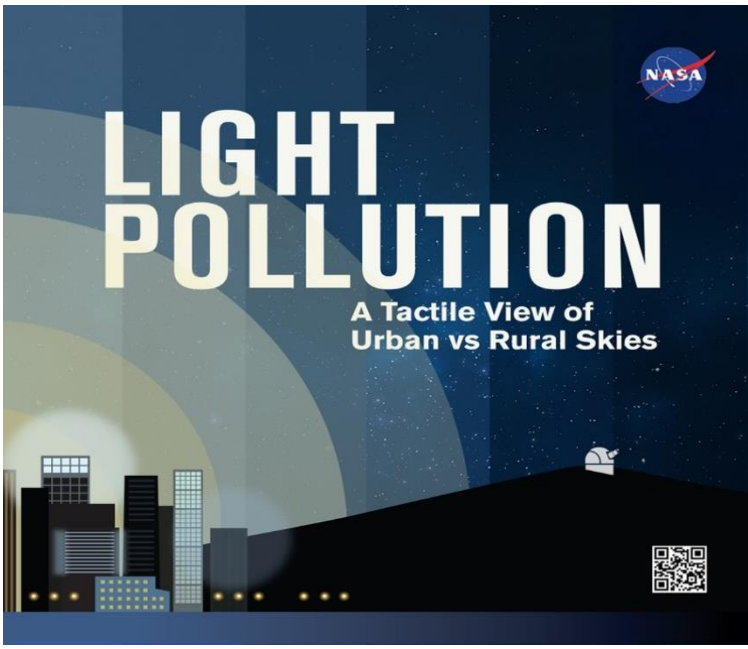
Keep on “keeping on” because it is a work in progress. I have a personal adage that says, “a teacher has not taught unless the learner has learned”. I can sit up in front of my classroom and spew out all sorts of cool stuff and facts, but if my students have not learned, then I have not taught. The key is to be aware of that and sensitive to the fact that your learners come in all shapes, sizes, and abilities, so you got to try to be as universal as possible for them. Another of my education adages is that “good teaching is helping your students to believe that what they are learning is pertinent, fun, and important. Whether or not it really is.”

> *“A teacher has not taught unless the learner has learned.”*

You were also involved in the production of educational books for visually impaired audiences, one of the last two books being about how light pollution affects the night sky. Could you explain concretely how you convey this phenomenon through a tactile book?

When Dr. Cass Runyon and I met in California, she invited me to the Exceptional Needs Workshop, which is another program that had such a fantastic team aspect to it. We brought together NASA's scientists, teachers of science, high school special education teachers, and scientists with disabilities on a NASA grant to try and design accessible activities for public schools. Our tactile books started to develop out of these activities in 2008, and we now have eight books or so, on the moon, on Mars, etc. In addition to the books, we also have a lot of ancillary activities that enhance specific topics in astronomy.

Cass, Joe and I just finished a tactile book on Earth called "Earth: A Tactile View of the Blue Marble" and we have two new books in the making. "Getting A Feel for Eclipses", highlights the October 2023 and April 2024 major solar eclipses in the United States; including the paths of totalityand the dynamics of a solar eclipse.



Light pollution braille book. Credit: NASA SSERVI.

We have a new book "Getting a Feel for Light Pollution". Light pollution is just the idea that there are some parts of the world that are darker than others because some areas are plagued by city lights, billboards and technology. This tactile book explores a prominent winter constellation called Orion and a summer constellation called Cygnus, the Swan. What do they look like in a dark sky? In moderate light pollution? And in a heavily polluted area? We do that by using bumps. The bigger the bump, the brighter the star. And it's a progression book because as you get to the next level, some stars you don't see anymore. It can be that the bumps that were larger, that were representing brighter stars are now smaller, illustrating that they appear fainter to us. It is a fabulous product and we are really excited about it because it's suitable for families. Whether you have a child who is visually impaired or not, you can have fun learning about light pollution tactilely.

The easy way to create a tactile book is to simply outline an image or a picture. But we try to go the extra mile. We do not want to just outline a planet or the sun.

We spend a lot of time on details and develope masters to reproduce Braille and tactiles on thermoformed sheets so that they actually feel like the object looks. And that is where people like Ken Quinn, whom I mentioned earlier, Ken Silberman and Robert Shelton, who are both blind scientists who work at NASA, come in handy as they can test these things.

David Hurd teaching students with disabilities. Credit: Lexi Pollock

Our books only include the tactiles. The text can be accessed by scanning a QR code in the lower right-hand corner of each of our books. You then get an audio file, refreshable Braille, or text-to-speech. I've seen people who are totally blind and holding our books, accessing them with their cell device and listening to them while they are exploring the tactiles at conferences. It's really a magical moment.

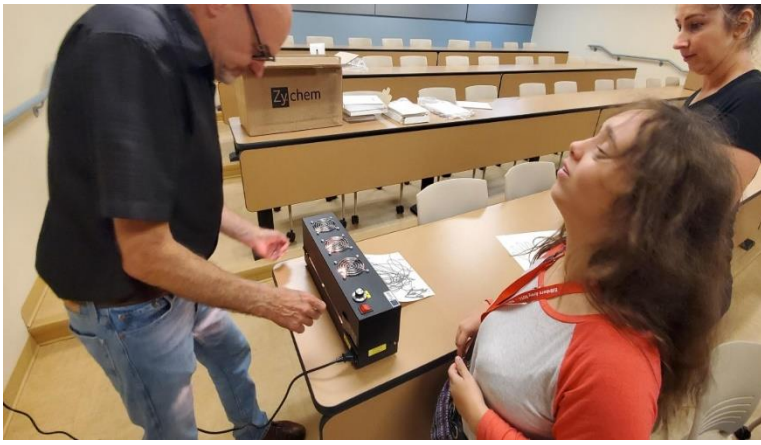
Some of your books have been translated into other languages. Could you tell us about the different types of Braille? Do you plan on translating more?

I presented our book about the 2017 eclipse at the International Planetarium Society and a planetarium director from Argentina reached out to us saying they had two eclipses coming up in 2020 and in 2021. With the help of Joe Minafra (NASA) and Cass Runyon (College of Charleston), we got the momentum going and the funding through NASA Headquarters, thanks to Kristen Erickson. We have a couple of those international products in the waiting. But here is the difficulty, and I'm learning this myself: Braille, unfortunately, is not international. I find myself limited by my disability to understand different Braille. I really wish we had a universal Braille code. But we usually offer what's called UEB Braille, which is commonly used here in the US and relatively easy to interpret.

> *"Braille, unfortunately, is not international. I find myself limited by my disability to understand different Braille."*

Do you think other sciences could benefit from the use of tactile materials?

I certainly hope this work could be a catalyst for people with expertise in other STEM areas to take some of this and create a tactile book about their topic, just as we did in astronomy. One of the books I had mentioned earlier, "The Earth: A Tactile View of the Blue Marble", is about the earth as viewed from space and the last article is a gorgeous tactile of a hurricane. We also highlight ice sheets in Antarctica, the North Pole, and different penguin colonies, and we even have a tactile of the Landsat 9 satellite that is now monitoring changes on Earth.

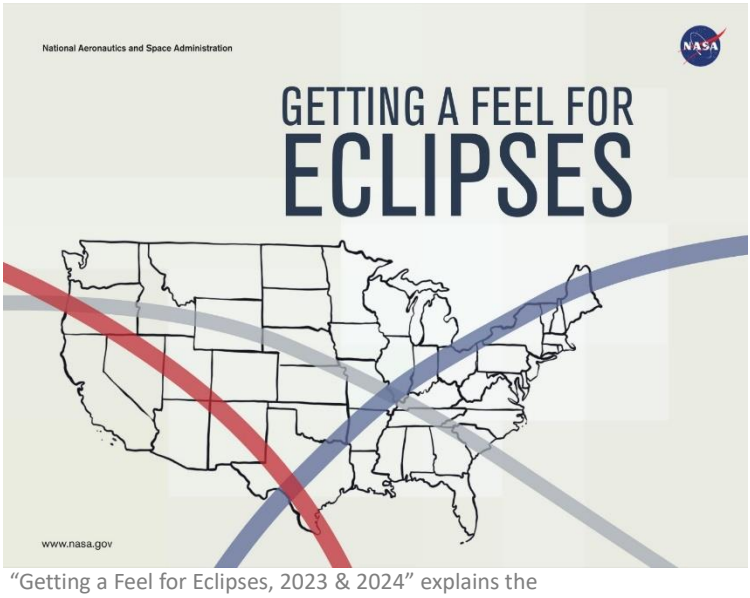


David Hurd and Angelina working together to create swell touch diagrams. Credit: Lexi Pollock.

Any last words?

I've mentioned lots of names: Robert Shelton, Anna Green, Cassandra Runyon, Ken Quinn, Joe Minafra, Ken Silberman... And I would like to emphasize again that this is a team effort and I'm standing on the shoulders of giants.

Another thing to turn to for inspiration is a book called "A Smile as Big as the Moon", by Mike Kersjes. It's about a teacher teaching a special needs group and taking them to space camp and the teacher's administrators' resistance to it and NASA's resistance to it. So it is about overcoming those obstacles or challenges and getting everybody on the same team, and the success that that program ultimately gained. It's an amazing, inspirational, moving book. ■



"Getting a Feel for Eclipses, 2023 & 2024" explains the details surrounding the October 14, 2023 and April 8, 2024 eclipses. Created by Dr. Cassandra Runyon, College of Charleston, Department of Geology & Environmental Geosciences, Charleston, South Carolina; David Hurd, Pennsylvania Western University, Planetarium and Department of Biology, Earth and Environmental Sciences Edinboro, Pennsylvania; Joe Minafra, NASA Solar System Exploration Research Virtual Institute (SSERVI) NASA Ames, California Credit: NASA SSERVI

BIO

David Hurd is currently Professor of Geosciences and Planetarium Director at Edinboro University of Pennsylvania and holds a B.S. in Geology from Iowa State University, an M.S. in Science Education from University of Nebraska and a Ph.D. from Cleveland State University. He has produced and implemented tactile astronomy materials for those who are blind and presented workshops on teaching astronomy to students with visual impairments. In addition to Hurd's innovative work in the classroom, he also provides interactive and live planetarium programmes for thousands of K-12 and public participants annually and is nationally recognized in the planetarium community for his inclusion of ll learners in STEM initiatives. Hurd works at Edinboro University of Pennsylvania which is nationally recognized for its for its service to students with disabilities. Dr. Hurd continues to push for expanded experiences for all students to highlight STEM interests and careers. In addition to his professional endeavors, Hurd also shares a personal connection to those with disabilities. Two of his four sons have significant disabilities. This has helped shape his passion and desire to see expanded opportunities in learning about science.

RESOURCES

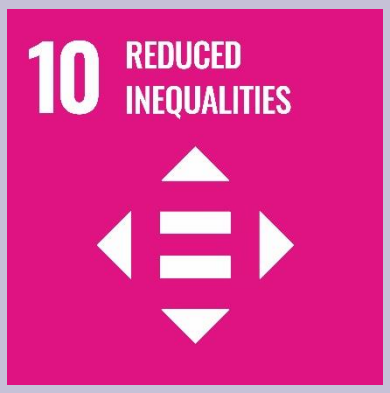
- Edinboro University Planetarium Geosciences: [Link]
- Great Lakes Planetarium Association: [Link]
- NASA SSERVI Braille books: [Link]
- Getting a feel of lunar craters (video): [Link]

CONTACT

Learn more about David by visiting his profiles on the following websites:

Edinboro University Planetarium Geosciences

David-Hurd-Lectures



ABOUT

This article is part of the "Space+: Pathways for All Abilities" interview series under the United Nations Office for Outer Space Affairs Space for Persons with Disabilities project. The aim of this interview series is to raise awareness of the importance of disability inclusion and to advance inclusive and equitable development in the space sector through sharing the experiences of and lessons from disability advocates and persons with disabilities in space.

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Space for Persons with Disabilities project
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